POLITECNICO DI TORINO

ARCHITECTURE FOR THE SUSTAINABILITY DESIGN
A.Y. 2022/2023
Graduation period July 2023

From Historical Documentation to 3D Model Creation:

The pavilion of Hungary at the Turin 1911 International Fair

Supervisors:
Prof. Filiberto Chiabrando
Dott. Alessandra Spreafico

Candidate:
Mojtaba Bazrafshan

Abstract:

Preserving documentary legacy is crucial for promoting cultural values, education, and societal growth. However, challenges such as environmental factors, financial concerns, and legal requirements necessitate proper preservation strategies. Advancements in 3D modeling and digital technologies have revolutionized the study and preservation of historical architecture, enhancing understanding and communication. Rendering engines and immersive technologies play a crucial role in 3D modeling and visualization, empowering artists to enhance visual quality and engagement. The Turin 1911 project focuses on digitally reconstructing historical buildings, addressing limitations to achieve a faithful representation. The Pavilion of Hungary serves as a notable case study, showcasing comprehensive approaches to creating accurate 2D representations and subsequent 3D models. The 3D modeling phase involves shape creation, refinement in 3Ds Max Studio, and optimization for AR experiences. Preservation of documentary legacy, advancements in 3D modeling, rendering engines, and immersive technologies contribute to preserving, understanding, and visualizing historical documents and architectural heritage. The Turin 1911 Case Study demonstrates the challenges and meticulous steps involved in digitally reconstructing historical buildings, creating immersive experiences for viewers. The integration of preservation strategies, digital technologies, and immersive experiences contributes to protecting and enhancing cultural heritage for present and future generations.

Contents

INTRODUCTION

The inability to personally encounter historical-architectural heritage that has vanished poses a significant obstacle to comprehending the past. While experts in the field can partially overcome this limitation by studying original documentation, such as drawings, photographs, and written sources predominantly preserved in archives, the majority of people lack the technical expertise to fully grasp two-dimensional drawings and encounter difficulties accessing historical images. Even for non-experts, the idea of witnessing magnificent creations from the past as if they were still present holds immense appeal.

Recent advancements in 3D modeling and digital technologies have brought about a revolutionary transformation in the exploration and preservation of historical architecture. These immersive 3D digital models serve as comprehensive representations, capturing the essence of architectural entities shaped by their historical contexts. Tools like AutoCAD and 3D Studio Max have played a pivotal role in reshaping map creation and architectural visualization by incorporating documentary sources, thereby enriching our understanding and facilitating effective communication.

Within the realm of 3D modeling and visualization, the careful selection of rendering engines and immersive technologies becomes crucial. Rendering engines such as V-Ray and AR360 offer distinct features, while immersive technologies like Augmented Reality (AR) provide interactive experiences. Choosing the right tools empowers artists and designers to enhance the visual quality and engagement of 3D models, elevating the overall experience.

The primary objective of this thesis aligns precisely with the aforementioned goal: to make the splendor of past architectural marvels accessible to everyone. Specifically, the Turin 1911 project focuses on digitally reconstructing historical buildings and achieving a heightened sense of realism in visualization. However, this digital reconstruction process faces challenges due to limited visual material and a lack of interpretative and contextual understanding. Nonetheless, by addressing these limitations, it becomes possible to achieve a faithful representation of historical architecture.

A notable case study within the Turin 1911 project revolves around the Pavilion of Hungary. By integrating technical drawings and historical imagery, a comprehensive approach is adopted to create accurate 2D representations and subsequent 3D models. The workflow entails meticulous data gathering, the transformation of black and white images into colorized formats, and thorough verification of technical drawings.

In the context of the Turin 1911 project, geomatics and photogrammetry activities played a crucial role in capturing and analyzing data associated with the exhibition site, the Parco del Valentino, and its structures. Geomatics, an interdisciplinary field combining geospatial analysis and information technology, was employed to collect and process spatial data for the project.

Photogrammetry, a technique utilizing photographs to create precise 3D models, was specifically utilized for aerial photogrammetry in this research. A series of aerial photographs were taken, capturing the exhibition site from various angles and elevations. These photographs underwent subsequent processing using photogrammetry software, resulting in the generation of a point cloud. The point cloud represents the 3D coordinates of points on the terrain.

Further processing of the point cloud data involved constructing a triangulated mesh, accurately depicting the topography of the Parco del Valentino. This mesh serves as the foundational structure for the virtual environment that faithfully recreates the exhibition site.

By harnessing the power of geomatics and photogrammetry, the project team successfully captured detailed spatial information related to the exhibition site and its structures. This data serves as a valuable resource for creating an immersive and precise virtual representation of the Turin 1911 International Exhibition of Industry and Labor.

The first chapter of the thesis will delve into an analysis of the technologies employed to achieve the intended objective, covering modeling techniques and the creation of the virtual world.

Subsequently, the second chapter will commence with a concise historical introduction, laying the groundwork for a comprehensive explanation of the modeling processes employed. Finally, the thesis will describe the step-by-step process necessary for creating a captivating virtual environment.

In conclusion, the preservation of documentary legacy, the implementation of effective protection strategies, the utilization of advancements in 3D modeling and digital technologies, and the embrace of rendering engines and immersive technologies are all crucial elements in preserving, understanding, and visualizing historical documents, architectural heritage, and 3D models. The Turin 1911 Case Study provides insights into the challenges and meticulous steps involved in digitally reconstructing historical buildings and achieving a heightened sense of realism in visualization, ultimately creating immersive and captivating experiences for viewers.

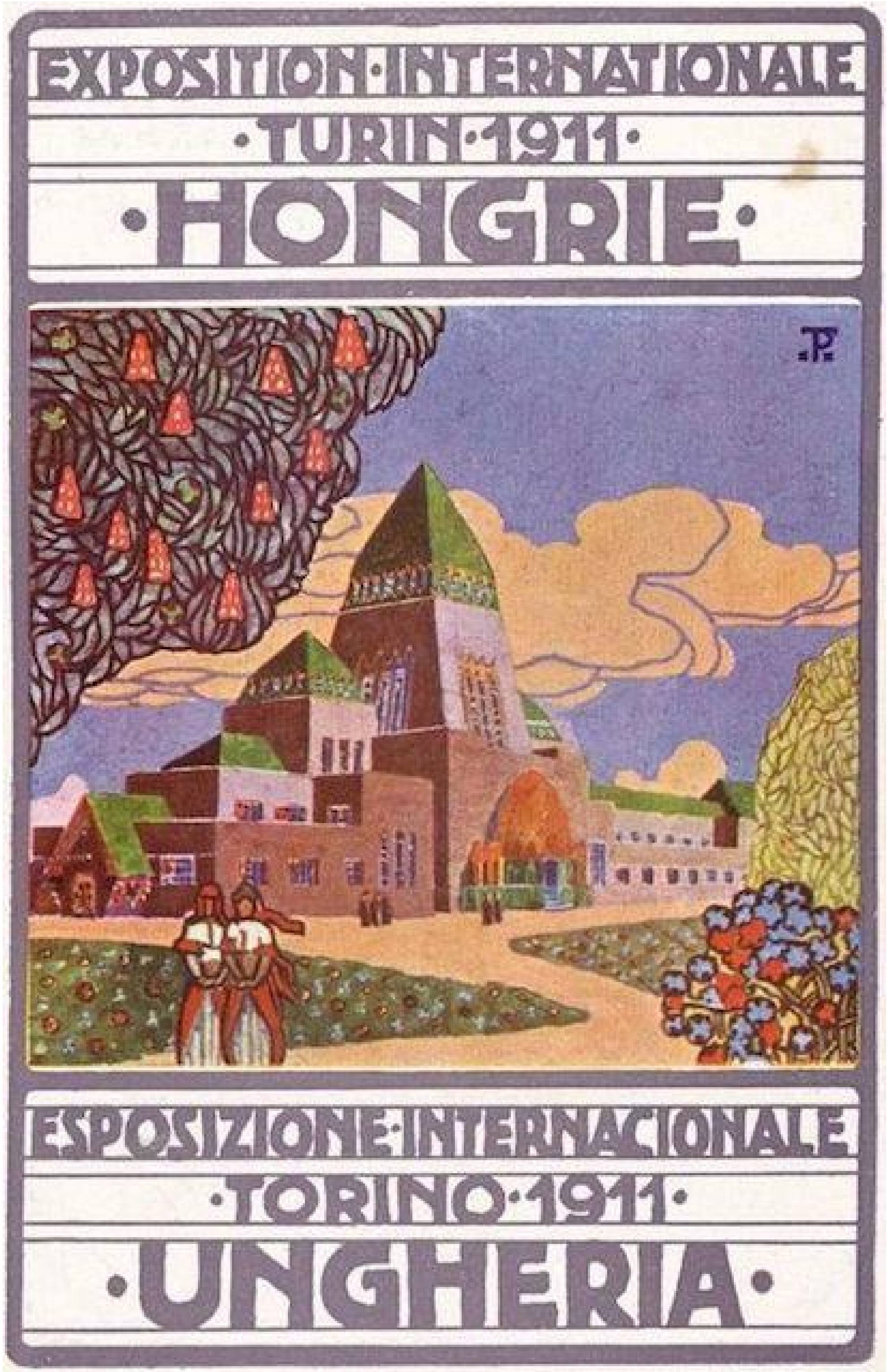


Figure 1: International exposition of industrial Art Turin 1911, Picture postcard, private collection, Budapest, https://italyworldsfairs.org/mainpage.html

FROM HISTORICAL DOCUMENTATION TO CREATION THREE-DIMENSIONAL MODELS

INTRODUCTION

The Significance of Preserving Documentary Legacy, Strategies for Protection, Advancements in 3D Modeling and Digital Technologies, Revolutionizing Map Creation and Architectural Visualization, and Rendering Engines for 3D Studio Max and AR 360-Degree Experiences

Preserving documentary legacy is of great significance, yet it poses several challenges. Archives, libraries, museums, and other repositories play a crucial role in the preservation process. UNESCO defines documentary legacy as movable objects comprising signs, codes, sounds, and pictures that are reproducible and the outcome of a planned documenting process. Preservation ensures the longevity and accessibility of documentary resources for future generations. However, adverse environmental factors jeopardize a substantial portion of the world's documentary legacy. Therefore, proper preservation strategies such as materials conversion and conservation activities are essential.

