

SCIENTIFIC CONSERVATION OF THE OUTSTANDING THEATERS OF THE 19th CENTURY AND THEIR INFLUENCE ON THE CREATION OF MODERN ART-SPACE

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Abstract

The article analyses the specifics of the stylistics of the external and internal decoration of the outstanding theaters of Romania, Ukraine and Poland; defines the role of the Viennese school in this process; describes the problems of preserving these unique objects and describes the process of complex restoration of Odesa National Academic Theater of Opera and Ballet by specialists from the Ukrrestavratsiia Corporation. The scientific novelty of the research lies in the analysis of the construction processes of Odesa Theater of Opera and Ballet and the Municipal Theater (Teatr Miejski) in Cracow to prove the generality of trends in theatre construction in the second half of the 19th century; the replacement of wooden structures with various metal ones, and analysis of the principles of operation of the different types of metal structures. The reasons for the emergency state of theatres have been ascertained. The procedure for the conduct of the restoration measures and the effectiveness of their results was analyzed. The paper aims to emphasize the importance of the National Theater of Iasi as an element of cultural heritage and educational factor, in the context of other theaters built based on the projects of Viennese architects Fellner and Helmer. The National Theater of Iași is a real architectural jewel and a charming local party for its leisure visitors. This architectural monument houses a curtain of great beauty. The ceiling that is painted by Al. Goltz with pastel colors that represent paradisiacal allegories, being represented nymphs and angels, framed in the rococo structure. The Great Hall of the theater which has 740 seats and has a stable, lodges and balconies. This building was considered one of the most successful constructions.

Keywords: Theater; Style and design features; Restoration; Romania; Ukraine; Poland; Viennese school; Architectural heritage; Conservation science; Empathic abilities; Culture; Education.

Introduction

Theater buildings represent a significant part of the historical and cultural heritage in different countries. Their construction became especially active in the second half of the 19th century. It took place against the background of the general spread of historicism-eclecticism with the use of elements of the historical styles of the past in a free combination – this is how

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the directions of pseudo-Gothic, pseudo-Renaissance and pseudo-classicism were formed. Significantly, certain historical stylizations were reflected in some functional type of objects. All historical stylizations were used for residential buildings but for theater buildings, as a result of their hereditary traditions with theatres of Greece and the Renaissance, Pseudo-classical or pseudo-Renaissance and pseudo-baroque stylizations were used for the decoration of facades and interiors.

The second half of the 19th century was affected by the spreading of historical stylizations in art and architecture. At the same time, there were some stylistic preferences: in residential construction, the list of stylizations was quite broad: pseudo-Gothic, pseudo-baroque, pseudo-Renaissance, pseudo-Moorish style, "brick style". But theatrical and generally spectacular buildings in Ukrainian cities were mainly built in the style of pseudo-Renaissance or pseudo-baroque as the styles of the embodiment of pomp and luxury.

Comparative analysis of the facade solutions of the theatres of the second half of the 19th century – Odesa Opera House (1884–1887, architects Ferdinand Fellner and Hermann Helmer) and the Municipal (Drama) Theater (Teatr Miejski) named after Polish poet Juliusz Słowacki in Cracow in the Old Town (1891–1893, architect Jan Zawiejski) proves that pseudo-Renaissance and pseudo-Baroque style was decisive for theatres in the 19th century. As well as at Odesa Opera House, the Municipal Theater in the Old Town in Cracow was in luxurious decoration combined with the latest constructive and engineering achievements of its time (the Municipal Theatre was the first building in Cracow with electric lighting). As in the case of many other theatres, its construction was announced by a competition, which was won by the Cracow architect Jan Zawiejski.

When we compare the facade and interior solutions of the Opera House in Odesa and the Municipal Theater in Cracow, we can observe some similarities. The facades of Odesa Opera House were decorated with 42 compositions personifying the muses of art, and two risalits of the facade of the Municipal Theater in Cracow are crowned with allegorical figures of Poetry, Drama and Comedy on the left (by Tadeusz Błotnicki) and Music, Opera and Operetta on the right (by Alfred Daun). Below the cornice, there are the allegorical figures of Joy and Sorrow. The top is decorated with figures of a young man and a young woman. The front staircase, the foyer and the auditorium of both theatres are magnificently decorated with stucco decoration of the pseudo-Baroque character. It testifies to the general trends in approaches to the design of theatre buildings in the 19th century.

Iasi has been considered for many generations as a city of beginnings, here was laid the foundation of the first National Theater (named after the poet Vasile Alecsandri) in Romania, the first Memorial House (writer and storyteller Ion Creanga), the first university (Mihaileană, became after 1860 a modern university in the style of the European ones) and of the first Botanical Garden. The National Theater of Iași is the successor of the Copou Theater, which has long been considered the outstanding cultural and academic center, having in time a "coat of arms from education". Iasi was and will remain the city of great schools, of great teachers, writers, of great history lessons attracting and developing national and universal personalities. Also in the Iasi environment, talents grow and develop, proving to be an environment conducive to creativity and the development of values.

The "Vasile Alecsandri" National Theater of Iași is a public cultural institution, subordinated to the Ministry of Culture and Cults, being the oldest National Theater in Romania. The building of the National Theater of Iași is inscribed in the List of historical monuments, having LMI code IS-II-a-A-03735. It is located opposite the seminary of the Metropolitan Church of Moldova and Bukovina, separated by Stefan the Great and Holy Boulevard through the Theater Esplanade (Fig. 1), located in the old town of Iași.

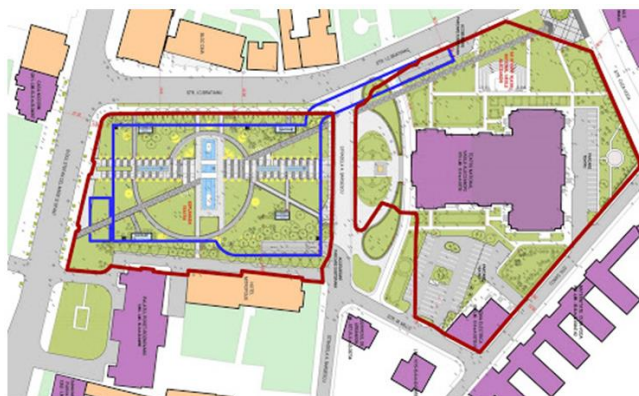


Fig. 1. The esplanade and the gardens surrounding the architectural edifice of "Vasile Alecsandri" National Theater of Iași

As an authentic and representative cultural edifice for a geographical area, respectively for an important community of Moldova, over time the National Theater of Iași went through a series of structural-functional transformations, most with ennobling role, but also through periods of decline imposed by the historical contexts. The National Theater of Iași suffered great damage caused by the Two World Wars, then by the two earthquakes (1940 and 1977), which shook it to the ground, along with a fire, which destroyed a series of movable properties. If, most of the preservation and restoration interventions allowed the restoration of the monument, as close as possible to the original form (1896), there is one, from 1973–1974, initially made for experimental purposes, based on the study conducted by the specialist Ioan Moraru, based on expertise carried out in a partnership to save the monuments in Florence, after the floods of 1966. This experiment proved to be a non-compliant achievement, when the foundations on the sandstone structure, strongly affected by degradation by embrittlement, were strengthened with 600 t of sodium silicate, strengthened by the process of electrosilicate and carbon dioxide injection, which released the sodium ion taken from the underground springs in Copou and dispersed by solvolysis and segregation over large areas around the monument. Over the next 20 years, it affected all the monuments in the area of the old town by the appearance of efflorescence and dampness.

It is the oldest and most beautiful place of its kind in the country, a real architectural gem, put into operation, based on the project of the Viennese architects Fellner and Helmer, by the Bucharest Construction Society and which houses real art monuments:

- the curtain, painted by the Viennese master M. Lenz and finished by one of his disciples, which has represented in the center an allegory of life, with the three ages, and on the right, the allegory of the Union of Romanian Principalities (Moldova, Transylvania and Wallachia);
- iron curtain, painted by Al. Goltz, with symmetrical ornamental motifs, tightly separates the stage from the rest of the room;
- the ceiling, painted by Al. Goltz in pastel colors, represents paradisiacal allegories, being illustrated with nymphs and angels in relief, from rococo stucco;
- brass chandelier and Murano crystals with 109 bulbs enrich the decoration of the painted ceiling.

In 1956, on the 140th anniversary of the first show in Romanian, the Iasi theater received the name of the great poet, playwright and man of culture Vasile Alecsandri (1821 – 1890) [1].

Currently, this building also houses the Romanian National Opera of Iasi.

The paper presents the main data about the National Theater from Iași, a real architectural jewel and a charming local place for active leisure for its visitors.

It is worth noting that at one time, the Vienna office of F. Fellner and G. Helmer also took part in the first contest (there were two) for the construction of the Municipal Theatre in Cracow. The drawing, presented by them, is kept in the National Archives in Cracow (Archiwum Narodowe w Krakowie) nowadays (Fig. 2).



Fig.2. The project of the Municipal Theater in Cracow by F. Fellner and H. Helmer.

