Premises of formation and development trends of modern theater architecture

N A Teleshova
Department of Engineering and Computer Graphics, South Ural State University, 76, Lenin Avenue, Chelyabinsk 454080, Russia

E-mail: teleshovana@susu.ru

Abstract. A theater as an architectural form and as a performance art went through a long and difficult path of establishment and transformations before it reached its present state, which, however, continues to change constantly. This article considers the main stages of the theater architecture development. The authors analyze the structure of entertainment facilities within the framework of various historical periods and stylistic movements. They identify the factors influencing the formation and further development of this type of structures. The authors give examples of the latest architecture of theater buildings.

1. Introduction
Theater is one of the oldest arts, which origins date back to the times of Ancient Greece. As a special type of buildings, it appeared in parallel with the birth of theater performances. Theater as a synthetic form of art absorbed many elements, among which the theater structure, frame and shell with its complexly organized space are important [1].

2. Main stages of the theater architecture development
The theater of Ancient Greece was an open building located on a gentle slope of a natural hill. The structure of the building consisted of three main sections: "orchestra" – a round platform for actors, "theatron" – seats for spectators and "skena" – a service room, where the actors could change clothes and store the stage property [2].

Later, after the adoption of the traditions and skills of the Greeks, the Romans made their changes to the structure of theater buildings. Unlike Greek theaters, where the steps rested on natural slopes, the slope of the Roman theater building was created artificially, which made it possible to freely choose a place for construction [3].

In the literature dealing with the Roman architecture development, the first amphitheater is described as a "double theater". Both its halves made of wood and standing on wheels could be joined along the diameter forming an integral building. The structure did not have a roof, its function was performed by the "velarium" – a giant silk tent covering the amphitheater from above from scorching sun rays or bad weather [4,5].

After the fall of the Roman Empire, the ancient antique civilization was practically wiped off the map. The Christian religion actively struggled with pagan culture. All the theaters were closed, and the actors were anathematized. But, despite this, the theater survived mainly due to itinerant road
companies. They showed their performances in city streets and squares, and used vans or wagons as a stage [6].

In the Renaissance era, revolutionary changes took place in the theater business. The main factor that influenced the development of the theater of that time was an active construction of theater buildings.

A cardinal reconstruction began with the appearance and development of new genres. Early in the XVII century opera gains a foothold on the stage, another type of theatrical art – ballet grows and forms. In this period, a fundamentally new type of a theater building – a stepped theater is formed. It is also called class or rank, since it divided the audience into categories according to the position held. The most privileged part of the audience was located in the stalls and on the lower tier of balconies. Less noble and rich had to take higher seats.

The appearance of the ogee arch, which divided the space into the audience area and the acting area, marked the appearance of a new stage form called a "black box". The front of house, the backstage and the main staircases occupied most of the building, which gave a complex structure of the interior organization, and the use of the hall’s domed ceiling – great opportunities for creating an architectural expressive volumetric composition. At this time, the theater building obtains impressive, monumental facades [7,8].

Further, theater mainly developed under the sign of a change in aesthetic directions. Early in the XIX century, new trends appeared in the concept of the theater building placing in question those traditions that had reigned in this area for more than two centuries. But these plans were still so weak that they could not have any noticeable effect on actual construction [9].

In general, theater buildings of that time are characterized by the following features: pompous architecture that attracts viewers and personifies the idea of the theater as an art temple; spacious halls; large stage; advanced equipment for moving the scenery in the stage space.

By the end of the XIX century, there appear ideas of functionalism requiring of the theater to express its spatial essence in external forms. The theater building has no more that compositional unity, as it had before. Strict silhouettes give way to a more free design of facades. Eclectic parts incorporating various styles of the past become characteristic [10].

By the beginning of the XX century, it became clear that the stepped theater had already run out of stream and became an anachronism. Outstanding architects-innovators were engaged in designing cultural and entertainment institutions. In their view, the theater building should combine new aesthetic ideals and engineering principles. The unification of the stage and the hall, refusal of the classical black box, absence of suites and balconies, release of facades from sculptures and frescoes necessary for this type of building, attraction to a new form – all these ideas excited the designers of that time. The volume should be maximally functional, not containing any excesses, every detail should be relevant.