Documentary heritage holds immense value as it reflects a nation's culture, identity, and disseminates information in various concrete forms. It offers opportunities for learning, social justice, cultural values, enjoyment, and inspiration. Preserving documentary legacy extends the useful life of materials, making them accessible and valuable to society. It promotes people's opinions, imagination, cultural values, educational possibilities, growth, prosperity, and contributes to the social credit system.

Managing and preserving documentary heritage involves visual media, mechanical vehicles, intermetallic materials, journals, and other conventional materials. Visual documentation has become a vital research tool, requiring precise surveying for monument understanding. Historians, academics, scientists, archivists, public officials, journalists, politicians, and the general public are consumers of documentary heritage. Preserving documentary heritage faces challenges related to policies, financial concerns, legal requirements, knowledge and competencies, protection and conservation methods, user needs, and cultural and social implications.

Advancements in 3D modeling and digital technologies have revolutionized the study and preservation of historical architecture. Traditional architectural representations have now been transformed into immersive 3D digital models, enhancing the processes of structural surveying and depiction. The concept of 3D modeling in historical architecture requires a comprehensive understanding of architectural values and accurate documentation. These digital models serve as meta-models, encompassing the complexity of buildings and representing specific architectural entities with unique characteristics shaped by historical contexts.

The visualization of real and imaginary spaces has always been crucial in architectural education and practice. AutoCAD, a widely used CAD software, has revolutionized the process of creating accurate 2D maps by incorporating pictures and documentary sources. Additionally, 3D Studio Max offers advanced visualization capabilities, enhancing the visual quality of architectural models. By integrating these tools with documentary sources, the generation of accurate maps and realistic 3D models has become possible, enhancing the understanding, communication, and appreciation of architectural designs.

In the realm of 3D modeling and visualization, the choice of rendering engine and the incorporation of immersive technologies are crucial factors in enhancing the visual experience. Each rendering engine, such as V-Ray, Arnold, Corona Renderer, Mental Ray, and Redshift, offers distinct features and capabilities. Understanding the strengths and weaknesses of each engine empowers artists and designers to make informed decisions based on their specific needs and preferences. Immersive technologies such as AR and AR360 further enhance the visualization of 3D models, providing users with interactive and immersive experiences.

In conclusion, preserving documentary legacy, employing strategies for protection, utilizing advancements in 3D modeling and digital technologies, revolutionizing map creation and architectural visualization, and selecting the appropriate rendering engine and embracing immersive technologies are all crucial elements in the preservation, understanding, and visualization of historical documents, architectural heritage, and 3D models. These efforts contribute to the accessibility, longevity, research, education, and cultural initiatives surrounding our valuable heritage.

Preserving Documentary Legacy: Strategies and Challenges

Reasons in general to preserve historical evidence

The preservation of documentary legacy is greatly aided by the presence of archives, libraries, museums, and other repositories (Hedstrom & Montgomery, 1998). Documentary legacy is defined by UNESCO (2010) as objects that are movable, made up of signs, codes, sounds, and pictures; capable of preservation; reproducible; and the results of a planned documenting process. According to Sawant (2014), preservation is the process of keeping library and archive items in good condition so that they can be used in their original physical form or in other useful ways.

According to Kamatula and Mnkeni-Saurombe (2013), documentary property holds immense significance as a vital element of a nation's culture and a source of identity. However, Edmondson (2002) highlights a concerning reality: a significant portion of the world's documentary legacy is at risk of vanishing due to adverse environmental factors. Factors like humidity and moisture, air pollution, and water damage pose significant threats to the preservation of these valuable documents.

Proper preservation is essential to guarantee the lasting accessibility, utilization, and reusability of documentary resources. Two key strategies, namely Materials Conversion and Conservation Activities, play crucial roles in achieving this goal. Materials conversion involves replacing the original artifact while retaining at least its intellectual content, ensuring the resource's longevity. On the other hand, conservation activities focus on partially preserving the physical item through methods like new binding, contributing to its proper preservation (Srivastava & Kumar, 1986).

The documentary history of society holds immense value. As noted by Majumdar (2005), this documented legacy serves as a vital means of illustrating culture through diverse tangible forms that disseminate information. Kamatula and Mnkeni-Saurombe (2013) further emphasize the significance of documentary heritage, highlighting the various opportunities it provides individuals for enhancing learning, promoting social justice, nurturing cultural values, and engaging in activities that bring enjoyment and inspiration. Accessing and understanding this documentary heritage is crucial for recognizing the essential role preservation plays in safeguarding our collective memory.

Documentary evidence comes in many forms

Preserving information in all its forms has been a significant pursuit throughout human history (Adeeb & Ghonaimy, 1997). Majumdar (2005) classified documented heritage into written and oral formats while examining preservation and conservation. This vast collection of literature exists in written form across diverse cultures and scripts, encompassing a wide range of surfaces that serve as physical mediums for recording information. These surfaces include materials like paper, parchment, papyrus, stone tablets, clay tablets, metal plates, and various other mediums that have been employed throughout time to safeguard and transmit written knowledge (Majumdar, 2005). Additionally, Boston (1998) offers a range of management and preservation of different types of materials or resources in his preserving guide. Boston separates them into five categories: visual media, mechanical vehicles, intermetallic, and journal and other conventional materials.

The most ancient and largest collection of documents, according to the author, is those made of paper and other conventional materials. This classification is crucial since it makes it easier to comprehend topics in terms of their origins. The collection of historical manuscripts contained documents and writings from private organizations and people involved in national activities. Another kind of documentary history that was maintained was the collection of printed and published works. It had a thorough selection of written works. These included a variety of publications, including books, periodicals, journals, government reports, Hansard, reports, maps, and a film collection. The Printable Publications Act required the preservation of published and printed works. **(Mkuwira, 2015)**

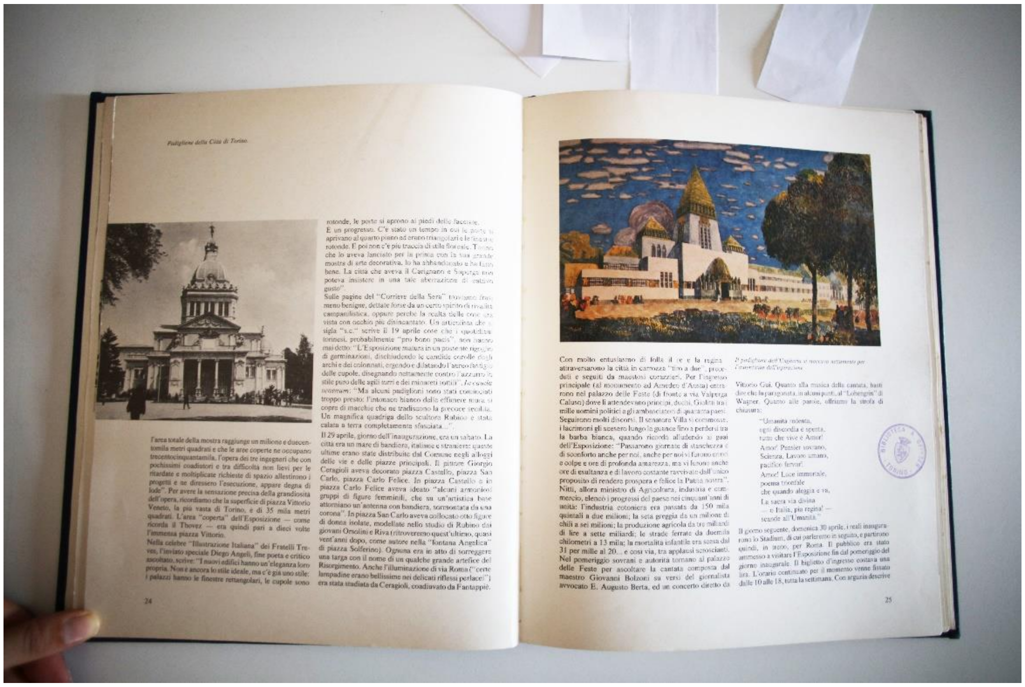


Figure 2: Pavilion of Hungary, Torino 1911 La Favolosa Esposizione, Carlo Moriondo

Figure 3; Pavilion of Hungary, Torino 1911 La Favolosa Esposizione, Carlo Moriondo

Documentary heritage conservation challenges

Preserving documentary legacy is a complex task that entails addressing various challenges to ensure effective heritage conservation monitoring. Krtali and

Hasenay (2012) emphasize the importance of considering multiple factors in the preservation process. These factors encompass policies and strategies, financial considerations, legal requirements, knowledge and competencies, protection and conservation methods and techniques, user needs, as well as the cultural and social implications of preservation.