<https://ank.gov.pl/rysunki-zwycieskiego-projektu-w-konkursie-na-teatr-miejski-slowackiego-biura-fellner-i-helmer/>

One big issue is that the outstanding theater buildings in Ukraine are still insufficiently described in the scientific literature, especially in the part that concerns specific technologies for their restoration. A separate aspect is related to the relevance of the study of theatre buildings of the 19th century for modern visual art formations on the principle of clustering since the issue of such art establishments is becoming more and more relevant against the background of the revitalization of non-functioning buildings in large cities.

Given the lack of scientific sources devoted to the restoration of theatres in Ukraine, the authors analyzed a broad scientific base, helping to solve this problem.

An analysis of the experience of restoration and stylistic features of theatre buildings of the 19th century should begin with the study of the monument protective experience and the issues of preserving the historical and cultural heritage and the historical environment since most of the examples of theatres in Ukraine and Poland can prove that these objects are in a valuable historical environment. In this sense, a series of articles were analyzed [2-6]. The general issues of the need for comprehensive monument protective measures and counteraction to the degradation of the historical environment, raised in these articles, are also relevant to theatre buildings. The second aspect of the research concerned the analysis of stylistic trends in European architecture of the 19th century. This aspect was investigated by [7-11]. The analysis of these publications showed that the stylistic solution of European theatres in the second half of the 19th century corresponded to the general trend of historicism, which allowed for a free interpretation and combination of elements of the styles of the past. At the same time, it is possible to prove with specific examples the fact that the particular stylistic preferences were observed in the solution of buildings for various functional purposes (for example, despite the widespread of pseudo-Gothic, the authors could not find examples of 19th-century theatres in the pseudo-Gothic style).

Considering the lack of published sources devoted to methods and problems directly relating to the restoration technologies at Odesa Opera House, the project sources of the Ukrrestavratsiia Corporation were used – the volume "Working Project" [12]. A significant block was constituted directly by restoration sources – the articles in scientometric publications

[13–18]. Although these publications do not provide insight into the process of restoration of Odesa Opera House, they illustrate a general systematic approach to the restoration activities in general, contain general characteristics of materials and structures traditional for the 19th century and methods of restoration of buildings of that period [14, 18]. Also, the Ukrainian normative documents [19–22] and the materials of the International Charters [23] were involved.

The theme of theater as the action that takes place directly in the presence of the viewer is related to art criticism theories, which, among other things, highlight the role of media in the current relationship "actor-spectator", which led to the involvement of the appropriate source base.

Today, there is a significant deviation from the classical concept of the visible, the live performance that is implemented in the classical theatre; it is due to the rethinking of the mere term of performance, including thanks to the media development.

The concept of ephemerality has been one of the main features that differentiate performance art from contemporary art forms. This concept was expressed in detail in the 1970s when it testified art's liberation from alienation and subordination to the laws of the market. In 1993 this idea was proclaimed by Peggy Phelan in her book "Unmarked. The Politics of Performance", which presented a broad interpretation of this approach to art [24]. She recognized "disappearances" as the ontological source of performance, attributing to it the role of a vehicle for supporting the "reproductive ideology" that dominates in the contemporary culture. Considering the performance from the point of view of an ontological perspective, the author emphasized that it is impossible to preserve, reproduce or document it. The performance is not involved in the circulation of representation that is the author did not even envisage not only the possibility of prolonging the performance by documenting but also the possibility of its transition into a material-objective phenomenon, which acquires the character of some kind of long-term object [24].

In modern conditions, more and more attention are paid to the role of documentation and medialization in the art of performance [25]. The opposition to the views of Peggy Phelan on the topic of medialization is traditionally represented by the views of Philip Auslander. He opposed the ontological division of performance, arguing that the relationship of the existing things and medialization should be conditioned more as a relationship of dependence and complementarity (or imbrication) than the opposition. He also emphasized that what is characteristic of performativity is the intermediation in the sense of mediation, "existence between" [26]. That is why modern performance is understood very broadly, both as the immediate activity and recording, documentation of the actions, created not necessarily in the presence of the viewer.

The aforementioned can also be attributed to the classical theatrical spectacles, which today can be repeatedly viewed in recording or during the live broadcast of performances, actively used by theatres under the conditions of the pandemic and their impossibility of accepting spectators.

Under the influence of transformation of the tastes of society and changes in expressive means, classical theatrical performances have also changed; cases of "modernization" of famous theatrical performances by "modernizing" plot lines or modernizing the scenery have become more frequent.

The analysis of the source base revealed noticeable problems in the coverage of restoration activities at the prominent theatres in scientometric sources and made it possible to formulate a range of the un-investigated issues:

- in the existing sources, there is no comprehensive description of the specific problems of the emergency state of theatres of the 19th century and the entire cycle of restoration measures at the facilities of Ukraine and Poland;

- the restoration measures of previous periods have not been evaluated in terms of their effectiveness;
- the functioning of the theatre as an art cluster is not considered, and it is not formulated how the principles of the functional organization of theatre buildings of the 19th century can be successfully used in modern art formations on the principles of clustering.

Materials and Methods

The breadth of the study, which covers several countries, determined the choice of research methods, among which were chosen the following general scientific research methods: the methods of historical and comparative analysis, the graph-analytical method, the method of system-structural analysis in combination with archival and design materials, and also materials of field surveys. The methods of historical and comparative analysis made it possible to comprehensively investigate the specifics of the development of theatre construction in the 19th century and trace the general trends and directions of impacts and borrowings; the method of system-structural analysis made it possible to analyze the process of restoration of Odesa Opera House and the Municipal Theater in Cracow as systemic integrity from the general to the particular and was supplemented with photographs and graphic images. The method of the system-structural analysis has allowed us to do the element-by-element research of the materials, structures and technologies of the individual components of both theatres; to compare them with each other to get conclusions about the tendencies of theatrical construction in the second half of the 19th century.

Results and discussion

The experience of the complex restoration of Odesa National Academic Theater of Opera and Ballet

The history of the theatre, specific building materials, structures and decoration

Odesa Opera House is an example of an object of restoration of the immense complexity, taking into account the conditions of construction, the uniqueness of the decorative finishing, the acute emergency condition of all structures and the ornamental finishing.

The unique building of Odesa National Academic Theater of Opera and Ballet, with an audience hall for 1600 people, was built in 1884–1887 upon the design of the famous Viennese architects Ferdinand Fellner and Hermann Helmer and is considered their best object, the second theatre in Europe after the Vienna Opera and the fifth in the world. The facades and interiors of Odesa Opera House are marked by the uniqueness of their decorative finishing. The facades, originally painted in golden brown, with accents in the boxes, were decided in the style of the late Italian Renaissance with baroque elements; the interiors of the spectator rooms were in the style of the late Viennese baroque and French Rococo. For decorative finishing of the theatre facades, light crystalline limestone was used (columns, parapets of boxes and porticos, covering plates, balusters). Limestone and shell rock was used for the imposts of openings-exits in the boxes. The three-tier lavishly decorated facades of the spectator section along the central axis were interrupted on the south side by a two-tier portico with an attic – the main entrance to the theatre. This part of the theatre was most luxuriously decorated. The eastern and western facades were accentuated with single-tier three-frame porticoes over the entrances.

The sculptural and decorative finishing of the facades was made of artificial stone; all 42 compositions personified the muses of art. The covering of the cupola over the spectator section was made of zinc sheet with numerous decorative elements using the chasing and repoussé technique.

The complicated rich rocaille decor combined with gilding adorned the five-tier hall, the stairs and the foyer. The ceiling of the hall was decorated with scenes from Shakespeare's plays;

in the centre, there was a large bronze chandelier with crystal pendants. In the audience space, in addition to the hall, there were mosaic floors with stylized floral ornaments. The sketch of the theatre curtain was developed by the famous artist F. Golovin. In addition to the unique decoration, the horseshoe-designed hall has remarkable acoustics.

The theatre was built on a complex relief in such a way that the spectator part (hall, foyer, gallery) in the form of an enormous horseshoe is located on the flat part of the plateau, along the axis of one of the main streets; the stage part, embedded in the natural slope, had a cubic shape and a service facade went out onto a small, secondary street (P.I. Tchaikovsky Street).

The emergency problems and the first restoration and repair measures

The building was built on the strip foundations of limestone 0.6 – 2.4 – 4.0m wide, with the lower part of rubble masonry. The average load on the ground exceeded the initial subsidence pressure for loess soils and led to the settlement of the foundation soils when they get wet [12].

The first cracks appeared already during the walling up, and after 13 years of operation of the theatre, the building already needed repair. The heavy deformations emerged in the theatre building in 1900: cracks appeared in the walls, arches, floors and ceilings as a result of the settlement of the eastern part of the building by 17.7cm. At that time, they undertook the works to expand the foundations in the south-eastern part of the theatre, but these steps did not bring any effect, and the deformation processes continued. Back in 1903, the subsidence of the walls of the tiers was up to 20cm, and there was a slope of the floors of the foyer and corridors.

In 1918–1919, the pylon of the portal wall of the stage settled, due to the leakage of the water supply networks. In 1927 new cracks appeared on the stage walls and in the eastern part of the foyer. In 1925, after the fire, the heavy guillotine opening fire curtain of the stage was installed; it gave rise to the appearance of additional cracks in the walls of the portal wall; together with cracks from subsidence of the foundations and foundations, led to its emergency state.