The architects together with the directors were actively searching for an exit from the closed stage space. To bring the performance closer to the audience, the proscenium was enlarged and put forward into the audience space, theater projects were created with an arena stage surrounded by the audience or a transformer stage that spun, rose up and down, and a screen was used as a stage flat to synchronize the actors' actions with what was reproduced on it [10-12].

The expressiveness of the building’s appearance was achieved by the work with various architectural volumes, which were perceived as an independent expressive means. There appeared an interest of airy, weightless designs. Glass became not just a material, but a symbol of transparency. A transparent facade did not focus on its own shape, but on the infrastructure of the object.

Theater at the turn of the XX-XXI centuries is a diverse, multifunctional, technologically equipped complex designed for various kinds of events and arts. Recent achievements in the theatrical sphere inevitably influence the structure of theater buildings [13]. There is a need to supplement the project with various types of halls and additional premises, which allows us to expand the repertoire, increase the employment of actors, increase the number of visits and, consequently, the profitability of the building. Two-, three- and even four-hall multifunctional complexes appear.
Computerization of design has an increasing influence on the development of the architecture of theaters and concert halls. It does not only effectively provide routine processes, but also creates opportunities for a creative search, which are unthinkable for traditional design [14].

Performance art centers amaze with new unprecedented forms, compositions of powerful reinforced concrete volumes, solid and grid metal textures. It seems that the building itself becomes a giant expressive mask that covers the inner technological essence.

As a result, the main trends in the development of modern performative architecture have become evident: a variety of technological schemes; colossal range of the hall capacity, consequently, polarization of the volumes of theater buildings; consolidation of main national facilities due to the large number of halls and associated functions, their leading out to the urban planning level; appearance of a new sign system of theater facades made of glass and metal, where the wall texture is released from the bearing function [15].

3. New forms of theater architecture

Theater buildings are undoubtedly the most important element in the formation of the visual appearance of the urban space, their architecture must be bright, imaginative, expressive, in line with the modern trends in the theater sphere.

Frank Gehry, Zaha Hadid, Jean Nouvel, Santiago Calatrava, Paul André and others are actively searching for space-planning solutions. They take into account all the knowledge accumulated over the centuries, about sound, light and staging art, use new materials and designs, create memorable silhouettes.

3.1. Walt Disney Concert Hall. Architect Frank Gehry. USA, Los Angeles. 2003

Frank Gehry's architecture is characterized by curved, disturbed surfaces, overlapping of simple geometric shapes and abundance of metal (anodized zinc, corrugated aluminum, titanium). Among the most significant works of Gehry is Walt Disney Concert Hall in Los Angeles.

The building was planned as a major center of musical culture and art. Therefore, the facility was designed from the very beginning, and then it turned out to be very ambitious. The architect used the effect of conflict between different volumes of the structure, the curved surfaces of which contrast with straight elements perfectly performing the function of load-bearing structures (Figure 1). Special attention is paid to the contrast of the texture and color of the building's finishing materials – cold metal outside and a warm wood inside [16].

![Figure 1. Walt Disney Concert Hall. General view.](image1)

![Figure 2. Walt Disney Concert Hall. Organ and a part of the stage.](image2)

Initially, the smoothly curved exterior shapes were lined with sheets of polished stainless steel. But after the construction was completed, it was necessary to make some corrections in the appearance of the building: the reflectivity of steel sheet coatings turned to be too active. The sidewalk around the building was heated to 60 degrees Celsius, and on sunny days there was unbearable heat in the
apartments of residents of nearby houses, from which even air-conditioners could not save. Using a computer program, engineers were able to calculate the most dangerous reflective surfaces, which were then treated with sandblast flows [17].

The interior of the building, which is a logical continuation of the exterior, is no less interesting. The free plan, where the premises flow one into another, in addition to a large concert hall, includes a lounge, restaurants, cafes, book and souvenir shops.

In strict adherence to Frank Gehry’s concept, acoustics was also calculated according to a computer model, which made it possible to achieve an ideal sound. Expensive wood panels were used for interior decoration of the large concert hall designed for 2,265 seats. The stage and the orchestra space are surrounded by spectator rows from all sides. There is a unique organ in the center designed by the architect in the form of a beam of pipes sticking out at different angles (Figure 2). It took more than a year to manufacture, assemble and tune it.