The challenges in documentary heritage conservation arise from the need to navigate and overcome these factors. Developing suitable policies and strategies is essential to guide preservation efforts. Financial concerns pose a challenge in allocating resources for the conservation and maintenance of documentary materials. Legal requirements and compliance must be adhered to, ensuring that the preservation activities align with relevant laws and regulations.

Preservation also requires a deep understanding of the knowledge and competencies required to handle and safeguard diverse documentary forms. Identifying suitable protection and conservation methods and techniques is crucial to mitigate risks and ensure the longevity of the materials. Additionally, considering the needs and expectations of users is vital to enhance accessibility and usability of preserved documentary heritage.

Moreover, the cultural and social implications of preservation cannot be overlooked. Documented heritage reflects the identity and history of communities, making it necessary to approach preservation in a manner that respects and preserves cultural values. Addressing these challenges in a comprehensive and thoughtful manner is crucial to ensure the effective conservation and monitoring of documentary heritage.

Strategies for Protecting Documentary Legacy

Preserving and protecting documentary heritage is a critical endeavor that requires various methodologies and strategies. One approach is the implementation of preservation strategies for documentary heritage, which includes methods such as basic repairing, small repairs, binding, cleaning, dusting, photocopying, and appropriate shelving techniques. These strategies aim to address challenges posed by biological agents, environmental variables, and human impacts that can harm the documentary heritage collection (Mkuwira, 2015).

One crucial aspect of managing historical data is the digitization of archival records. This involves converting physical records into digital formats to ensure easier storage, access, and preservation. To facilitate this process, the creation of an automated inventory system is essential. By utilizing electronic tools, archivists can organize digitized documents, establish parameters for categorization, and enhance user interaction. The automated inventory streamlines the management of digitized records, making it simpler to retrieve and work with them effectively (Morandín-Ahuerma et al., 2022).

The digitization of archival materials holds significant global potential, enabling the creation of numerous academic, cultural, scientific, and other initiatives. It provides a practical means of storing and accessing information, setting the stage for secure utilization of archival records for study, commercial purposes, and legal objectives. The digital preservation of archival records ensures their long-term availability and facilitates their recovery and use in various domains (Morandín-Ahuerma et al., 2022).

In summary, strategies for protecting documentary legacy encompass the utilization of preservation methodologies, the digitization of historical data through automated inventory systems, and the global potential offered by the digitalization of archive materials. By implementing these strategies, the preservation, accessibility, and utilization of documentary heritage can be effectively safeguarded for present and future generations.

Figure 4: Digitization of historical data, https://www.wikiwand.com/en/Digitization

standards for availability digital historical materials

The availability of digital historical materials relies on the adherence to specific standards and guidelines throughout the digitization process. UNESCO's book, "Fundamental principles of digitalization of documentary legacy," provides a useful approach that divides the digitization process into four major phases: conceptualization, pre-digitization, computerized transformation, and post-digitization procedures. These phases encompass critical tasks such as resource evaluation, material selection, metadata collection, and quality control. However, it is important to note that accessibility for individuals with impairments is often overlooked in these actions (UNESCO, n.d.).

To establish an accessible user interface for documentary historical repositories, UNESCO introduces both "basic guidelines" and "advanced guidelines." The basic criteria serve as general recommendations for institutions, project managers, and collectors who engage with documentary heritage and culture services. On the other hand, the advanced guidelines are aimed at content producers such as editors and web developers (UNESCO, 2020).

To ensure accessibility in the digital repository creation process, several principles and ideas should be followed. Firstly, it is crucial to consider accessibility from the outset rather than treating it as an afterthought during document digitalization. Adequate budget allocation for accessibility considerations is necessary. Additionally, involving individuals with impairments and accessibility specialists throughout the process is important to gain valuable insights. Collaboration with subject-matter and document-specific material specialists is essential for effective implementation. Clear and concise language should be used to describe the subject matter, and accessibility considerations should be incorporated when designing digital platforms. Conducting training sessions on digital accessible awareness for stakeholders is recommended, with direct engagement of individuals with impairments to understand their challenges.

These fundamental principles establish the foundation for accessibility in digital documentary history. It should be noted that additional technical procedures may be required to ensure successful implementation. Advanced ideas for achieving accessibility in digital historical materials include capturing high-quality digital photos with textual descriptions, ensuring high resolution and adjustability of digital photographs, making PDF files viewable on screens, supplementing videos with subtitles or sign language interpretation, including text transcripts for audio files, providing content in multiple languages, and exploring diverse methods for conveying the material.

Adhering to these standards and guidelines enhances the availability and accessibility of digital historical materials, allowing individuals with impairments to engage with and benefit from the digitized documentary legacy (UNESCO, 2020).

Advancements in 3D Modeling and Digital Technologies in Historical Architecture

Historical architecture and 3D models

The integration of 3D models and digital technologies has revolutionized the field of historical architecture, particularly in structural surveying and depiction. In the past, architectural representations were limited to two-dimensional drawings.

However, with the advent of 3D models, data, and digital modeling technologies, significant advancements have been achieved.
Structural surveying plays a crucial role in assessing the condition and integrity of buildings and structures. By utilizing 3D models and digital technologies like laser scanning and photogrammetry, accurate and detailed representations of architectural structures can be generated. This enhances the efficiency and accuracy of structural surveying, enabling a comprehensive understanding of the structure's physical properties.
Depiction, on the other hand, involves visually representing architectural designs and structures. Traditional two-dimensional drawings have been transformed by 3D models and digital technologies. These digital models capture intricate details, textures, and spatial relationships, resulting in more realistic and immersive representations of historical architecture.
The integration of 3D models and digital technologies has not only revolutionized surveying and depiction but also transformed how historical architecture is communicated and understood. Stakeholders can now engage with architectural designs and structures in an immersive and interactive manner, thanks to enhanced visualization capabilities. This facilitates better communication, analysis, and preservation of architectural heritage, leading to a deeper understanding and appreciation of historical architecture.
In the context of 3D modeling, it is important to acknowledge the conceptual connection between architectural history and knowledge. Digital models serve as meta-models for complex architectural structures, capturing their unique characteristics, historical events, and cultural developments. These models go beyond virtual non-places found in computer game platforms, as they represent specific architectural individuals within their historical and contextual contexts.
In summary, the integration of 3D models and digital technologies has significantly advanced the fields of structural surveying and depiction in historical architecture. The shift from two-dimensional drawings to 3D models has resulted in more accurate representations of architectural structures. These technologies have improved visualization, analysis, and communication, leading to a better understanding and preservation of architectural heritage. The use of 3D models as meta-models for architectural history further enhances the capture and representation of complex architectural characteristics and their historical significance.

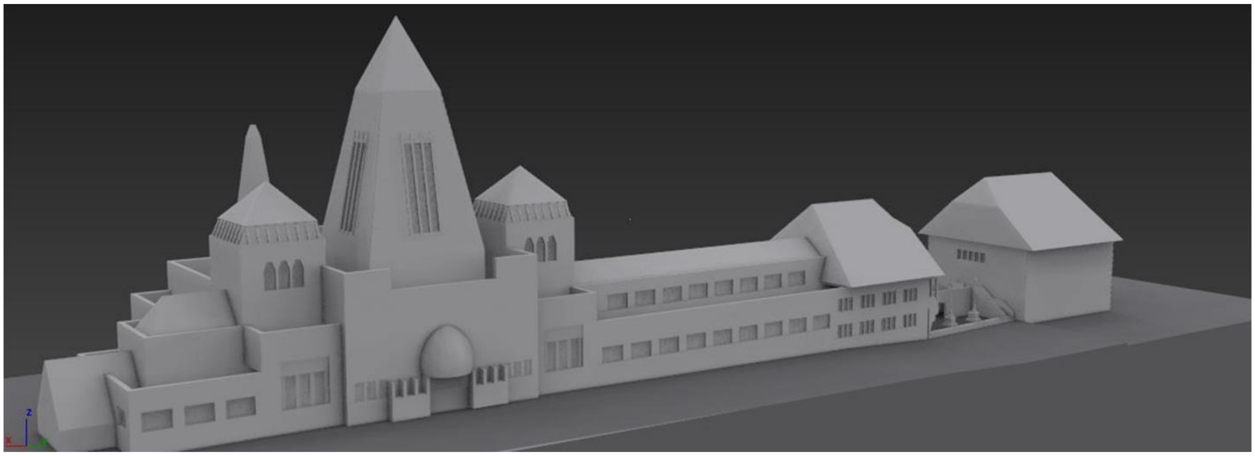


Figure 5: The north view of the Pavilion at the primary step of 3D modeling (Author)

