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Review paper

SHAPING THE SPACE OF CONCERT HALLS AS CULTURAL VENUES THROUGHOUT HISTORY AND ITS INFLUENCE ON CONTEMPORARY DESIGN

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Abstract

The development of concert halls throughout history reflects the innovation of architectural and acoustic principles, adaptation to social, cultural and technological changes, as well as changes in the needs of performers and audiences. The design process, from the first spaces intended for musical performances to today's multifunctional concert halls, has been accompanied by adaptation to various aesthetic and functional requirements. The paper analyzes key historical periods in concert halls, starting from ancient and medieval spaces, through baroque and classicist halls, to contemporary concert buildings. The focus is on architectural features and acoustic principles that have developed over the centuries and created contemporary concert space design. The aim of the research is to identify, through an analysis of historical development, the key principles that have shaped the development of concert halls throughout history, as well as to examine their impact on the application of the principles in contemporary architectural design. Special emphasis is placed on sustainability, innovative technological approaches and adaptation to contemporary requirements of performers and audiences.

Key words: *Concert halls, Historical development, Contemporary design, Architectural design*

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1. INTRODUCTION

The architecture of concert halls has always played a complex role in the cultural and urban life of the community. Their development throughout history reflects aesthetic, technological and social changes, with the relationship between performer and audience remaining a central shaping element. Starting with ancient amphitheatres, through richly decorated Renaissance and Baroque halls, all the way to modernist and contemporary buildings, the space of the concert hall was constantly subject to evolution. Historical forms and acoustic principles of design provided the basis for the creation of flexible, functional and technologically advanced spaces, which respond to contemporary demands for multifunctionality, sustainability and urban integration [1].

In the contemporary context, concert halls are seen as cultural centers that connect art, technology and society. Their designs increasingly include adaptable stage configurations, energy efficiency and digital systems, but still draw inspiration from historical spatial-acoustic solutions. Therefore, analyzing the historical development of these buildings is not only an academic reflection, but also a necessary prerequisite for the creation of modern architectural solutions that serve the cultural, educational and urban needs of society.

The subject of the research paper includes the specificity of the design of the space of concert halls through historical periods, focusing on the development of spatial, architectural and acoustic characteristics, as well as the identification of the principles that influenced the concepts of modern concert halls. The goal of the research is to analyze the historical development of concert halls to systematize the key spatial, form and acoustic principles that have influenced the architecture of contemporary halls and to identify concepts for implementation in contemporary design with a focus on sustainability, technological innovation and adaptation to modern demands of the audience and performers. During the preparation of the paper, the applied research methods are data collection and analytical method, for the sake of systematic presentation of historical periods, data analysis and comparative method, which identified and compared spatial and acoustic characteristics through different periods, as well as the case study method, which enabled the analysis of modern realized objects in order to recognize the application of historical principles.

2. HISTORICAL DEVELOPMENT OF CONCERT HALLS

The historical development of concert halls reflects the centuries-old evolution of architectural, technological and musical concepts. From the first public spaces for music to precisely designed concert halls, each historical stage brings new spatial, acoustic and social values that influence the shaping of cultural objects.

2.1. Ancient and medieval music spaces

The earliest form of public buildings designed for the efficient communication of theatrical and musical performances before large audiences were the ancient open amphitheatres, which date back to BC. The open ancient theater marks the starting point of the meeting between architecture, acoustics and theatrical performance. This simple structure consists of a large stepped audience space in the shape of a truncated cone, a flat stage area for the choir ("orchestra") and a stage building with a raised stage for the actors (Fig.1a). One such type of amphitheater is Epidaurus in Greece (Fig.1b). The "good acoustics" of these

amphitheatres, and Epidaurus in particular, was the result of a number of parameters: sufficient sound amplification on the stage, uniform spatial acoustic coverage, low reverberation, improvement of voice tone, which contributes to perfect intelligibility even on seats 60 meters away, provided that the noise in the environment is low [2].