So, at first, the settlement of the building was in the eastern part, later – between the central and eastern portals; then cracks appeared in the load-bearing walls of the western part; the further destruction manifested itself in numerous cracks in the walls, lintels and ceilings and the destruction of individual elements.

In 1954–1956, the strengthening of the foundations was carried out by the method of soil silicization. However, it did not bring any effect, since there was no reinforcement in some parts of the foundations after their drilling. The restoration work in 1966 concerned the restoration of sculptures, mosaics of floors, the gilding of interiors, but the deformations of the structure continued in the future.

During the studies of 1963–1989, groundwater and soil moistening from the water supply networks were recorded. In the 1980s, the entire building was in an acutely emergency condition: it split into 36 separate blocks, the slope of the walls towards the sea was 20cm, the width of the opening of numerous cracks was 6cm, the floor beams of 2–3 tiers shifted and sagged by 30cm. In 1997–1998, the investigation showed that the deformations did not stop.

Studies in 1997–1998 found out the reasons for the uneven settlement of the theatre building and the appearance of deformations [12]:

- complex configuration of the theater plan, absence of expansion joints, insufficient rigidity of the building and reinforcement elements;
- the presence of a layer of loess soils under the foundations with their periodic moistening; intensive geological processes – flooding, subsidence phenomena through bulk soils and a rise in the level of groundwater, karst phenomena;
- the ineffectiveness of use of various widths and depths strip foundations and the reverse effect of silicization;
- the presence of heavy fire-fighting equipment of the stage box, for which the building was not designed.

Conclusions about the consequences of the emergency state of the foundations and foundations were formulated as follows:

- 1) during its existence, the building has undergone numerous deformations, as a result of which cracks appeared in its parts;
- 2) the appearance of cracks in the walls led to a split of the building between the stage and spectator sections and the division into four parts of the walls of the spectator section;
- 3) deep longitudinal cracks were recorded on the ceilings of the tiers, the floors shifted along the annular walls, as a result of which the annular cracks emerged. The floors of the tier vestibules sloped towards the outer walls;
- 4) as a result of subsidence and destruction of the outer annular walls, the floor beams of the second and third tiers were displaced from the supporting sections of the masonry; the supporting sections of the masonry under the supports collapsed, due to which the beams sagged for 30cm;
- 5) on radial trusses, the slabs were bent and swollen on the columns to which the trusses are attached. An annular I-beam at the top of the auditorium wall, on which the roof trusses are supported, has torn apart along the line of the bolt holes;
- 6) the beams of the monolithic ribbed slab of the deck of the stage part got cracks and chips with an opening width of up to 20mm in many places supported by the walls of the stage;
- 7) at the time of the survey, the north-eastern corner of the theatre building was 175mm lower than the north-western corner, the deepest subsidence was recorded at the eastern lobby and amounted to 375mm; all staircases of the spectator section were inclined to the south, the portal of the main entrance was inclined to the south and east by 200mm; the walls of the stage have a slope in the north-east direction for 200mm;
- 8) corrosion of metal structures is observed in some rooms;
- 9) progressive deformations led to the emergency state of the decor and an emergency state of load-bearing structures and assemblies; the emergency state of the building poses a danger to people.

It was found out that foundations of a complex configuration, mainly without expansion of the base, with an average width of 1.4–1.5m, have different depths; the difference in elevations within the building is up to 4m. During the operation of the theatre, the building received uneven settlements (up to 30cm) and deformation of the underground part, which led to the appearance of cracks.

Since 1887, the facades were repaired 5–6 times, but those were cosmetic repairs. The state of the facade at the time of the survey was due to the primitive technologies of repair and restoration measures when lime-cement and cement grout were used. It led to a distortion of the color scheme of the facades; the stucco details became less expressive; the rusticated areas had thick layers of later overlaying's. The sculptural decoration made of natural limestone and artificial stone reinforced with metal, the color of which was practically identical to natural stone, suffered greatly under the influence of climatic conditions, in particular, losses and cracks appeared on all sculptures, as a result of weathering the outlines of the sculptures suffered. Corrosion of the reinforcement metal accelerated the destruction of the sculptures.

The process of complex restoration of Odesa National Academic Theater of Opera and Ballet

The specificity is the use in the building of the Odesa Opera House of various types of ceilings of the 19th century: the ceiling made of monolithic reinforced concrete ribbed slabs; the ceiling made of metal trusses of complex configuration; brick vaults on metal beams; the ceiling of metal decking on beams filled with limestone residues with lime mortar; the monolithic reinforced concrete ceilings. Unlike, for example, "House with Chimaeras", where the roofs are only from the roofing metal, several types of roof coating of the 19th century were used in Odesa Opera House: metal sheet roof covering, zinc roofing and roofing made of galvanized steel roofing sheet.

The priority measures for eliminating the emergency condition of Odesa Opera House building were identified. They were aimed at stabilizing the spatial stability of the building, strengthening the large-span load-bearing structures of the ceiling of the stage openings of the firewall walls and the large-span structures of the roof trusses of the auditorium covering, the structures of monolithic reinforced ceilings in the bathrooms, and the structures of the ceilings of all tiers; the frames of the ceilings of boxes and balconies; the liquidation of breakdown susceptibility; ensuring further operation of the building; compliance with the modern standards and requirements for theatre buildings; first of all, strengthening the footings, foundations and superstructure of the main portico of the stage box and their protruding pediment parts. In the western emergency portico, a partial rearrangement of the vaults was envisaged [12].

It was decided to use the auger cast piles in combination with the jacked ones. Strengthening the existing foundations was supposed by transferring loads from the existing foundations through the transverse beams in their masonry to slab-and-beam grillages, from them to piles with a diameter of 200mm and then to reliable load-bearing soils of the footing. Monolithic reinforced concrete auger cast piles were provided along the outer contour of the building and in all rooms where it was possible to install the auger cast pile equipment. Prefabricated reinforced concrete jacked piles are installed in the walls adjacent to the stage portal, in the stage box walls on both sides. Monolithic reinforced concrete grillages were installed along the walls of the foundations on both sides. The ligatures were designed to accommodate horizontal seismic loads.

Thus, the system of frames with transverse pick-up beams, grillages, stiffening nodes and horizontal ligatures formed a reliable stiffening disk, the main bearing elements of which in the form of grillages rest on the pile field.

Odesa Opera House was another example when the reinforcement of foundations by the method of auger cast-in-place piles turned out to be the only effective one. In 1998–2001, the weight of the structure was transferred to the auger cast piles in combination with a grillage, which essentially created a newly reinforced foundation for the theatre. It stopped deformation processes and made it possible to transfer the load to reliable soil layers.

The walls of Odesa Opera House are laid of shell-limestone combined with brickwork masonry (the 19th century). The structural scheme: in the annular walls of the auditorium there is a metal frame made of metal racks and crossbars made of I-beams, resting on the column tables. The problems were as follows: the appearance of cracks due to uneven subsidence of the foundations and wetting of the footings.

In addition to strengthening the footings and foundations of Odesa Opera House, the following emergency measures were proposed [12] (Fig. 3):

- strengthening of the front walls of the spectator section;
- reinforcement of the suspended ceiling and ceiling of the auditorium;
- reinforcement of the side porticos structures;
- strengthening of the supporting structures of the floors of the second and third tiers;
- strengthening of the structures of the portal wall;
- restoration and reconstruction of the decorative finishes;
- compliance of the engineering networks and internal planning with applicable standards;
- renovation and reconstruction of the theater square.

Strengthening the superstructures of Odesa Opera House provided for arrangement in the walls at several levels to the height of the walls while preserving the decorative finish of the following things:

- steel belts of bandages along the outer and inner walls at the level of the 2nd tier and the sub eaves part of the walls;
- a monolithic reinforced concrete belt at the attic level along the outer and inner walls of the spectator section;

- steel-reinforced concrete disks of stiffness on the level of the orchestra stalls and the level of the 2nd and 3rd tiers of the spectator part;
- steel disks of stiffness in the attic level of the spectator part;
- monolithic reinforced concrete disks of stiffness at the level of the coverings of the western and eastern porticos and the level of the ceiling of the central portico;
- steel belts of clips in two levels of the stage box;
- steel sub-struts of trusses and bracings in two levels of the portal wall;
- steel sloping joist/beam system at the ceiling level under the sculpture "Melpomene" of the central portico;
- reinforced cement shirts in vaulted and arched ceilings;
- monolithic reinforced concrete ceilings over new premises and in areas of existing destroyed ceilings;
- strengthening of individual units and structures with significant damage;
- injecting the cracks opened for more than 3 mm with polymer cement mortar with reinforcement piercing along the main faults, and without piercing, in arches and vaults;
- strengthening of arched, vaulted and ordinary lintels by installing of unloading metal beams or contoured metal framing over them;
- replacement of the ceiling areas with corrosion of metal elements;
- strengthening of walls in places of the maximum loading;
- reconstruction of the stage box: the installation of an integrated unloading metal structure of four columns, which are connected with horizontal galleries and joined by vertical bracings; on the columns, it is arranged a system of cross metal trusses with cantilever sections-overhangs, to which equipment is attached without loads on the walls [12].

As was already described in detail in the previous section, priority measures were taken to eliminate the emergency state of the portal wall with numerous cracks. In the portal wall, they arranged bracings and sub-struts of trusses. The cracks in the inter-floor construction of Odesa Opera House were stitched and fixed with reinforcing rods and injected with an appropriate solution.