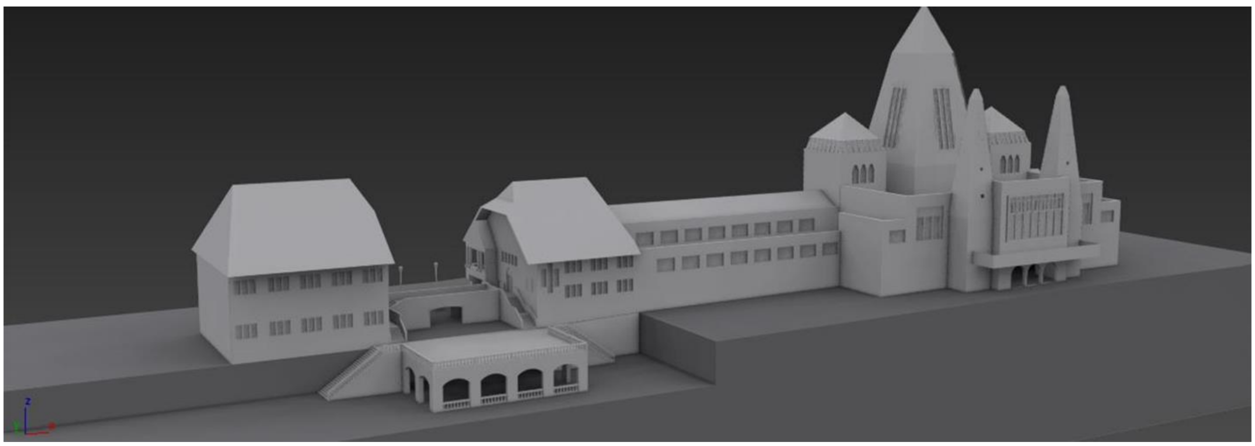


Figure 6: The south view of the Pavilion at the primary step of 3D modeling (Author)

Exploring the Significance of Architectural Models in Historical Studies

Architectural models hold immense significance in the realm of historical studies. They serve as the ultimate output of architectural surveys, encapsulating the essence of architectural modifications. The transition from traditional surveying methods to 3D optical measurement techniques has greatly influenced the development of architectural models. Moreover, the interplay between the subject of study, the phenomenal reality it represents, and the model itself plays a crucial role in understanding architectural history.

Architectural models can be created manually or automatically using advanced software such as CAD (Computer-Aided Design) and BIM (Building Information Modeling). They can be either static or dynamic, allowing for manipulation and interactivity. However, it is vital to establish appropriate standards for their creation and utilization.

When examining architectural history, the physical environment shaped by human beings becomes a focal point. Its palpable existence and its significance as a temporal and geographical occurrence form the core subjects of historical architectural studies. By referencing Paul Ricoeur's insights on the narrative aspect of construction and the historical dimension of architectural form, we can perceive architectural models as visual representations of architectural stories. These models provide a tangible means to explore and analyze the historical context and evolution of architectural structures.

In summary, architectural models have a profound significance in historical studies. They serve as a tangible representation of architectural modifications and advancements. The adoption of 3D optical measurement methods and advanced software has enhanced the creation and manipulation of these models. By considering the narrative aspect of architecture and its historical significance, architectural models offer valuable insights into the development and contextual understanding of architectural history.

Reverse Modelling and Digital Technologies in Historical Architecture

The Reverse Modelling process is a methodological approach in historical architecture that involves creating digital models based on a digital surface survey. By utilizing techniques like laser scanning or photogrammetry, a comprehensive survey of the physical surface is conducted. The collected data is then used to generate a digital model using polygonal or polynomial modeling techniques.

Unlike traditional modeling methods, which rely on pre-existing physical structures, the Reverse Modelling process begins with the digital representation of the surface. This approach offers increased flexibility and accuracy in capturing the intricate details of historical architectural elements. It allows for a more precise and detailed digital reconstruction of historical structures, enhancing the study, analysis, and preservation of architectural heritage.

Surveying for Building Analysis and Preservation: Methods and Challenges

Finding a building's measurements, geometry, form, materials, etc. entails surveying it. This stage is essential because it advances our knowledge of the structure and actively promotes preservation strategy. **(Pocobelli et al., 2018)**

Surveys have historically been conducted using the triangulation process, which entails physically obtaining measurements, marking reference points (referred to as stations), and triangulating each corner using a laser instrument or meter rule tape. Because every point of the construction is determined using two measurements, error propagation is restrained. The combination of Digital Photogrammetry and Laser Scanning is now popular, as mentioned in several of the papers we studied. Because the pictures produced by digital photogrammetry are captured from various angles, the method is founded on the triangulation concept. Integrating it with laser scanners enables the acquisition of high-resolution images of the textures of materials and, as a result, data on material deterioration. Post-processing of the images is necessary, and this can often be done with only one software product. However, due to the need for accurate calibration on both devices and the possibility of error propagation, the combining of Laser Scanning results and Digital Photogrammetry outcomes can be sensitive. **(Pocobelli et al., 2018)**

Revolutionizing Map Creation and Architectural Visualization

The visualization of real and imaginary space has long been a fundamental aspect of architectural education and practice (Evans, 1989). Architects extensively rely on visual methods and techniques to develop compositions, communicate abstract concepts, specify design products, and analyze design ideas. Published photographs and drawings play a crucial role in our understanding of world architecture, often surpassing personal experience.

The emphasis on the visual in architecture is not coincidental, as human interaction with the natural and built environment is predominantly visual (Gombrich, 1990). Visual information is essential for various activities, from aesthetic appreciation to action planning, enabling the analysis and formulation of ideas. Visualization has proven to be a valuable tool in understanding and controlling complex processes, evident in the widespread use of pictorial instructions for tasks like assembling furniture or tying knots.

Creating Accurate 2D Maps: Incorporating Pictures and Documentary Sources with AutoCAD and Beyond

When it comes to drawing 2D maps, AutoCAD has emerged as a leading CAD software that has reshaped the entire process through its integration of pictures and documentary sources. While AutoCAD stands out, it's important to acknowledge the presence of other CAD software options in the market, each offering unique features for map creation. By understanding these differences, designers can make informed decisions about selecting the most suitable tool for their specific needs.

AutoCAD, renowned for its widespread usage and popularity, provides designers with a comprehensive suite of tools explicitly designed for seamlessly integrating visual and documentary references into 2D maps. Leveraging aerial and satellite imagery, along with digitized documentary sources, AutoCAD empowers users to create accurate representations of various elements such as topography, land use, and infrastructure. This results in highly precise and detailed maps that effectively communicate spatial information.

One notable feature that sets AutoCAD apart is its georeferencing capability, enabling the alignment of images with the map's coordinate system. This functionality ensures that the integrated pictures and documentary sources are accurately placed within the spatial context of the map. By precisely overlaying georeferenced images, AutoCAD enhances the overall spatial accuracy, enabling designers to seamlessly work with real-world data.

Moreover, AutoCAD offers robust digitizing tools that allow designers to trace and convert relevant features from documentary sources into editable and analyzable entities. This capability empowers designers to extract valuable information from historical maps, surveys, or other documentary sources, seamlessly integrating them into their 2D maps. By digitizing features such as roads, buildings, or boundaries, AutoCAD facilitates further analysis, modification, and integration of the captured information.

The utilization of pictures and documentary sources in map creation using AutoCAD brings forth several remarkable benefits. Firstly, it significantly enhances the accuracy and efficiency of the mapping process by directly integrating visual references, minimizing manual measurement errors, and ensuring that the resulting map precisely reflects the actual landscape. Additionally, AutoCAD's ability to represent intricate details supports decision-making in urban planning and design projects. Designers can thoroughly analyze existing conditions, evaluate the impact of proposed changes, and effectively communicate their ideas.

Furthermore, AutoCAD's capabilities in incorporating pictures and documentary sources also contribute to the preservation and analysis of historical sites. By digitizing and integrating historical maps or archival photographs, designers can create visual records of historical landscapes and structures. This not only aids in documenting and safeguarding architectural heritage but also enables researchers and historians to study and analyze historical developments and changes over time.

While AutoCAD excels with its powerful capabilities for map creation, it's important to recognize the presence of alternative CAD software options. These alternatives may offer distinct features, user interfaces, or specific strengths tailored to diverse mapping requirements. Evaluating these options based on the specific needs and preferences of the project is crucial to ensure the selection of the most appropriate CAD software for drawing 2D maps.

In summary, AutoCAD's integration of pictures and documentary sources has revolutionized the process of creating accurate 2D maps. Its georeferencing capability, digitizing tools, and robust feature set empower designers to produce precise and detailed maps, enhancing accuracy, efficiency, and decision-making in the fields of urban planning, architecture, and engineering. While AutoCAD remains a widely used CAD software, designers should consider exploring other options to choose the software that best aligns with their specific mapping needs.