a b

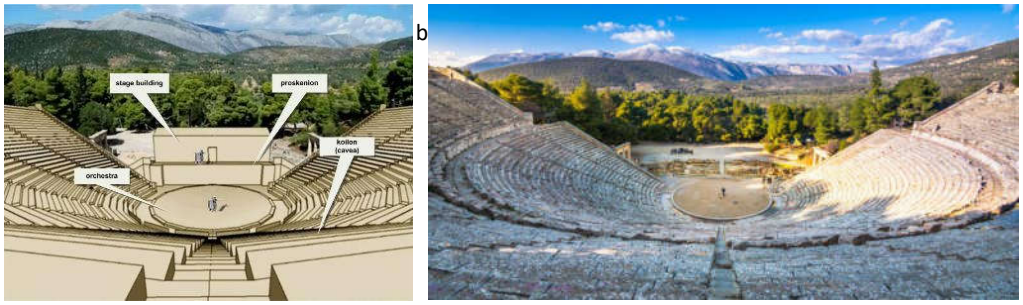

Figure 1a - Structure of the open-air theater of the Hellenistic period, https://acoustics.org/ and 1b - Amphitheater in Epidaurus, Greece, https://www.lonelyplanet.com/

During the Middle Ages, musical performances were moved to sacred buildings - churches, cathedrals and monasteries, where new acoustic possibilities based on reverberation and vertical spatiality arose. In this period, there are no separate concert halls; the music is a function of the liturgy and the spaces are not designed for the purpose of acoustic optimality, but they still provide inspiration for later forms.

2.2. Renaissance and Baroque halls

At the beginning of the Renaissance, there was an increase in interest in secular music and public performances outside the church framework. The first halls in palaces and courts, like those in Florence and Venice, were rectangular in shape, often decorated with frescoes and with high ceilings, but still without standardized acoustics.

The Baroque period brings significant development: the first specially designed music halls appear. Prominent examples are the Musikverein in Vienna and the Gewandhaus in Leipzig. In this period, the typology of the rectangular hall ("shoebox" form) begins to develop, which will later become a classic model for concert halls. Ornamentation, richness of decoration and connection of music and architectural expression dominate these objects, while acoustic characteristics begin to gain importance in design.

The first recorded public concerts took place in London in 1672. Although the idea worked well there, Germany and France did not follow their example until 1722 and 1725, respectively. Dedicated rooms for public concerts appeared in the following years, but it was only by the mid-18th century that they became firmly established as the dominant venues for musical art [3]. The architecture of concert halls, due to the increase in audience size and the corresponding growth in the number of musicians in the orchestra, had to respond to these new demands. The construction of Hicksford's Rooms (1738) and Holywell Music Room (1748) in England (Fig.2a) provided seating for 300 people. This trend of increasing seating capacity and longer reverberation time continued with the Hanover Square Rooms from 1775 in London (Fig.2b), which accommodated 800 people and had a reverberation time of approximately 1 second, as well as the 1781 Leipzig Altes Gewandhaus (Fig.2c) for 400 people with a reverberation time of 1.3 seconds [3].

a

b

c

Figure 2a - Holywell Music Room, Oxford, England – interior view, https://www.musicatoxford.com/, 2b - Hanover Square Rooms, London, England, https://www.alamy.com/ and 2c - Leipzig Altes Gewandhaus, Germany, https://www.gewandhausorchester.de/haus/historie/

2.3. Classical concert halls of the 19th century

This period is considered the golden age of the development of concert halls. The first public facilities dedicated exclusively to the performance of music were built, such as the Musikverein in Vienna (1870) (Fig.3a) and the Concertgebouw in Amsterdam (1888), which are still considered one of the most acoustically high-quality halls in the world. Typical features of these spaces include a rectangular shape ("shoebox" shape), high ceilings, vaulted galleries and decorative elements that contribute to the diffusion of sound [4].

The development of instruments and the expansion of the orchestra, together with the increasingly numerous audience, led to an increase in the dimensions and capacity of concert halls. At the same time, the awareness of the importance of the choice of materials and the finishing of surfaces for sound quality is developing, which makes the architecture of concert halls a combination of acoustic science and artistic expression.