The facades and interiors of Odesa Opera House are noted for the uniqueness of their decorative finishing and represent the stylistic solution of the second half of the 19th century (Fig. 4) [12]. For the time of the survey, the sculptural composition on the southern facade, the sculptural compositions of the attic of the eastern, southern and western facades, and the sculptural compositions of the first tier of the central portico were in disrepair or were lost. The pinnacles of the stage box were in extreme emergency conditions. Some of the elements of the statue of Greek goddess Melpomene in a chariot were lost. Most of the decor required primary emergency response, repair and restoration measures.

After examining and fixing the emergency roof structures, the initial zinc-sheet roof of the auditorium was restored.

In the spectator part of the theatre and the auditorium, in the ceilings of the tiers and "white stairs", there are stucco ceilings, stucco decorations and plaster, which are attached to the wooden circular suspended structures with insulation made of reeds. At the time of the survey, the decor of the hall with the painting required restoration measures, as well as the decor of the foyer and recreation areas and the mosaic floors, which required strengthening and restoration. All wooden cladding structures, as well as the suspended ceiling of the auditorium, were restored by the method of prosthetics to preserve the acoustics.

Only old finishing technologies and traditional materials were used to preserve the unique acoustics of the auditorium.

Restoration Odesa National Academic Theatre of Opera and Ballet.



a. The condition of the facade of the Opera House before the restoration.



b. After the restoration. 2007.



c. The process of strengthening the foundations.



d. The process of strengthening the foundations.



e. The process of strengthening the foundations.



f. The condition of the roof elements of the Opera House before the restoration.



g. After the restoration. 2007.



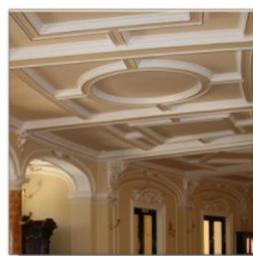
h. After the restoration. 2007.



i. Emergency condition before restoration.



j. The process of restoration of floors.



k. After the restoration. 2007.

Fig. 3. The process of complex restoration of the Odesa Opera House.
Materials of Ukrrestavratsiia Corporation

Restoration Odesa National Academic Theatre of Opera and Ballet.



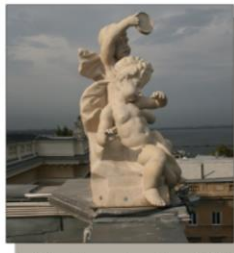
a. Emergency condition before restoration.



b. After the restoration, 2007.



c. The condition of the stucco figures on the roof before the restoration.



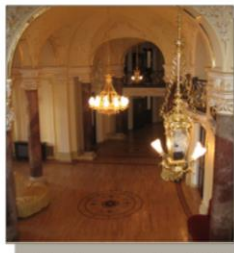
d. After the restoration, 2007.



e. The sculptural composition "Melpomene" and the facades of the Opera House after restoration.



f. Emergency condition of interior decor before restoration.



g. After the restoration, 2007.



h. A fragment of the restored decoration of the theatre auditorium.

Method of restoration of a plafond with a decor (according to M.Orlenko)



i. The condition of the theatre interior before the restoration.



j. Restoration of stucco decoration in the interior of the Opera House.



k. After the restoration, 2007.

Fig. 4. Restoration of the unique decor of the Odesa Opera House.
Materials of Ukrrestavratsiia Corporation

The National Theater of Iași is an element of cultural heritage, a tool for preserving the past and an opportunity for education

The evolution of the National Theater of Iași, as an institution of architectural system

The first National Theater of Iași was founded in 1840 under the direction of Costache Negruzzi, Vasile Alecsandri, Mihail Kogălniceanu and will operate from December 22, 1846 in the hall of the Great Theater in Copou. Initially, the management of the theater troupe was provided by Costache Caragiale. The first Romanian show, under the roof of a national state theatrical institution organized in boyar houses, took place on November 18, 1840, with the play "Farmazonul din Hârlău" by Vasile Alecsandri, staged by Costache Caragiale.

Thus, the documents of the time mention that a first theater show in Romanian takes place in Iași in the house of the boyar GHICA, where the play "Mirtil și Hloe" by Gheorghe ASACHI was staged. In fact, the cultural life of Iași started with numerous performances of foreign troops (Italian, French, Russian) in the program of performances that were staged in specially arranged rooms [27].

The writings of N.A. Bogdan – "The City of Iasi", second edition 1913, states that "The first of these (theater shows) was the one arranged in the houses of the boyar Lascarachi Agachi called "Talpan" in 1812 by the Italian Gaetano Magi.

In 1832 "...another French comedy and vaudeville troupe arrives in Iași under the direction of two Fouraux brothers and, not finding Magi's theaters, transforms Dr. Peretz's house in Goliei Street into a theater. The theater is active under the name "Théâtre de variété". On this stage is organized the show in Romanian "Celebration of the Moldavian shepherds", on April 10, 1834, in which the "actors" were Gheorghe Asachi, Vasile Alecsandri, Matei Milo, Mihail Kogălniceanu, Alecsandru Mavrocordat, N. Docan, Scarlat Varnav and other sons of boyars" mentions these documents.

In this "Théâtre de variété" were given the first performances of the National Theater of Iași established in 1840 until 1846 when the new hall of the Great Theater of Copou was inaugurated in the house of the boyar Mihai Sturza, now owned by the Epitropy of St. Hospital, Spiridon of Iași [28].

The seasons of 1849–1850, 1851 and 1852 were seasons that were successful due to Matei Milo, but after a period of triumph follows a period of administrative problems (frequent changes of leadership) or social (cholera epidemic). In 1866, the Government grants a subsidy to the City Hall, with the obligation to ensure the administration of the Iași Theater, but this project does not give results and they decide to hire a professional director in the person of the actor N. Luchian who will collaborate with the band of actors from Iași and the band from Bucharest of Mihai Pascaly.

There follows a period of searches regarding the repertoires that correspond to the purpose of the National Theater considered as a true school of language, interpretation of morals and training of different segments of the public.

A devastating fire from the night of 17 to 18 February 1888 destroyed the building of the Copou Theater (Fig. 5), the new building being built on the site of the old town hall after several attempts between 1894 and 1896 by Viennese architects Fellner and Helmer being considered a true architectural jewel, the oldest and most beautiful place of this kind in the country, inaugurated on December 1, 1896 by Mayor Nicolae Gane.

The steps for the construction of a new theater lasted until 1894, when the contract with the Viennese architects Fellner and Helmer was approved. The plans of the building belong to the famous Viennese architects, who were known for similar projects of theaters in Vienna, Prague, Odesa, Zurich.

The current building was built on the site of the old town hall, between 1894 and 1896, being considered to be the oldest and the most beautiful place of its kind in the country. On December 1, 1896, the National Theater building was inaugurated by Mayor Nicolae Gane.

Along with the theater, its power plant (Fig. 6) was inaugurated, which marked the beginning of electric lighting in Iasi.



Fig. 5. The old building of the National Theater of Copou
https://ro.wikipedia.org/wiki/Fi%C8%99ier:TNI_1846.jpg



Fig. 6. The image of the National Theater of Iași (1922), with the Power Plant on the right

For the access to the first show (December 1, 1896), after the inauguration, a gilded bronze medal (engraver: N. Șternberg, Iași) was beaten, in memory of its inauguration (Fig. 7), used as an access ticket to the performance hall [29-31].

The opening program included "Uvertura Națională" by Flechtenmacher, the vaudevilles "Muza de la Burdujeni" by Costache Negruzzi and "Cinel-cinel" by Vasile Alecsandri, but also the verse comedy "Poetul romantic" by Matei Millo. The income of the first evening was distributed to the poor from Iași, and the revenues of the soiree went to the artists of the Dramatic Society of Iași.

Figure 8 shows a series of period views, found in the collection of Professor Ion Sandu from Alexandru Ioan Cuza University of Iași, with the image of the National Theater of Iași in different historical contexts.



Fig. 7. Gilded bronze medal, made in 1896 in his workshop by Professor Nicolae Șternberg from the School of Arts and Crafts in Iași (collection of prof. Ion Sandu; Iași)



Fig. 8. Vintage views of postcards published in Iasi: (a) 1896, (b) 1906, (c) 1918 and (d) 1980.

Less than a year after the official opening, the activity was suspended due to the necessary works, following the damages caused by subsidence of the foundation land, highlighted by cracks and fissures of the structural elements of the construction.

In 1920, it was proposed by the technical staff of the city and the town hall to close the theater, in order to prevent a catastrophe.

In 1922, the director of the theater at that time, the poet Mihai Codreanu, asked the City Hall to set up a commission of technical staff to ascertain the "state of solidity" of the theater. Following the minutes concluded, it was decided to close the theater and summon the Ministry of Arts, at that time, to take "urgent measures to restore this monument".

Later, in 1940, because of the earthquake, the polycandrum fell from the performance hall, and during the Second World War, the city of Iasi was bombed, very strongly, as in 1944, on the theater building falling two shells; one of the shells exploded at the level of the frame,

dislocating the cover and destroying a metal truss, and the second pierced the dome, damaging it, without the bomb exploding.