Producing 2D Maps in AutoCAD Using Pictures and Documentary Sources

Producing accurate and detailed 2D maps in AutoCAD using pictures and documentary sources involves utilizing the power of AutoCAD software to create precise and informative maps. By incorporating visual references such as aerial photographs, satellite images, topographic maps, and survey data, designers can accurately represent the desired location or site. The process typically begins with gathering the necessary reference material, which serves as the foundation for creating the 2D map. This material may require preparation, such as resizing or converting file formats, to ensure compatibility with AutoCAD.

Setting up the AutoCAD environment is essential to match the scale, units, and coordinate system of the reference material. This step ensures accurate measurements and alignment between the imported data and the AutoCAD drawing. Using the imported pictures and documentary sources, designers create the base map by tracing or digitizing key features and boundaries of the location or site. Various AutoCAD tools, such as polylines, arcs, and splines, are utilized to accurately represent the outlines and contours of objects on the map. To enhance the map's accuracy and visual appeal, additional details and features are added.

This may involve labeling landmarks, roads, buildings, vegetation, and other relevant elements. AutoCAD provides tools such as text, hatch patterns, and symbols for annotation and representation. Throughout the process, designers review and refine the 2D map to ensure accuracy, completeness, and suitability for the intended purpose. Final adjustments and corrections are made before exporting or printing the map for use in various applications, such as urban planning, architecture, engineering, or historical analysis.

By leveraging AutoCAD's capabilities and integrating pictures and documentary sources, designers can create accurate, detailed, and informative 2D maps that serve as valuable tools in understanding and visualizing spatial information. The utilization of pictures and documentary sources in map creation brings several benefits, including improved accuracy and efficiency, detailed representation of the landscape, enhanced decision-making in urban planning and design projects, as well as the preservation and analysis of historical sites. AutoCAD's powerful capabilities enable designers to incorporate pictures and documentary sources, resulting in accurate, detailed, and informative maps that serve various purposes in urban planning, architecture, and engineering.

Producing 3D models in AutoCAD Using 2D Maps with real references

Producing accurate and detailed 3D models in AutoCAD using 2D maps as references involves several key steps. It begins with gathering the necessary 2D maps and drawings that provide information about the object or structure to be modeled. These references serve as the foundation for the 3D model, ensuring its accuracy and fidelity.

Using the 2D maps as a guide, designers then translate the flat representations into three-dimensional objects in AutoCAD. This conversion process utilizes various 3D modeling techniques such as extrusion, lofting, sweeping, or revolving to create the basic geometry of the model. Designers need to have a solid understanding of AutoCAD's 3D modeling tools and techniques to accomplish this effectively.

Once the basic 3D geometry is established, designers shift their focus to adding intricate details and refining the model's appearance. This involves incorporating accurate dimensions, textures, materials, and surface finishes based on the information provided by the 2D maps. AutoCAD's rendering capabilities and material libraries play a crucial role in enhancing the realism of the model.

Throughout the process, designers meticulously review and refine the 3D model to ensure its accuracy and alignment with the original 2D maps. Proportions, shapes, and edges are adjusted to achieve a high level of precision and detail. It is an iterative process that requires careful scrutiny and attention to eliminate any discrepancies or errors.

Validation of the 3D model involves comparing it with the original 2D maps to ensure that all dimensions and proportions align correctly. This phase is crucial in verifying the accuracy of the model and ensuring its reliability for further use. Peer review and feedback from stakeholders can provide valuable insights during this validation process.

Once the 3D model is complete and validated, it can be exported or integrated into other software or applications for various purposes. AutoCAD offers a range of file formats that facilitate compatibility with different platforms and workflows. The 3D model can be utilized for presentations, simulations, analysis, or even physical prototyping.

By leveraging AutoCAD's powerful capabilities and incorporating real-world references, designers can create accurate and detailed 3D models that find applications in various fields such as architecture, engineering, visualization, and prototyping. The process allows designers to bring their ideas to life, communicate them effectively in a three-dimensional space, and facilitate informed decision-making in the design and construction process.

Exploring 3Ds Max: A Powerful and Distinctive 3D Modeling Software for Architects

3Ds Max is widely recognized as a leading software in the field of 3D modeling and animation, offering numerous advantages and capabilities that set it apart from other software options, including popular programs like AutoCAD, SketchUp, and

Rhino. In this article, we will delve into the strengths of 3Ds Max, highlighting its unique advantages over these specific software choices in the architectural field.
One of the key advantages of 3Ds Max lies in its extensive set of tools and features that cater to the architectural industry. Whether you're creating intricate architectural models, realistic visualizations, or captivating animations, 3Ds Max provides a versatile platform that meets the specific needs of architects. Its comprehensive toolset ensures that users have the necessary resources to bring their creative visions to life.
Rendering capabilities play a crucial role in achieving high-quality architectural visuals, and 3Ds Max excels in this area. The software offers advanced rendering options such as V-Ray and Corona Renderer, which produce stunning and photorealistic renderings. Moreover, 3Ds Max supports the integration of these third-party renderers, allowing architects to choose the rendering engine that best suits their specific needs and preferences. This flexibility sets it apart from other software like AutoCAD and SketchUp, which have more limited rendering capabilities.
Another noteworthy advantage of 3Ds Max is its intuitive and customizable user interface. The software allows architects to tailor their workspace to their specific workflow preferences, enhancing productivity and efficiency. Whether you prefer a specific layout, need to customize hotkeys, or want to create a custom toolbar, 3Ds Max offers the flexibility to adapt the software to match your individual working style. This level of customization sets it apart from the more rigid interfaces of AutoCAD, SketchUp, and Rhino.
Furthermore, 3Ds Max benefits from a thriving user community, which contributes significantly to its advantages in the architectural field. With a large and active user base, there are extensive online resources, tutorials, and plugins available specifically catering to architects. This vibrant community fosters knowledge sharing, problem-solving, and continual learning, making it easier for architects to expand their skills and stay up to date with the latest trends and techniques in architectural 3D modeling and visualization. This strong user community sets 3Ds Max apart from other software choices in the architectural field.
When it comes to architectural visualization, 3Ds Max particularly shines in comparison to software like AutoCAD, SketchUp, and Rhino. Its powerful features and capabilities enable architects to create highly realistic and visually captivating architectural visualizations. With a wide range of lighting, shading, and material

options, architects can produce stunning and lifelike renderings that effectively communicate design intent to clients and stakeholders. Additionally, 3Ds Max excels in animation and simulation capabilities, allowing architects to create dynamic walkthroughs, flyovers, and interactive presentations of their architectural designs, providing a more immersive and engaging experience compared to other software options.

The detailed texturing and material editing capabilities of 3Ds Max further enhance the visual quality of architectural models. Architects can create and edit textures, apply realistic materials, and adjust their properties, achieving intricate and accurate representations of various surface finishes. This level of detail and realism sets 3Ds Max apart from the more limited capabilities of AutoCAD, SketchUp, and Rhino in this regard.

Furthermore, 3Ds Max offers specialized modeling features tailored to architectural design, including advanced techniques like spline-based modeling and parametric modeling. These tools empower architects to create complex geometries, intricate architectural details, and parametric designs with ease, surpassing the capabilities of AutoCAD, SketchUp, and Rhino.

Integration with other software is yet another advantage of using 3Ds Max in the architectural field. The software seamlessly integrates with other commonly used design and visualization tools, such as Autodesk Revit and Adobe Creative Suite, allowing for efficient data exchange and a more streamlined workflow. This interoperability distinguishes 3Ds Max from software options like AutoCAD and Rhino, which may have more limited compatibility with external tools.

In conclusion, 3Ds Max stands out as a powerful and distinctive 3D modeling software specifically tailored to the needs of architects. Its versatility, rendering capabilities, customizable interface, and strong user community make it a preferred choice over software options like AutoCAD, SketchUp, and Rhino. In the realm of architectural visualization, 3Ds Max offers advanced visualization capabilities, animation and simulation features, detailed texturing and material editing, specialized modeling techniques, and seamless software integration. These advantages contribute to the creation of highly realistic and visually appealing architectural visualizations that aid in better understanding and communication of design features, setting it apart from other software options in the architectural field.

Enhancing 3D Models in AutoCAD with 3D Studio Max: Phases and Techniques

Enhancing the level of detail, realism, and visual quality of a 3D model created in AutoCAD can be achieved through a series of techniques using 3D Studio Max. By taking advantage of the advanced features and capabilities of 3D Studio Max, designers can refine and improve the initial AutoCAD model, resulting in a more sophisticated and visually appealing outcome.

The process begins by importing the AutoCAD model into 3D Studio Max, ensuring that the fundamental geometry and structure of the model are preserved as a starting point for further enhancements. From there, the focus shifts to enhancing the model's geometry and details. Using advanced modeling techniques such as subdivision surfaces and polygonal modeling available in 3D Studio Max, designers can add intricate details, refine the shape, and overall structure of the model.