Along with the growth of the orchestra came the need for a conductor - a role that did not exist in the modern sense until then. Numerous performers are more difficult to coordinate without clear leadership, so the conductor becomes a key figure. Also, in the compositions of this period, the accent increasingly shifts from the melody to the tone color, which additionally affects the acoustic requirements of the space.

In parallel with this development, the role of concert halls goes beyond a purely musical function. Facilities such as the Royal Albert Hall in London (1871) (Fig.3b) and Carnegie Hall in New York (1891) (Fig.3c) became large cultural centers, intended not only for concerts but also for various events, which further confirms the importance of such spaces in the urban and social context [5].

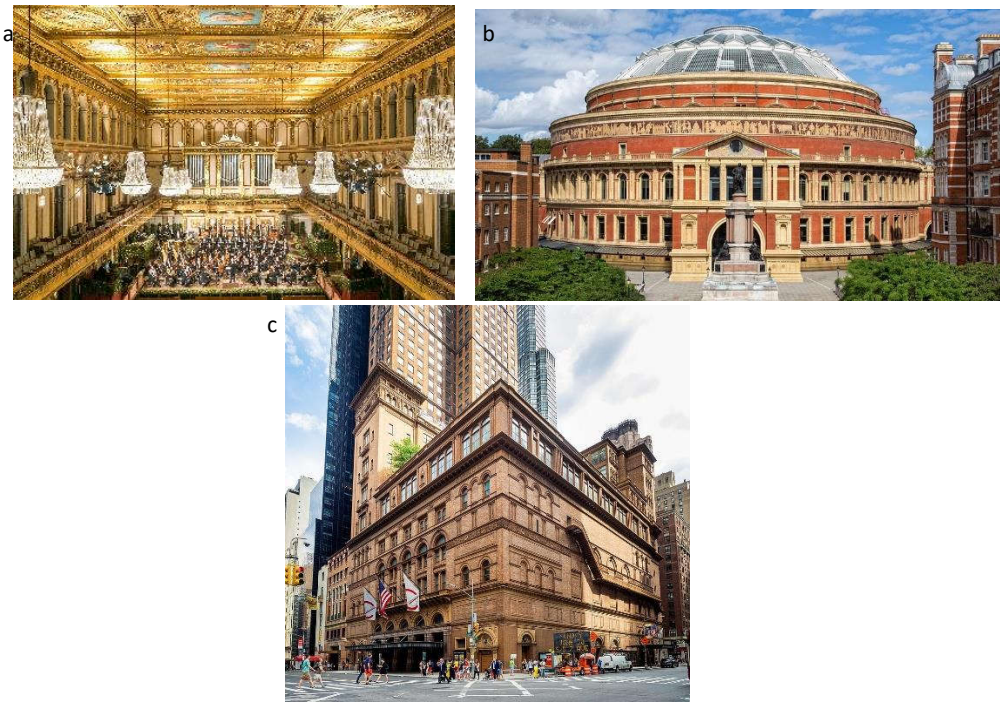

Figure 3a - Musikverein, Vienna, Austria – interior view, https://concert-vienna.com, 3b - Royal Albert Hall, London, England, https://www.londontheatre.co.uk and 3c - Carnegie Hall, New York, United States, https://www.waltersgroupinc.com

2.4. Beginnings of the Modern Approach in the 20th Century

In the 20th century, technological progress, especially in the field of acoustics and modern building materials, brought significant changes in the design and construction of concert halls. New approaches enabled the emergence of increasingly sophisticated facilities, adapted not only to classical music, but also to a wider range of musical genres and other types of events. The diversity of musical expressions and the growing needs of performers and audiences have led to the emergence of multi-purpose halls, capable of transforming according to the demands of the program — from symphonic concerts, through rock performances, to conferences and multimedia events.