Between 1955 and 1960, a series of cracks were reported in the area of the main entrance and the main hall, with serious consequences on the structural elements.

In 1969, cracks and subsidence in the western part of the performance hall were reported again, due to the wetting of the loess that constitutes the foundation layer, as well as the existence of cellars and vaults under the foundations of the building.

Starting with 1970, the theater building is kept under permanent observation, following the evolution of the settlements and the variation of the water table. It was found that, due to the lifting of the groundwater, due to the deep foundations of the new blocks built in the central area, the building collapsed slowly and unevenly. As a result of their aggravation, in 1973 the National Theater was closed again.

Between 1973 and 1974, works were done to consolidate the foundation ground by electrosilicate, which apparently stopped the settlements, but caused a strong salinization of the walls, to appreciable heights (1.5... 2.5 m), with negative influences in terms of the integrity of the building materials of the Theater buildings, but also to other monuments in the vicinity, with stone masonry or brick. During the same period, structural consolidation works were carried out, from a structural point of view.

After the 1977 earthquake, other repairs and consolidations were carried out, but without carrying out all the works mentioned in the expertise and in the consolidation project.

After the 1986 earthquake, the building suffered other degradations, following the expertise being proposed works to consolidate the structural elements.

We mentioned these stages of degradation and interventions made over time to signal that all were performed only locally, strictly on a damaged element, without any overall intervention on the entire resistance structure.

From 2000, when the last restoration works started and until 2011, the National Theater of Iași carried out its activity in several locations. Due to these restoration and preservation interventions, the performances took place at Sala Teatru (Teatru la Cub), Sala Pod Pogor Fiul, Sala Studio Teofil Vâlcu and Sala Uzina cu Teatru.

The interior of the "Vasile Alecsandri" National Theater of Iași

Inside the National Theater, in the center area, there is a large nave with the performance hall, the stage and the balconies on three levels (Fig. 9a), surrounded by the access halls, which start from the main foyer in front (Fig. 9b).



Fig. 9. Images from the Interior of the National Theater of Iași:

(a) Performance hall (view of the stage with the curtain painted by M. Lenz);

(b) The foyer of the theater, with central access to the performance hall and side halls for access to lodges (balconies)

The role and functions of national theaters

It is known that any theater, has very specific goals and functions and offers one of the ways to escape from everyday life, a way to promote true cultural values. It can be mentioned that the theater can be a fascinating phenomenon viewed in its spectacular dimension, that "social mirror" that reflects the phenomena and situations in society and at the same time is in a permanent change and reconstruction.

In recent years, more and more people have chosen theater as a form of entertainment through the possibility of caricaturing society, thus allowing the understanding of imperfections and the exteriorization of feelings, which at certain stages were not allowed in society, so it can be said that it has catharsis role. It is mentioned by some specialists that in defining the human personality, especially of adolescents, not only school, with literary works and books read, can play an important role, but also theater can enrich empathic and communication skills, tailoring well-formed and free personalities in a closed world, sometimes between too many fears, prohibitions and clichés. By participating in the show, by playing a role, the man surprises those around him by displaying states, feelings, situations helping him to know himself emotionally, cognitively, aesthetically, to perceive his limits and managing to detach himself from everyday life.

In contemporary society, the issue of education acquires new connotations determined by changes in all areas of social life. Theater performances, as well as extracurricular activities, form in the case of young people a capacity for perception, understanding, observation, perseverance and exploration of the sense of abstraction [4].

Participating in theater shows socializes people and stimulates their intelligence and creativity. By offering a field of action to assert personality, the theater thus acquires the role of educating to give young people the satisfaction of expressing their feelings and behavioural elements acquired. By participating in the show or by playing a role, the man surprises those around him by displaying states, feelings, situations helping him to know himself emotionally, cognitively, aesthetically, to perceive his limits and managing to detach himself from everyday life.

"Built according to the latest plans and provisions, solid, comfortable and luxurious, the National Theater of Iași is a true architectural jewel and a charming local party for its visitors. It cost, with its complete endowment, new decorations and furniture, brought from abroad, new suits as well, the special installation of electric light, steam heating and automatic fans, an amount of over 2,000,000 lei. The exterior view of the Theater is as imposing as the interior – with four monumental facades, surrounded by beautiful gardens, with in front the bronze statue of Alecsandri, and to the north of Miron Costin" [1].

The main entrance to the theater building is highlighted by Viennese architects by a classical portico consisting of four composite columns. The pediment is an attractive exterior adornment for the building and depicts a mythological scene whose mythical characters and animals are caught in motion. In the center of the stage and at the same time of the pediment is presented the goddess Diana, enthroned on a float, the rest of the scene of the composition is represented by tigers, humans and in the small space from the sharp peaks of the pediment the characters are represented lying. The façade features balconies, other relief sculptures and Ionic columns. This architectural monument houses a curtain of great beauty painted in 1896 by the Viennese Lenz and continued by a disciple of his. The painting represents an allegory of life with the three ages in the central part and an allegory of the Union of the Romanian Principalities, then the Iron Curtain painted by Al. Goltz with symmetrical ornamental motifs.

The ceiling is also painted by Al. Goltz with pastel colors representing paradisiacal allegories being shown nymphs and angels, framed in the rococo structure. Also, on the ceiling next to the orchestra pit is the coat of arms of the four reunited provinces, with the heraldic insignia of each and from the royal coat of arms in a parallel plane is visible the sceptre, the royal insignia being removed after abdication.

The Great Hall of the theater has 740 seats and has a stable, lodges and balconies. The hall has the best acoustics, with elements in Rococo and Baroque style, richly decorated with halls with graceful statues and harmoniously colored marble, chandeliers that create an atmosphere of enchantment and elegance, this building was considered one of the most successful constructions of Viennese architects. Today the building houses the Romanian Opera [32].

The 1418 electric lamps and the Venetian crystal chandelier illuminate the theater and the main curtain. The National Theater also supplied the first public lighting installations in Iași (the lighting of the Theater Square with 12 electric lamps with voltaic arc) which was the beginning of the electrification of the city of Iași. The National Theater also received the diploma of appreciation "Protector of cultural heritage" offered for efforts to promote, preserve and protect the cultural heritage of the Northeast Region.

National Theater of Iasi – edifice of culture and education

Currently, the theater has a troupe of 36 actors, 2 directors and 2 set designers, along with other departments, such as managerial, administrative and technical, as well as partnerships on projects and collaborators, who work with the theater team. The season has 8 – 10 titles to which is added the resumption of successful shows [33].

The repertoire tries to satisfy the most diverse requirements being made up of texts proposed based on the criteria of using the band, directorial offers and market tests including pieces from classical and universal drama and aiming to promote new names in Romanian drama.

The orientation of the cultural message is multi-directional, trying to maintain the balance between the formal and the ways of contact with the public.

Theater is considered "as an active component in contemporary education and, if the most appropriate metaphor of the contemporary world is that of 'the world as theater', then it means that the educational process must, among other things, be based on this idea, which to succeed in deconstructing it but also in reconstructing it in different components of the education process", says professor Nicolae Manda, Rector of the "Ion Luca Caragiale" National University of Theater and Cinematography in Bucharest (UNATC).

Some specialists mentioned that in defining the human personality, especially of adolescents, not only school, with literary works and books read, can play an important role but also theater can enrich empathic and communication skills, tailoring well-formed and free personalities. a world sometimes closed between too many fears, prohibitions and clichés.

In the lecture "Express educational theater" at the Education Congress 2013, the theater critic Mihaela Mihailov mentioned "the various faces of education through theater, considering that the first is participatory education. This is a type of horizontal education, which gives everyone involved the right to participate, with equal rights, in the creation of a common space of knowledge. The theater of participatory education creates a common environment of reflection and action, in which all adolescents can express themselves and create together, a cultural action" [4, 34].

Another side of the theater's influence on personality was considered "creative education". Picasso considered that "every child is creative. The problem is how to make it stay that way" [35]. In this sense, theater can be accepted in solving the problem through interest, curiosity, spontaneity, openness to other new horizons by combining the real with the fantastic.

We can also emphasize the role of theater as a "cumulative education" that is based on the integration of new experiences in everyday life, information, topics and themes that can provide. Through theater performances and themes addressed to adolescents and not only, they learn to be in solidarity with each other, with various problems, thus generating groups, communities that fight for common rights to mobilize in certain tense situations. The theater is also stimulating communication in freedom of expression and movement as well as in vigor. The emotional language of the theater emphasizes the way the message is transmitted by

establishing a relationship of communication and interest with the receiver who in our case is the spectator. "Each adolescent becomes a narrator, a receiver who can change the perception of reality through the story he tells" [34].

Theater helps the individual to understand more easily to get rid of anxieties by resolving conflicts, facilitating communication and facilitating social inclusion and freedom of expression. The "feeling of communication" mentioned by Alfred Adler can be likened to what in theater is called "team spirit", Adler mentioning that man is the only being in the universe unable to live in solidarity. "No matter how far we research in the history of society, we do not find anywhere any trace of an individual who has lived alone, faith in society has always existed" [35]. It can be considered that in addition to the educational role, the theater also has a therapeutic role by understanding one's own person and others, developing the capacity for social adaptability and various critical situations. By positively influencing the psyche through pleasant and cheerful learning methods in contrast to conventional formal and behavioral methods, an active education can be offered, encouraging originality and giving maximum freedom. The theater is also a promoter of the ideas of the great playwrights, who transpose on stage experiences, feelings but also valuable concepts. Knowing that the theater is in connection with the life of all the arts is done as far as possible "their mirror".