The next phase involves applying materials and textures to enhance the visual appearance and realism of the model. With a wide range of material creation and mapping tools, 3D Studio Max enables designers to apply realistic surface textures, reflections, transparency, and other material properties, assigning suitable materials to different parts of the model to achieve the desired visual outcome. Lighting and rendering play a crucial role in creating a visually appealing and realistic 3D model. Designers utilize virtual lights within the scene, simulating different lighting conditions to achieve the desired ambiance and leveraging advanced rendering techniques in 3D Studio Max to generate high-quality images with realistic lighting and shading effects.

Fine-tuning and refining the model are essential steps to ensure the desired level of detail and accuracy. Designers meticulously review and make adjustments to proportions, refine textures, smooth surfaces, and eliminate any inconsistencies or imperfections, continuously iterating to achieve a polished and high-quality 3D model. Once the improvements and refinements are complete, the refined 3D model can be exported from 3D Studio Max in various file formats for further use. This versatile output can be utilized in presentations, visualizations, animations, virtual reality experiences, or seamlessly integrated into other design workflows.

By combining the strengths of AutoCAD and 3D Studio Max, designers have the opportunity to enhance their 3D models, elevating them to a higher level of realism, detail, and visual quality. This integrated workflow empowers designers to create captivating visual representations that effectively communicate design intent and engage viewers.

Enhancing 3D Model Visualizations: Rendering Engines and AR 360-Degree Experiences

In the world of 3D modeling and visualization, artists and designers strive to enhance the visualization of 3D models by leveraging the strengths and features of different rendering engines and embracing immersive technologies. The aim is to elevate the visual experience and take it to new levels of realism and interactivity. By understanding the unique capabilities of each rendering engine and exploring immersive technologies, artists and designers can unlock the potential to create stunning and captivating visual representations of their designs.

The selection of a suitable rendering engine is a crucial aspect of the process. Various rendering engines, such as V-Ray, Arnold, Corona Renderer, Mental Ray, and Redshift, offer different features and functionalities that cater to specific needs and preferences. Factors like rendering speed, quality, ease of use, software integration, and project requirements need to be considered when choosing the right rendering engine. Understanding the strengths and weaknesses of each engine empowers artists and designers to make informed decisions that align with their vision and objectives.

Immersive technologies, including augmented reality (AR) and AR360, present exciting opportunities to enhance the visualization of 3D models. AR overlays virtual content onto the real world, providing an interactive and immersive experience for users. AR360 combines immersive 360-degree views with augmented elements, allowing users to explore virtual spaces and interact with virtual objects or information in a captivating way. By embracing these technologies, artists and designers can create immersive and engaging experiences that bring their 3D models to life.

In summary, the aim of understanding the strengths and features of various rendering engines and embracing immersive technologies is to elevate the visualization of 3D models. It enables artists and designers to push the boundaries of realism, interactivity, and engagement, ultimately creating visually stunning and immersive experiences for their audiences.

Comparison of Rendering Engines for 3D Studio Max

Various rendering engines available for 3D Studio Max, such as V-Ray (Evans, 1989), Arnold (Barlow, Blakemore & Weston-Smith, 1990), Corona Renderer (Evans, 1989), Mental Ray, and Redshift (Barlow, Blakemore & Weston-Smith, 1990), provide different features and capabilities, resulting in distinct rendering outputs.

Figure 7: V-ray vs Corona, https://www.antoniobosi.com/maya-render-tests-reviews-comparisons/vray-vs-corona-render-interior/

- V-Ray, known for its advanced lighting and shading techniques and photorealistic results, is widely regarded as one of the top rendering engines for 3D Studio Max (Evans, 1989). Arnold, on the other hand, offers a physically-based rendering approach and is favored for its ease of use and high-quality results (Barlow, Blakemore & Weston-Smith, 1990).
- Corona Renderer stands out for its user-friendly interface and fast, interactive rendering capabilities, making it suitable for architectural visualization and interior design projects (Evans, 1989). Although Mental Ray, a previously popular rendering engine, has been discontinued, it offered advanced ray tracing, global illumination, and support for advanced materials. Redshift, a GPU-accelerated rendering engine, is known for its speed and efficiency, leveraging the power of modern graphics cards for fast rendering times and supporting features like volumetric rendering and subsurface scattering (Barlow, Blakemore & Weston-Smith, 1990).

When selecting a rendering engine for 3D Studio Max, considerations such as rendering speed, quality, ease of use, integration with the software, and specific project requirements should be taken into account (Evans, 1989; Barlow, Blakemore & Weston-Smith, 1990). Each rendering engine has its own strengths and weaknesses, and artists should assess their needs and preferences to make an informed decision.

Rendering Architectural Models in 3D Studio Max with V-Ray

Rendering architectural models in 3D Studio Max using V-Ray involves several phases to ensure the creation of realistic and visually appealing renderings of architectural designs (Chaos Group, n.d.). The process begins with scene preparation, where the 3D model of the architectural structure is imported into the software, and the scene scale, units, and coordinate system are set (Chaos Group, n.d.).

Next, the lighting setup phase takes place, where virtual lights are placed in the scene, their intensity and color are adjusted, and global illumination techniques are utilized to achieve realistic lighting effects (Chaos Group, n.d.). Simultaneously, specific materials are created and applied to the surfaces of the architectural model, utilizing V-Ray's wide range of material options and customization features (Chaos Group, n.d.). This allows designers to replicate different surface finishes such as concrete, glass, wood, or metal.

Proper camera placement is crucial for capturing the desired perspective and composition of the architectural model. Designers position the camera within the scene and make adjustments to focal length, depth of field, and other parameters to achieve the desired visual impact (Chaos Group, n.d.). Once the scene, lighting, materials, and camera settings are finalized, the rendering process begins. V-Ray calculates the lighting, shadows, reflections, and other visual elements to generate the final high-quality render of the architectural model (Chaos Group, n.d.).

After rendering, post-processing techniques can be applied to further enhance the visual output. This may include adjustments to brightness, contrast, color balance, and the addition of effects such as depth of field or lens flares to achieve the desired aesthetic result (Chaos Group, n.d.). These post-processing steps contribute to the overall refinement and quality of the architectural renderings.

Immersive Technologies: VR, AR, and AR360 Comparative Analysis

Virtual Reality (VR), Augmented Reality (AR), and Augmented Reality 360 Degrees (AR360) are immersive technologies that enhance our perception and interaction with digital content. While they share similarities, each technology offers distinct experiences and applications. This comparison aims to provide a clear understanding of the differences and similarities between VR, AR, and AR360.

VR creates a fully immersive digital environment that replaces the real world. Users wear a HMD that covers their field of view and often includes motion tracking to provide a sense of presence in the virtual world. VR technology enables users to interact with and explore computer-generated environments, offering highly immersive and realistic experiences.

AR overlays virtual content onto the real world, enhancing the user's perception of reality. AR utilizes devices such as smartphones, tablets, or specialized glasses to superimpose virtual objects, information, or animations onto the user's view of the real world. Users can see and interact with both the real and virtual elements simultaneously, creating a blended experience.