One of the first significant examples in this new era is the St. Petersburg Philharmonic Hall (Fig.4a), built in 1900. Located in the then cultural center of the Russian Empire, this hall played a key role in the promotion of classical music in the 20th century, hosting numerous world-famous orchestras, conductors and soloists. Its opening symbolically marks the transition between traditional design principles and a new, modern approach that will become dominant in the following decades [3].

As the century progresses, concert halls deviate more and more from the classic "shoebox" typologies. Architects began to experiment with different spatial solutions - wind-shaped forms, arena and amphitheater layouts appeared, as well as so-called "vineyard" configurations, among which the most famous example is the Berliner Philharmonie (Fig.4b and 4c), opened in 1963 according to the project of Hans Scharun. These new models emphasize not only the acoustics, but also the visual communication between the performer and the audience, as well as the flexibility of the space [4].

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b

c

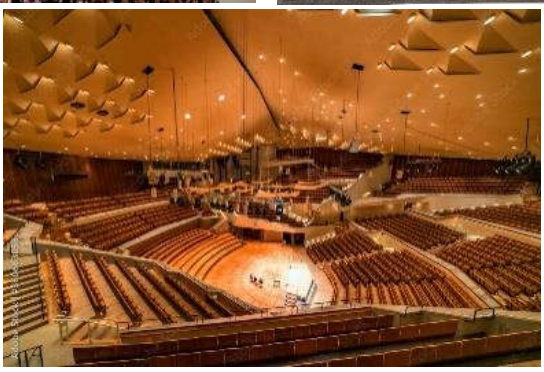

Figure 4a - Saint Petersburg Philharmonia, Russia – interior view https://guideforyourussia.com, 4b - Berliner Philharmonie, Berlin, Germany and 4c - Berliner Philharmonie, Berlin, Germany – interior view, https://www.archdaily.com

At the same time, variable acoustic elements - movable panels, ceilings and curtains - are introduced into the concert halls, which enable the optimization of the sound environment in accordance with the type of performance. Concert halls become multifunctional spaces, intended not only for music, but also for education, conferences and digital artistic performances, thus gaining a new social and cultural role in the contemporary urban context.

3. ARCHITECTURAL AND ACOUSTIC PRINCIPLES THROUGH HISTORY

The design of concert halls is the result of a long-term historical evolution in the domain of architecture and acoustics, conditioned not only by aesthetic aspirations, but also by the development of the science of sound, technological progress and social changes. From the original spaces adapted to music - such as court halls and churches - purpose-designed halls, with clear spatial and acoustic goals, have been developed over the centuries.

Classical "shoebox" forms, such as the one in the Musikverein in Vienna, dominated in the 18th and 19th centuries due to their favorable acoustic characteristics, while the 20th century brought experimentation with new spatial concepts, such as windward and arena forms, as well as the "vineyard" configuration - the most famous example being the Berliner Philharmonie from 1963. Over time, the concert hall grows into a complex cultural facility that, in addition to the main hall, includes spaces for education, social activities, rehearsals and multimedia events [6].

Historically speaking, acoustic solutions were primarily the result of experience and tradition, with the use of natural materials such as wood and fabrics. With the development

of acoustics as a science at the end of the 19th century, more precise design began based on physical parameters such as reverberation and absorption. Today, advanced computer simulations and flexible elements (movable panels, curtains, diffusers) are used in the design of halls, which allows adaptation to different musical genres.

Technological innovations significantly influence the architecture of these spaces. The use of modern materials such as concrete, steel and glass leads to larger spans and freer forms. The use of electroacoustics opens up new possibilities in sound transmission, but also poses challenges in the relationship between natural and amplified acoustics. Information technology, including BIM, enables precise modeling and optimization of the project before construction itself. In the last decade, the emphasis is increasingly on sustainability, energy efficiency and the integration of buildings into the urban and ecological whole [7].

4. CONTEMPORARY APPROACHES IN CONCERT HALL DESIGN

Contemporary concert hall architecture faces a series of new challenges that go beyond traditional acoustic and aesthetic requirements. Today's facilities are designed as multifunctional and technologically flexible spaces, designed to respond to the diverse cultural needs of the community. In addition to classical music performances, they are increasingly used for theater performances, electronic performances, film screenings, conferences and educational programs. This diversity requires the implementation of movable stage elements, flexible seating, variable acoustic panels and modern digital systems, which allow for rapid adaptation to different types of events [8].