3.2. Guangzhou Opera House. Architect Zaha Hadid. China, Guangzhou. 2010

Zhujiang or the Pearl River is the basis of existence and a landmark of Guangzhou, which sets the pace of its rapid life. There are many attractions, one of which is the Opera House, along the river embankment.

The government of the region announced plans for the construction of the theater complex in 2002, at the same time an international tender was held and won by the team of Zaha Hadid Architects, outranking such leading architectural bureaus as Coop Himmelb(l)au and OMA headed by Rem Koolhaas. The erection of the facility began in 2005 and lasted for 5 years.

The unique concept of the building is inspired by the surrounding landscapes. Smooth lines of the river valleys, majestic canyons, narrow gorges – all this can be seen in the architecture of the building, which fully reflects the individual style of Zaha Hadid (Figure 3).

The shape reminiscent of huge boulders is literally split by the "gorge" between the spaces of the two halls: the main hall, which has excellent acoustic characteristics and is designed for 1,800 seats, and the multifunctional hall for 400 seats – designed for performances, concerts and small performances. In addition to the halls, the planning structure of the theater includes the main lobby, the lounge area, rehearsal and ancillary facilities [18].

Figure 3. Guangzhou Opera House from a bird’s eye view.

Figure 4. Guangzhou Opera House. Interior of the main hall.

The dark gray concrete surfaces outside are combined with unusual glazing. Transparent inserts similar to natural inclusions in the stone layer of the sparkling crystal cores provide a good insolation of the premises in the daytime.

The interior of the theater cannot be considered without mentioning external architectural forms. It is a uniform subject-spatial environment, which is viewed as a whole, so the theater's interior repeats the same soft lines, fluid volumes similar to waves that run across each other (Figure 4) [19]. The
ceiling tiers are spotted with millions of light-emitting diodes reminiscent of the night sky with a myriad of stars. Every detail of this architectural structure is filled with symbolic meaning.

3.3. Harpa Concert Hall. Henning Larsen Architects Architectural bureau. Island, Reykjavik. 2011
The concert hall with a total area of 28 thousand square meters was built as part of a comprehensive renovation of the Reykjavik harbor area. The project was developed by Henning Larsen in collaboration with famous Icelandic artist Olafur Eliasson. According to the authors, they were inspired by the northern lights and the impressive natural landscapes of Iceland.

The center is designed as a multifunctional complex, which explains its complicated internal planning. The structure includes four concert halls, several conference halls, an art gallery and a spacious main lobby, which balconies offer a beautiful view of the city center, Mount Esja and Glacier Sneifeldsjökull.

The unique facades are of particular interest. They look like a crystal lattice made of glass and steel. Tinted colored cells absorb and reflect the sunlight, and the overall impression of the building varies depending on the time of the day and season. Shades of yellow, green and blue create a stunning kaleidoscopic effect (Figure 5). The dynamism is also due to the LED strips built into the grid design.

Harpa interiors are made in dark colors and decorated with natural stone. Eldborg large concert hall (Icel. Eldborg – a crater of an extinct volcano) can accommodate 1,800 spectators. It is decorated in red and black tones symbolizing the volcanic explosion (Figure 6). Silfurberg Hall (Icel. Silfurberg – Iceland spar (a transparent type of calcite)) has a capacity of 750 seats, Norrurljós Hall (Icel. Norrurljós – northern lights) – of 450 seats, and Kaldalón Hall (Icel. Kaldalón – a cold lagoon) – of 195 places [20].

According to the architects, this structure of the complex perfectly conveys the peculiarity of the landscape of Iceland: most of the territory of this far country is bound by glaciers with stony soil underneath and volcanoes in the interior.

4. Conclusion
Despite all the transformations that the theater has undergone throughout its centuries-old history, its structural and functional fundamental principle has remained unchanged: the same seats for spectators, performance venue and service facilities. However, the attributes of the classical theater – order galleries, sculptures, bas-reliefs and frescoes – disappeared forever in the designs of modern architects. They were replaced by new dynamic forms.

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