The experience in the complex restoration of the Juliusz Słowacki Theatre in Cracow, Poland

In the archives of the Cracow University of Technology, there is a detailed description of the restoration work in the theatre, which began before its 100th anniversary, celebrated in 1993, published by Jerzy Łacki, an employee of the Institute of Architecture and Monument Restoration of Cracow University of Technology [36]. Krystyna Parpzyca analyzed the descriptions given by him, which made it possible to compare the structures and materials of theatre in Odessa and Cracow, built in the same period, emergency state of the buildings and the scope of restoration measures [36]. An analysis of Jerzy Łacki's thorough article in a professional restoration publication was necessary to conduct a comparative analysis of the stylistic finishes, building materials and structures of two unique theatres built almost simultaneously, to compare the problems that arose during their restoration, and to argue the Viennese school's role in theatre design. Europe in the second half of the nineteenth century.

Specific building materials, structures and decoration.

The Paris Opera (architect Charles Garnier) became a model both of the functional organization and the constructive scheme for the Municipal Theatre built in Cracow (Fig. 10). K. Paprzyca systematized the information provided on the initial building materials and structures of the Municipal Theatre according to the following principle [36]:

- footings and foundations of the theatre;
- walls;
- ceilings and load-bearing support;
- roofs;
- engineering equipment;
- acoustics.

The building foundations made from the disassembled raw stone are in the thickness of fine sandy soil, a part of the old medieval city walls was taken for them.

The outer facade walls were laid of high-quality bricks with dimensions of 29x14x6.5cm; the theatre facades were decorated with rustication and pilasters up to the cornice above the first floor, in contrast to the smooth upper part. The windows have lavishly decorated frames built into monumental arches with key blocks [36].

The theatre building has a basement, the walls of which are laid with the use of the mixed transverse-longitudinal masonry technique with a layer of horizontal waterproofing of bitumen mastic of 7 mm below the level of the floor of the orchestra stalls and on the terraces. Both design and construction works were motivated by the idea of applying technological

innovations in the building. As can be seen from the surviving descriptions, only the best types of building materials were used during the construction. Samples from each batch of materials, such as hydraulic lime and Portland cement, were tested by the laboratory of the Society of Engineers and Architects in Vienna. The proposed material was taken only after receiving its positive assessment. The best-talented professionals were involved in the construction work. It allowed the use of Monier slabs, which at that time were considered modern materials compared to segmented ceilings or Klein slabs, and were less expensive than slabs made of brick sections due to the use of reinforced concrete slabs. The "Monier" type ceiling consisted of a steel beam and a reinforced concrete slab with a thickness from 6 to 12cm at the bottom, steel inserts from 8 to 12mm were used, with a distance of up to 15cm. Sectional ceilings were used in the basements, also known as cellars or Prussian covers, consisting of a steel I-beam and a brick vault with an arrow from 1/8 to 1/12 of the span between the steel beams [36].

The most economical span of steel roof purling is 6.0m with an interval of 80–200cm, averaging about 120cm. It was a widespread solution at that time. Riveted steel lattice purlings were used in the stage roof; the double-gable structure was fixed in the upper part longitudinally (Fig. 11).



Fig. 10. The main facade of the Juliusz Słowackiego Theater in Cracow
Photo by K. Paprzyca, 2021.



Fig. 11. View of the facades and dome of the theater from Plant. Photo by K. Paprzyca, 2021.

Above the hall, there were also riveted steel edge beams in the shape of a dome, fastened longitudinally along with the entire height, so that a lattice spatial system was created. The entire structure rests on external and internal walls. By then, steel lattice roof systems were the only reasonable solution in terms of span and cost.

The basement floor was made in the form of vaults and floor sections.

The orchestra stalls, balconies of the first and second floors, and galleries have sloped floors, and only the boxes are at the level of the surrounding corridors. Under the spectator part, there is a ventilation chamber with brick supports, on which the load-bearing iron beams of the floor are based. Above the orchestra stalls, the first and second tiers, there are sectional vaults on steel beams. In the adjacent to the stairwells part, the supporting structure is formed by steel box beams and ceilings in the "Monier" system [36]. The stairs rest on the middle sidewalls, the platforms – on the vaults between the steel beams. The steel structure of the building's roof is supported by external and internal walls.

The stairs rest on the middle sidewalls, the landings on the arch between the steel beams. The even distribution of loads from the principal steel girders was obtained by using stone lattice and box purlins. In the walls, the bracings with a section of 8/50mm with anchors were installed. A specially formed brick 10cm wide was used for the vaults of the boxes and the corridor. The ceiling above the spectator's part made like the ceiling "Monier", forms a shallow bowl with a diameter of about 20m, decorated with gilding and color at the bottom [36].

The auditorium and boxes were decorated with sculptural and stucco polychrome elements. The steel pillars supporting the vaults of the hall are riveted from the corner profile; the pillars of the box compartments are made of cast iron; the pillars, supporting the ceiling of the main hall, are made of iron and tied with brass wire. The supports were covered with a plaster coating to imitate plastering and sculptural decor.

The riveted two- and single-pitched roofs of the truss structure were manufactured by a company from Vienna, first covered with zinc sheet and then with the copper sheet over the formwork. The gutters were hidden in the wall, which subsequently led to some emergency problems.

The electric lighting was made by the company of J. Krzyzik from Prague. Eight gas candelabra were placed on the balustrades of the terraces, which were supposed to illuminate the auditorium in case of an electrical power outage and highlight the beauty of the building. The Vienna-based company "Korting" carried out ventilation and heating for several days [36].

The fabrics were impregnated with special anti-inflammatory agents so that, even in contact with heavy fire, they do not burn, but only char, and only in places directly exposed to the flame.

The project aimed to provide a good view of the stage from all seats. The perfection of the solution to this problem is evidenced by the ability to see the faces of the actors on the stage from 23m, and movements and gestures from 35m [36]. The second problem was the need to amplify acoustic waves through their reflection from all places in the auditorium because the main difficulty was the sound-wave propagation. Many waves are reflected to the dome, which acts as a resonator and amplifies the sound waves. The richness and power of sounds are achieved by the appropriate outline of the sidewalls of the hall.

The systematization of the constituent elements of the theatre was carried out by the method of system-structural analysis. It allowed us to carry out a comparative analysis of the materials and structures of Odesa Opera House and the Municipal Theater in Cracow.

Restoration measures at the end of the twentieth century

On October 21, 1893, the theater building was officially handed over to the public. Such a short construction period confirmed the organizational and professional skills of Jan Zawiejski. After fifty years of operation of the theatre, in 1954–1956 at the request of the theatre management, the boiler room, hot water supply system, sewerage system, supply ventilation and electrical installation were modernized.

In 1987–1993, on the occasion of the 100th anniversary of the theatre, at the request of the management of the theatre, the city council and the council for the revalorization of historical complexes in Cracow, the next design and facade works were carried out to maintain and improve the comfort of the building. Industrial Construction Enterprise "Budostal" in Cracow and specialist subcontractors from other Poland centers were chosen as the general contractor for the construction work.

In those years, Jerzy Łacki carried out field surveys of the building, which made it possible to prove that the use of a wooden structure in the construction of the theatre would be the worst solution for fire and economic reasons [36]. Jerzy Łacki checked the calculations of the structural elements, that is, the sectional ceilings of the lattice truss above the auditorium and the loads under the foundations of the load-bearing walls, and his calculations showed no risk of local overloading of the structural elements of the building [36]. It was found out that the building operates within the permissible limits of the loads, the stiffness conditions for bending and eccentrically compressed elements were also provided, the baseload norms under the foundations of the bearing walls were also not exceeded.

A significant technical problem that needed to be solved during the restoration activities was the increased moisture content of the walls of the theatre basements. Traces of wetting were recorded on the longitudinal, internal and partially external walls, swelling and loosening of the plaster layer and plaster chips were found [36]. During field examinations of the theatre building to establish the causes of moisture, it was revealed that there was no horizontal and vertical insulation at the basement level, which caused a capillary inflow of water through the walls of the foundation. Moisture entered from the outside of the building through cracks and pores in the walls of the foundations to the parts of the upper walls of the basement. Macroscopic examination of the plaster revealed sulphides, which occur along with salt efflorescence. The dampness of the walls caused the development of mould and fungus.

To protect all premises in the basement from excessive moisture, it was recommended to use modern methods of moisture protection in combination with drying measures.

It was planned to carry out additional lift shafts by breaking through sectional ceilings based on the replacement and lengthening of steel beams. It was designed to supplement the back wall of the theater from the side of the "Miniatures" building, where a ramp for stage decorations is provided, with a steel frame system built into the existing wall and connected to it with steel anchors [36]. It became necessary to solve the technical problem of ensuring the static nature of the longitudinal side of the theatre from the side of the Plant due to the need to dig a ditch 4.5–5.0m deep along the entire length of the wall. Initially, it was supposed to use reinforced concrete shields transmitting pressure from under the theater foundation, but this concept was abandoned, and the contractor was asked to use bored piles at a distance of 1.5m from the theater wall, from the bottom of the existing foundations to the required depth.