In parallel, sustainability is becoming a central theme in contemporary design. Concert halls are built using energy-efficient materials, passive ventilation and lighting systems, solar panels, green roofs and smart energy management systems. The aim is to reduce the negative impact on the environment, while at the same time increasing the comfort of the users and the long-term economic viability of the facility [9].

Numerous contemporary examples confirm the successful application of these approaches. The Elbphilharmonie in Hamburg, the Walt Disney Concert Hall in Los Angeles, the Harpa in Reykjavík and the Musiikkitalo in Helsinki stand out as buildings that combine architectural innovation, a high level of acoustic precision, sustainability and social openness. Through integration with the urban space, technical sophistication and diverse functionality, these buildings represent new standards in the design of concert venues around the world.

5. THE INFLUENCE OF HISTORICAL PRINCIPLES ON CONTEMPORARY DESIGN

The historical development of concert halls has strongly influenced contemporary design, which, despite technological innovations and more complex programs, still retains the fundamental spatial and acoustic values of the past. Classic forms, such as the rectangular "shoebox", remain relevant due to their proven acoustic efficiency and ability to provide an optimal experience for listeners. On the other hand, new approaches such as the "vineyard" seating arrangement are being developed to achieve a better visual and acoustic connection between audience and performers, creating a more intimate and inclusive atmosphere.

These forms are not just architectural forms, but are the result of centuries of research into acoustics and the organization of space [7].

Architectural references to Baroque and Classicism are still present, but today appear in abstract and modernized forms. They are manifested through the careful selection of materials, the way of using light and the internal forms of the space that are reminiscent of historical models, but are adapted to modern aesthetic and functional requirements. In contemporary projects, traditional elements are often combined with the most modern technologies and design solutions. Natural materials, such as wood and stone, are used not only for their visual appeal, but also for their ability to improve acoustics and create a warm, pleasant atmosphere that contributes to the overall experience of visitors [10].

Also, the rhythm and repetition of motifs characteristic of classical architecture are transferred into contemporary expressions through the use of panels, lamellar structures and acoustic elements, which simultaneously serve aesthetic and functional purposes. Light, which in history often had a symbolic meaning associated with spirituality and ceremoniality, is today a key design tool for shaping the atmosphere of a space and the emotional experience of the audience. In this way, contemporary concert hall design achieves continuity with a rich heritage, but at the same time does not remain trapped in the past – historical principles are not mechanically copied, but are creatively reinterpreted and adapted to the needs of contemporary society and art forms, allowing spaces to be functional, aesthetically relevant and culturally significant.

6. CONCLUDING CONSIDERATIONS

The design of concert halls as objects of culture is the result of a long-term and continuous evolutionary process in which artistic expression, technological innovations, acoustic knowledge and socio-cultural context were intertwined. From ancient theaters and medieval churches, through baroque and classical halls, to today's multi-functional and technologically advanced buildings, the architecture of concert spaces has developed in accordance with the needs of the audience, performers and the wider cultural community.

Historical models, such as the "shoebox" and "vineyard" form, remained relevant as typological and acoustic inspiration, and traditional elements such as proportion, centrality and materiality gained new meaning in the contemporary context. Today's projects do not represent a radical break with the past, but a deliberate synthesis of tradition and innovation. This is best reflected in the effort to make buildings energy efficient, adaptable to different programs and aligned with modern technological and social requirements.

Observing current trends, it can be concluded that the future of concert spaces will be directed towards greater openness, digitization of the experience, integration of new media and social inclusiveness. At the same time, there will remain a strong influence of historical principles that serve as proven foundations in the search for harmony between form, function and experience.

By understanding the past and its creative transformation, architects and urban planners can design concert halls that not only meet high technical and aesthetic standards, but also actively contribute to the cultural identity and dynamics of contemporary society.

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