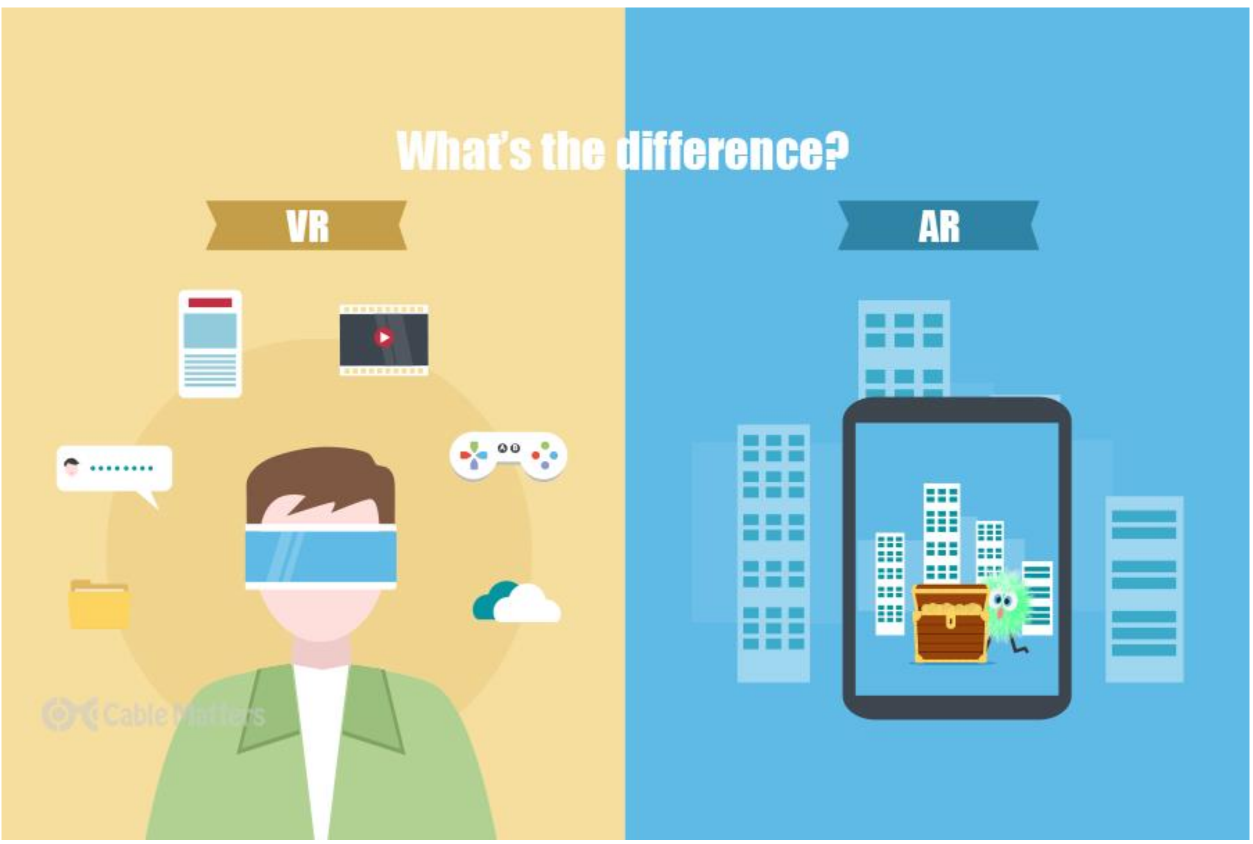


Figure 8: VR vs AR, https://www.cablematters.com/Blog/Virtual-Reality/vr-vs-ar

Augmented Reality 360 Degrees (AR360) combines the immersive aspect of 360-degree content with the interactive elements of augmented reality. AR360 allows users to view and interact with virtual objects or information superimposed onto a 360-degree panoramic view of the real world. This technology offers an enhanced perception and understanding of the environment by providing a more immersive and interactive experience.

Figure 9: AR 360, https://it.dreamstime.com/mani-che-tengono-compressa-mostra-cucina-bianca-e-di-legno-moderna-fondo-schizzo-del-modello-cad-concetto-aumentato-realt%C3%A0-image145911263

While VR isolates users from the real world, AR and AR360 maintain a connection to the physical environment. AR overlays virtual elements onto the user's real-world view, while AR360 adds augmented content to a 360-degree captured environment. Both AR and AR360 have a wider range of applications, including gaming, education, architecture, and training.

AR 360-degree combines the immersive experience of 360-degree content with the interactive elements of augmented reality technology. It allows users to view and interact with virtual objects or information superimposed onto the real world, enhancing their perception and understanding of the environment. This technology has gained significant attention in various fields, including gaming, education, marketing, and industrial applications.

AR 360-degree involves several key components and processes. First, a 360-degree capture or recording device, such as a 360-degree camera or specialized rig, is used to capture a panoramic view of the real-world environment. This footage is then processed and stitched together to create a seamless and immersive 360-degree image or video. Next, augmented reality elements are overlaid onto the captured 360-degree content. Computer vision techniques are utilized to track the user's position and orientation in real-time, ensuring precise alignment of virtual objects or information with the real-world view. These augmented elements can include 3D models, animations, text, or interactive elements that provide additional information or enhance the user's experience.

To view the AR 360-degree experience, users typically utilize a compatible device such as a smartphone or a HMD. The device's camera and sensors track the user's movements and adjust the augmented elements accordingly, creating a dynamic and interactive AR experience. Users can explore the 360-degree environment by moving their device or physically moving within the space, and the augmented elements respond accordingly.

The benefits of AR 360-degree are numerous. It allows for a more immersive and engaging user experience, enabling users to interact with virtual objects and information in a natural and intuitive way. It has the potential to revolutionize industries such as tourism, where users can virtually explore destinations before visiting or experience historical sites in their original context. In education, AR 360-degree can enhance learning by providing interactive visualizations and simulations. In marketing and advertising, it offers new and creative ways to showcase products or engage customers.

By understanding the differences and similarities between VR, AR, and AR360, we can harness the power of these immersive technologies to create innovative and engaging experiences in various fields.

Comparison of Software for Producing AR 360 Experiences from 3D Models in 3D Max Studio

Producing Augmented Reality 360 (AR360) experiences from 3D models created in 3D Max Studio requires the use of specialized software. This comparison provides an overview of different software options available for creating AR360 experiences and their suitability for integrating 3D models into immersive augmented reality environments.

Software for Producing AR 360 Experiences from 3D Models:

- Unity:

Unity is a popular game development engine that offers robust tools and features for creating AR360 experiences. It supports the import of 3D models from 3D Max Studio and provides a flexible platform for integrating them into interactive and immersive AR environments (Unity Technologies).

Figure 10: Unity, https://unity.com/

- Unreal Engine:

Unreal Engine, another widely used game development engine, is suitable for producing AR360 experiences. It offers advanced rendering capabilities and a user-friendly interface for integrating 3D models from 3D Max Studio into realistic augmented reality environments (Epic Games).

Figure 11: Unreal Engine, https://www.unrealengine.com/

- Vuforia:

Vuforia is an Augmented Reality platform that allows for the creation of AR experiences, including AR360. It provides tools for image recognition and tracking, enabling users to overlay 3D models onto real-world environments. Vuforia supports the import of 3D models from 3D Max Studio and offers features for adding interactive elements to the AR360 experience (Vuforia).

Figure 12: Vuforia, https://developer.vuforia.com/

- ARCore and ARKit:

ARCore (for Android) and ARKit (for iOS) are software development kits (SDKs) provided by Google and Apple, respectively. These SDKs enable developers to create AR applications, including AR360 experiences, for mobile devices. They offer tracking and mapping capabilities, allowing users to view 3D models in a 360-degree augmented reality environment (Google Developers; Apple Developer).

Figure 13:ARCore VS ARKit, https://www.coletiv.com/blog/augmented-reality-app-arkit-arcore/

- WebAR:

WebAR technology allows users to access AR experiences directly through web browsers, eliminating the need for dedicated mobile applications. Platforms such as 8th Wall and A-Frame provide frameworks and libraries for creating AR360 experiences that can be accessed through web browsers on compatible devices (8th Wall; A-Frame).

When producing AR360 experiences from 3D models in 3D Max Studio, software options such as Unity, Unreal Engine, Vuforia, ARCore, ARKit, and WebAR offer diverse features and capabilities. The choice of software depends on factors such as the target platform, desired interactivity, and project requirements. Each software provides a unique set of tools to facilitate the integration of 3D models into immersive AR360 experiences.

Creating Immersive AR 360-Degree Experiences from Interior Architectural Models

Creating captivating AR 360-degree experiences from interior architectural models in 3D Max Studio opens up exciting possibilities for showcasing and exploring virtual spaces. This integrated process outlines the step-by-step phases involved in producing such experiences, from model creation to interactive user interactions.

The first phase begins with the creation of a detailed 3D model of the interior architectural space using 3D Max Studio. This involves accurately modeling the walls, floors, furniture, and other elements present in the space. Texturing and material assignment are applied to enhance the realism and visual quality of the model.

Proper lighting techniques play a crucial role in creating a convincing AR experience. During this phase, the lighting is carefully set up within the 3D Max Studio environment to replicate the desired ambiance and atmosphere of the interior space. The scene is organized to optimize performance and ensure a smooth AR360 experience.

Once the interior architectural model is complete, it is exported from 3D Max Studio into a format compatible with AR software and platforms. Commonly used file formats such as FBX (Filmbox) and OBJ (Wavefront) are employed, allowing for easy importation into AR development environments.

Specialized software or development environments like Unity or Unreal Engine are utilized to import the exported 3D model and develop the AR360 experience. These platforms provide the necessary tools to place the model in a real-world environment using augmented reality techniques. Scale, position, and orientation of the model within the AR space are defined during this phase.

To enhance user engagement, interactive elements are incorporated into the AR360 experience. Users can interact with the interior architectural model, such as switching between design options, changing materials, or accessing additional information about specific elements within the space. User-friendly navigation controls are implemented to facilitate seamless exploration of the virtual interior environment.

Thorough testing is conducted to ensure that the functionality, visual quality, and performance of the AR360 experience meet the desired standards. User feedback and testing play a vital role in identifying any issues or areas for improvement. Refinements and adjustments are made based on the feedback received to optimize the AR experience.
By following these step-by-step phases, interior architectural models created in 3D Max Studio can be transformed into captivating AR 360-degree experiences. This integrated process offers users an immersive and interactive exploration of virtual interior spaces.

CONCLUSION

The preservation of documentary legacy is of immense significance, as it safeguards our cultural heritage, promotes education, and provides insights into our past. Adverse environmental factors pose a threat to this legacy, making preservation strategies such as materials conversion and conservation activities necessary. Documentary heritage serves as a concrete form of disseminating information, reflecting our culture and history, and emphasizes the vital role preservation plays in maintaining our collective memory. Access to and understanding of documentary heritage are essential for individuals from various fields, including historians, academics, scientists, archivists, and the general public.

Strategies for protecting documentary legacy involve a range of methodologies and principles aimed at preserving and enhancing accessibility. Repairing, cleaning, photocopying, and digitization are key techniques used to mitigate the harmful effects of biological agents, environmental factors, and human impacts on documentary heritage. Digitization enables the creation of automated inventories and facilitates easier organization, retrieval, and user interaction. Adherence to UNESCO standards and a focus on accessibility considerations ensure the availability and usefulness of digital historical materials.