The project provided for the strengthening of the transverse wall of the theatre from the side of the building "Miniatures" due to the planned decoration of warehouses and the construction of a ditch, draining the walls from the side of the Holy Spirit square. In the "Miniatures" building, it was planned to replace the floors above the basement from a sectional one with a reinforced concrete slab grating, thanks to the construction of the hatch in the scene, and to build the foundations to the required depth.

Due to the lack of social and office rooms for actors, the city authorities allocated a building at 40 Szpitalna Street, which is a continuation of the axis of the theatre, where doctors' offices, a canteen, a cafe, offices, guest rooms, and the theatre box office were designed. Considering the existing technical condition of the timber ceilings above the ground and the first floors of this building, as well as the new function and increased loads, it was necessary to replace the wooden ceilings with fireproof ones, strengthen the existing vaults above the ground floor and basement and stabilize the soil under the foundations in the middle parts of basement [36].

The demolition of the existing annexes in the back part was planned due to the poor technical condition and low historical value of the annexes, as well as because of the planned construction of new utility premises. The project also provides for the need to stabilize and partially replace the land in the courtyard at 40 Szpitalna Street.

Using the principles of clustering in modern entertainment art formations

The principles of functional organization of theatre buildings can be successfully used in the revitalization of buildings for other purposes, which are repurposed for modern urban spaces of art. This is especially relevant in the context of revitalization of industrial facilities in large cities. Such objects, especially those that are architectural monuments, can be repurposed for various functions, and one of such functions is art direction.

Today, in many countries the phenomenon of space formation, called the art cluster, has arisen and continues to develop. However, a detailed analysis of the principles of organization of objects, called in the literature as art cluster, proves that they often do not fit the concept of an art cluster and is a simple combination of independent rented premises. Moreover, despite the widespread use of the name "art cluster" in various sources, there is still no clear definition of the semantic content of this term relative to the word "art" and "cluster". At the same time, the current realities of life induce the emergence of just such art objects, given the development of new (including informal) trends in art, the need for new forms of work and self-expression of the artist, especially since traditional art institutions no longer satisfy all needs of the society.

The relevance of the topic is determined by the need for the emergence of new art institutions, taking into account the changing cultural preferences of society and the search for ways to re-profile unprofitable industrial enterprises for the new functions.

For the said purpose, it was decided to analyze the content of the term concerning its first and second parts and to formulate the defining features of the art cluster. The practical significance lies in the fact that based on the findings and recommendations, the defining features of art clusters as a specific form of organizing the process of making an art product have been formulated; in the assessment of urban areas and architectural design. The classical theatre was taken as a model of an art cluster aimed at the production of an art product.

Therefore, considering clustering, it is necessary to present the schemes of the interaction of arts. Such clusters can be roughly divided into simple ones – those that consist of the simple combination of a small number of types of art or several varieties of the same type and the complex ones that are a synthesis of arts.

Most often, simple clusters may contain such types of arts and their combinations: visual arts, music, fiction and choreography. In the complex clusters, representing the synthesis of many arts, it is possible to distinguish separately architecture and spectacular views (such as theatre, cinema, and others).

Each of these types of arts can develop both independently within itself and in interconnection with other types of arts, mutually enriching, which creates the corresponding intraspecific and interspecific connections. The popular process of transforming art as a self-sufficient phenomenon within oneself into an art cluster can be illustrated as follows: if an artist has just painted a picture and hung it in a gallery, this is a simple action, but if he supplemented this action with music or dance, it leads to a complication of the action and creation a fundamentally different approach and different interaction with the viewer.

If we analyze from this point of view the existing types of buildings that suit the definition of art clusters, then a typical example is an opera and ballet theater, where a zone for preparing an art product (performance) and a zone for presenting an art product are distinguished. At the same time, both of these components are aimed at the achievement of one common result – the public presentation of the performance. So, in the manufacturing of the final art product, the production sphere is involved (a set of workers of the conventionally called art-objects or art-units, whose activities are aimed at creating a joint art product) and the presentation sphere (a group of workers who provide a public presentation of an art-product).

The set of workers of the art-objects whose activities aimed at creating a joint art product forms an art cluster. The process of creating the final art product consists of two stages: the creation of an art object and its public sale, that is, in the creation of an art product, some participants create the product of spiritual production, and other participants popularize and implement it, that is, the ultimate goal is the public realization of a work of art.

An art cluster is formed from several art objects united by a common infrastructure; the art objects are interconnected by internal links and aimed at achieving the general result. Based on a combination of several small homogeneous industrial art clusters (for example, a music cluster of musicians and an art cluster of theater decoration artists), it is possible to form a mega cluster with a combination in its structure of several simple clusters and additional art objects connected by a common infrastructure.

So, an art cluster assumes that all components from an art orientation are interconnected, and the total effect of their joint action is several times greater than the one of the separate members. Thus, the first defining feature of an art cluster as a specific art formation is as follows: it is not just a random set of tenants-carriers of some types of artistic activities; it is a particular number of participants working for one result and their activities are interrelated. It explains the first reason for the unprofitability of the monuments of industrial architecture redesigned for the artistic function – it is non-observance of the principles of formation and successful functioning of the cluster or the absence of the principal art function as an "anchor".

According to the analysis of the content of the term's "art" and "cluster" and the ways of the functioning of various types of buildings, it was found out that entertainment objects most correspond to the means of clustering. The objective of the study was to present a generalized model of art education with the functioning of an art cluster in its composition, using the norms outlined in [22], and based on the fact that in a complex version, all connections between art objects at the end lead to the creation of a certain common action, a particular event, which becomes the final product of spiritual production [4].

Considering the need to obtain an environment for each member of the community, it is important to use the links specified in [22], based on which classification was created in the thesis, which is presented in a simplified form and based on it, if necessary, a more detailed scheme can be developed, taking into account the projected objects, and a list of the necessary functions.

According to the generalized scheme, it is possible to distinguish six enlarged groups of premises concerning their functional orientation, participating in the creation of the final product of the art cluster. These groups are interconnected by production links, formed concerning their needs. In particular, the spectator complex (SC), the demonstration complex (DC), the production complex (PC) and the administrative complex (AC) are separated, which in turn are divided into smaller components: the premises of the spectator complex (PSC), the premises of the demonstration complex (PDC), stage service premises (SSP), warehouse premises (WP), administrative and amenity premises (AAP) and workshop premises (WP). The presence of internal connections aimed at the overall result distinguishes an art cluster from an art centre.

The premises of the spectator complex (PSC) include premises in accordance with the design assignment. The expansion of the spectator complex allows the introduction of new additional functions to the art cluster, which nevertheless, will not affect other industrial relations.

The premises of the demonstration complex (PDK) include an auditorium, a stage and technological support rooms responsible for the final demonstration of the product of spiritual production and the technical component of the demonstration.

The stage service premises (SSP) include staff rooms, rehearsal rooms and rooms for technical staff.

The structure of the administrative and amenity premises (AAP) includes work premises for administrative and technological personnel and engineering, operational and technical premises.

The most complex type of art clusters is an art cluster aimed at spectacular performance as a final product, as this type of organization provides for the most extensive list of component rooms and the closest in the way of organizing space to a theatre. At the same time, simple art clusters can exist – they have two main components – the production of an art product and the popularization (and implementation) of an art product. As well as a complex cluster, a simple cluster, although it has a simpler organization of internal connections between its participants, its goal is also not just the creation of a work of art, but the presentation and promotion of this product.

According to the method of organizational activity, an art cluster can function as a consortium, when several art objects are temporarily combined to create a joint product of spiritual production, as an association or as a corporation of art objects, provides for longer cooperation to produce a collective result.

Based on the developed theoretical model of art education, it can be proved that some existing art formations with theatre in their composition, aimed at the entertainment function, do not fully correspond to it. The Inkubator Sztuki/Kultury in Lodz was taken as an example. At the same time, we should note that this institution does not position itself as an art cluster, but just as an art incubator, and we will briefly mention that, just as until now, there has not been a well-defined theoretical definition of what exactly defines the concept of "art cluster" also requires a theoretical definition of the concept of "art-incubator" in terms of its components "art" and "incubator". Inkubator Sztuki/Kultury is an entrepreneurial enterprise founded by the "Fabryka Sztuki" institution operating in Łódź Art Centre. "Fabryka Sztuki" is one of the institutions operating in the Lodz Art Center, established by the Lodz Art Center, the Choreia Theater Association and the Lodz City Office in early 2007. "Fabryka Sztuki" activities are primarily educational and focused on theatre and contemporary art: performances and theatre master classes, musical projects and concerts, meetings, lectures and presentations are held here.

The creation of such art incubator in Lodz as a means of modernizing the existing public sector of the arts to meet the new active cultural demands of society, in the meantime, does not correspond to the theoretical models of spectacular or artistic art establishment with an art cluster and an art centre, since a significant part of the residents works separately.

As, as mentioned above, revitalized buildings are often architectural monuments, this raises the question of implementing appropriate restoration measures to preserve those parts of the building that have the status of protection (facade, facade and part of the interiors, the entire volume with the original layout) and the provision of demolition of low-value extensions. According to the authors' experience, most often the monuments of industrial architecture date back to the second half of the XIX century – XX century, i.e. built of brick, concrete, reinforced concrete, have wooden, metal or reinforced concrete floors, which determines the established list of restoration measures [37]. The main problems of accidents are unsatisfactory condition of foundations and foundations, moistening of walls, ceilings and roof with a roof, hence the appearance of bio destroyers, cracks, chips and peeling.

Conclusions

The analysis of the construction and restoration measures for Odesa Opera House, the National Theater of Iași and the Municipal Theater in Cracow made it possible to form some trends in the theatrical construction of the second half of the 19th century, where the famous Viennese school played the leading role. A comparative analysis of the construction conditions, materials and structures of both theatres was carried out.

The Municipal Theater in Cracow is located on a calm land environment, Odesa Opera House – on a complex landslide-prone terrain with planting soils during the closure. The foundations of the Municipal Theater are made of raw stone, the foundations of Odesa theater are made of limestone with the lower part of rubble masonry. In both theaters, one of the reasons for the emergency condition was associated with moisture: in the Municipal Theater, – due to the lack of horizontal and vertical waterproofing of the basement, which caused a capillary inflow of water through the walls of the foundation; in Odesa Theatre, due to the presence of a layer of loess soils under the foundations – periodic moistening, intensive geological processes – flooding, subsidence phenomena through bulk soils and a rise in the level of groundwater, as well as due to the leakage of engineering networks.

In Odesa Theater, the main task was to transfer the load to the lower reliable layers of the base, thus ensuring the statics of the structure, "footing-foundation-structure".

The walls of Odesa Opera House, made up of shell limestone in combination with brickwork, were in more emergency condition than the Municipal Theater in Cracow. Light crystalline limestone, shell limestone, the metal-reinforced artificial stone was used for decorative facades. The external facade walls of the Municipal Theater in Cracow made of high-quality bricks with dimensions of 29x14x6.5 cm. Both theaters are magnificently decorated externally and in interiors with a combination of pseudo-Renaissance and pseudo-baroque stylizations; the theme of muses and arts dominates in the decor.

In both theaters, the progressive constructive schemes of that time were embodied. Odesa Theater was designed by Viennese architects, Viennese companies took part in the construction of the Municipal Theater in Cracow, specifically, the building materials were previously tested by the laboratory of the Society of Engineers and Architects in Vienna, the roofs were made by a company from Vienna, "Korting" company from Vienna performed ventilation and heating works.

In Odesa Opera House, several types of floors were applied simultaneously: the ceiling made of monolithic reinforced concrete ribbed slabs; the ceiling made of metal trusses of complex configuration; brick vaults on metal beams; the ceiling of metal decking on beams filled with limestone residues with lime mortar; the monolithic reinforced concrete ceilings; the beams of the monolithic ribbed slab of the covering the deck of the stage; the ceiling of the stage openings of the firewall walls and the large-span structures of the roof trusses of the auditorium ceiling; monolithic reinforced ceilings in the bathrooms.

In the Municipal Theater, several types of ceilings were also used at once: the ceilings of the "Monier" system made of steel beams and reinforced concrete slabs with a thickness from 6 to 12cm in the lower part, with steel inserts from 8 to 12mm, with a distance of up to 15cm; steel roof structure; sectional ceilings of a steel I-beam and a brick vault with an arrow from 1/8 to 1/12 of the span between the steel beams; riveted steel lattice girders were used in the part of the stage roof, above the auditorium – riveted steel edge beams in the shape of a dome, fastened in the longitudinal direction along with the entire height; sectional vaults on steel beams above the orchestra stalls, the first and second tiers.

In Odesa Theater, in the annular walls of the auditorium, a metal frame was made of metal racks and I-beams, resting on the column tables. In the Municipal Theater, the vaults of the auditorium are supported by steel supports riveted from the corner profile, the pillars of the box compartments are made of cast iron, the pillars supporting the plafond of the ceiling of the main hall are made of iron and tied with brass wire. The supports are covered with a plaster coating in imitation of plastering and sculptural decor.

In Odesa Opera House, several types of roofs of the 19th century were used: metal sheet roof covering; the roof of the dome over the spectator's part made of zinc sheet with numerous decorative elements using the chasing and repoussé technique, and a roof made of galvanized steel roofing sheet.

In the Municipal Theater, the riveted single- and double-pitched roofs with the truss structure were manufactured by a company from Vienna, and at first, covered with zinc sheet and then with the copper sheet on the formwork.

The peculiar feature of both theatres was the innovative engineering equipment of that time and the special attention to acoustic calculations.

Thus, the construction of two theaters simultaneously in two distant cities of different empires proved the commonality of style and construction-design tendencies in the theatrical construction of the second half of the 19th century and the dominant role of the Viennese school.

The peculiarities of the structure of Odesa Opera House were as follows: a harmonious combination on the facades of the late Italian Renaissance style with baroque elements, in the interiors of the audience premises – the styles of the late Italian Baroque and French Rococo, the uniqueness of decorative finishing, non-standard volumetric-spatial composition and planning, unique acoustics.

The issues identified were as follows: deformations and subsidence of the building; the appearance of cracks in the walls, arches, floors and ceilings; the inclination of the floors of the foyer and corridors; settlement of the pylon of the stage portal wall; new cracks in the walls of the stage and the eastern part of the lobby due to leakage of water supply network; the installation of the heavy fire curtain, which led to a dynamic effect on the walls of the stage and the appearance of additional cracks in the walls of the portal wall and its emergency state; destruction of individual elements. Due to the emergency state, the building was covered with cracks everywhere, it split into 36 separate parts, its slope towards the sea was 20cm, the crack opening width was 6cm. As a result of the subsidence of the foundations, the floor beams of the second and third tiers shifted and sagged by 30cm. All porticos of the theatre were in disrepair. In the interiors, permanent deformations of the supporting structures were observed.

The reasons for the emergency state were as follows: complex configuration of the theatre plan; lack of expansion joints; insufficient rigidity of the building and reinforcement elements; the presence of a layer of loess soils under the foundations with their periodic moistening; intensive geological processes – flooding, subsidence phenomena through bulk soils and a rise in the level of groundwater, karst phenomena; ineffective use of strip foundations of various widths and depths and the opposite effect of silicatization; the presence of heavy fire-fighting equipment of the stage box, for which the building was not designed.

The primary measures were as follows: since the method of strengthening the foundations by silicatization did not bring any effect, the measures were aimed at stabilizing the spatial stability of the building, first of all, strengthening with auger piles in combination with the jacked piles of the foundations; foundations and ground structures of the central portico of the stage box and their protruding pediment parts; in the western emergency portico, it was envisaged to partially rearrange the vaults for strengthening the large-span load-bearing structures of the ceiling of the stage openings of the fireproof wall and the large-span structures of the roof trusses of the auditorium; the structures of monolithic reinforced ceilings in the bathrooms; the structures of the ceilings of all tiers and frames of the boxes and balconies; the compliance with the requirements of modern standards to the theatre buildings. It was supposed to strengthen the front walls of the spectator section; the suspended ceiling of the auditorium; the side portico structures; the load-bearing structures of the ceilings of the second and third tiers; portal wall structures; restoration and reconstruction of decorative finishes; renovation and reconstruction of the theatre square. Only old finishing technologies and traditional materials were used to preserve the unique acoustics of the auditorium.

The well-established principles of functional ties within theatres of the 19th century became the basis for the development of functional schemes of modern art formations based on the principles of clustering, which becomes especially relevant against the background of the massive appearance of such art institutions in former industrial enterprises. The example of the

Mystetskyi Arsenal ("Art Arsenal") in Kyiv, which combines such functions as event orientation, gallery/exhibition space/museum, business space, educational space, food, testifies to the effectiveness of transforming non-functioning monuments of industrial architecture into art-oriented [4, 16]. The Mystetskyi Arsenal is a unique example both in terms of its rich history (the Old Arsenal of the Kyiv-Pechersk Fortress on the site of a former convent and artillery Zeichhaus, a Soviet-era defensive repair plant) and in terms of its classicist architecture with Baroque elements and hall type layout. Revitalization of this object provided the developed complex of works carried out by experts of Ukrrestavratsiia corporation, among which – strengthening of the bases by Franki-Miga piles, arrangement under the building of cellars up to 3–4.8 meters high where they were not, complex restoration of facades, full roof replacement and roofs (copper roof), installation of a stage, interior decoration from high-quality materials.

The mission of the National Theater of Iași consists in the production of valuable performances that become theatrical and cultural events for this reason the National Theater of Iași underline both the national drama emphasizing the current and the international, universal, classical and contemporary in representative performances through the quality of the artistic act from a directorial, scenographic, interpretative point of view. The identity of the institution "The oldest national theater – The newest theater complex" (4 halls, 4 theaters in one) means the concern for diverse creative horizons, for combining established production directions with innovative meanings coming from independent alternative areas is an important cultural pole that accumulates advanced traditions and ideas and as the Iasi National Theater wants to build a complete image of current theatrical aesthetics, its cultural strategy is aimed at diversifying the most relevant cultural programs to satisfy the public. It is also important to relate to the tradition to the 200 years of theater in Romanian and to the 175 seasons of National – but also the connection to the immediate reality that implies theatrical projects moulded on the current aesthetic needs.

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