Advancements in 3D modeling and digital technologies have revolutionized the study and preservation of historical architecture. Immersive 3D digital models provide a more accurate and comprehensive understanding of structures, capturing their physical aspects as well as historical and cultural significance.

Techniques such as reverse modeling, digital surface surveys, and laser scanning have enhanced building analysis and preservation. The ongoing development of new techniques continues to shape the field and promote effective preservation strategies.

AutoCAD, 3D Studio Max, and documentary sources have revolutionized map creation and architectural visualization. The integration of visual and documentary sources in AutoCAD enables the creation of accurate 2D maps, while 3D Studio Max enhances the realism and visual appeal of architectural models. The choice of rendering engine and the integration of immersive technologies such as AR and AR360 further enhance the visualization of 3D models, providing opportunities for stunning renderings and captivating experiences.

Overall, the preservation of documentary legacy, the implementation of preservation strategies, advancements in 3D modeling and digital technologies, and the integration of immersive technologies contribute to the protection, availability, and enhanced understanding of our cultural heritage for present and future generations.

The pavilion of Hungary Case study

Turin 1911: Digitally Reconstructing the World's Fair

'Turin 1911' is a collaborative project between Politecnico di Torino and the University of California San Diego (UCSD) that brings together a diverse team of experts from various disciplines. The project's main objective is to digitally reconstruct the Turin 1911 World's Fair, exploring the synergies between traditional research methods and digital technologies. By recreating this lost universe, the project aims to examine the fair as a significant expression of 20th-century ideology and a symbol of modernity and progress.

Figure 14: Turin 1911: The World's Fair in Italy, https://italyworldsfairs.org/

The Significance and Impact of the Universal Exhibition in Turin: A Case Study of the "Fabulous Exhibition" of Turin 1911

The Case Study of Turin in 1911 examines the significance and impact of the Universal Exhibition held in Turin from April 29 to November 19. This grand exhibition, organized to celebrate the momentous occasion of Italy's fiftieth anniversary of Unification, drew an impressive crowd of approximately 7 million visitors.

The decision to hold three simultaneous exhibitions in Rome, Florence, and Turin, each with its own unique theme and attractions, was a deliberate choice. These exhibitions aimed to showcase the cultural, industrial, and artistic achievements of the nation and represented the three successive capitals of the Kingdom of Italy in different periods.

The motivation behind this division can be traced back to the visionary thinking of Secondo Frola and Ernesto Nathan, who believed that by spreading the exhibitions across multiple cities, the impact and visibility of the celebrations would be magnified. This strategic approach allowed each city to showcase its distinct character and historical significance while collectively highlighting the unified identity of Italy. The Universal Exhibition of Turin in 1911 served as a testament to the country's progress and offered a platform for international recognition and exchange. The rich tapestry of exhibits, encompassing various industries, technological advancements, and artistic achievements, left a lasting impression on the millions of visitors who flocked to experience this extraordinary event.

"The metropolis of strong and industrious Piedmont is responsible for gathering in an International Industrial Exhibition the various manifestations of economic activity, while Rome, the beacon of Italian thought, is tasked with summarizing through patriotic, historical, and artistic exhibitions the concept that presided over those economic activities" **(Treves, 1911)**.

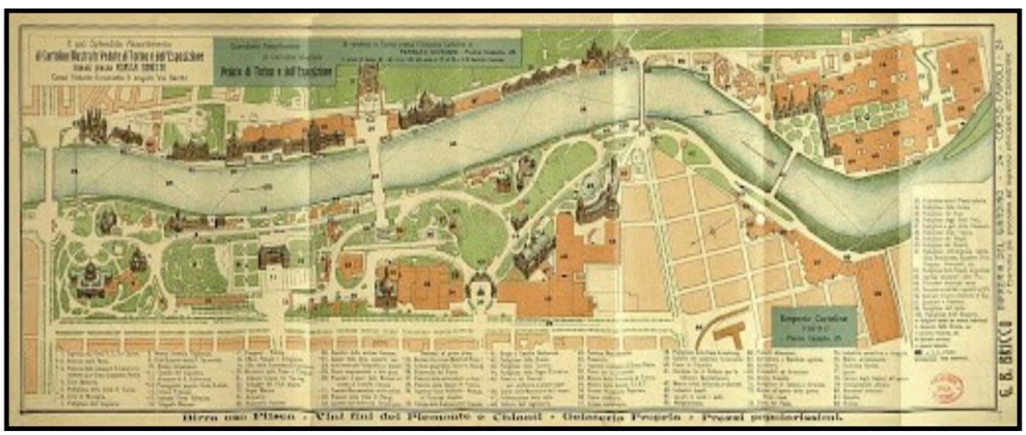


Figure 15: Map of the exhibition, ("(1911), Practical Guide to Visiting the International Exhibition of Industries and Labor," 1911)

The 1911 exhibition, titled the "International Exhibition of Industry and Labor," was held in Turin due to its exceptional industrial significance in Italy during that era. Turin had become the country's foremost city in terms of industrial prowess, boasting a substantial workforce and a dense concentration of factories within its boundaries. This rapid industrial growth and prominence led to Turin being chosen as the host city for the exhibition. Furthermore, Turin's industrial leadership was solidified when it became the headquarters of the Italian Confederation of Industry in 1906, further emphasizing its status as a focal point for industrial activities in the country.

The event attracted the participation of 31 nations spanning different continents, each showcasing their contributions within the designated exhibition space. Within the park, a range of impressive pavilions and structures were erected to accommodate the displays and cultural representations of these nations. Notable features included the grand Monumental Bridge spanning the Po River, the majestic Monumental Fountain situated on the neighboring hill, which served as a focal point for the exhibition grounds, and the Pavilion of Hungary representing its respective countries' unique contributions. Furthermore, to ensure a seamless and enjoyable experience for visitors, additional infrastructures were put in place. These included the implementation of a monorail system and an electric funicular, providing convenient transportation options and enhancing accessibility throughout the exhibition grounds.

Figure 16: Electric funicular connecting the two banks of the Po River, (Giorgio Pelassa, n.d.)

Starting from 1912, almost all the structures and infrastructures of the exhibition were dismantled. This process was relatively simple because the structures were designed to be ephemeral, constructed using materials like wood and plaster that allowed for quick assembly, disassembly, and easy disposal, ensuring a return to their original state. The uniqueness of the exhibition lay in its departure from the conventional fairground style of the time, which often consisted of a haphazard collection of different architectural types that lacked cohesion. The organizers of the event, dissatisfied with this characteristic observed in previous exhibitions, made the decision to adopt a unified architectural style closely tied to the Baroque tradition of Turin, specifically following the design principles of Filippo Juvarra.

By opting for a unified architectural style, the organizers aimed to create a sense of harmony and coherence throughout the exhibition. They wanted the various structures to complement each other and contribute to a cohesive aesthetic experience for the visitors. This departure from the norm reflected a desire to elevate the artistic and architectural value of the exhibition, emphasizing the cultural significance of the event. The influence of Filippo Juvarra, a renowned architect known for his Baroque designs, played a significant role in shaping the architectural style of the exhibition, further contributing to its unique character **(Della Coletta, 2006)**.

Unlike previous exhibitions, the one in Turin also provided an answer to another issue that had been evident in Italy for several years, namely the lack of a national style. The Turin Exhibition proposed the Turin Baroque as a model to be followed in order to present the State as unified, not only for aesthetic reasons but also to meet the demand of the entire political class of that time, which aimed to represent the value and ambitions of the State.

The Pavilion of Hungary: A Unique Architectural Gem at the Turin Exhibition 1911

Out of the numerous structures present at the event area, including national, regional, provincial, city, and colonial pavilions, as well as service buildings, bridges, and manufacturing pavilions, one particular structure has been selected as a notable case study due to its unique characteristics in terms of size, architectural style, and geometric complexity. The Pavilion of Hungary has been chosen as the building for analysis. Spanning an area of 6000 m2 near the River Po, the Pavilion of Hungary ("(1911), The Turin 1911 Exhibition," 1911) was a distinctive and artistically valuable structure. It consisted of flanked blocks with pyramidal towers representing Attila's tent and served as a prominent landmark in the exposition. The pavilion, designed by Hungarian architects Emily Töry, Maurice Pogány, and Dénes Györgyi, featured vibrant colors that contrasted with the predominant "white city" aesthetic of the exposition and stood as the last example of Hungarian national style.

Figure 17: South view of the Pavilion of Hungary, https://italyworldsfairs.org/mainpage.html

The design of the Pavilion of Hungary was selected through a national competition among the country's top architects, aiming to surprise the Hungarian people themselves. It showcased architectural elements from Hungary's ancient history, reinterpreted in a modern style specifically for the occasion. The architects intentionally sought to reproduce a scene from the ancient Hungarian nomadic life, presenting visitors with the sharp pyramidal towers that, at first glance, resembled a grand encampment rather than a traditional palace, evoking memories of the East.

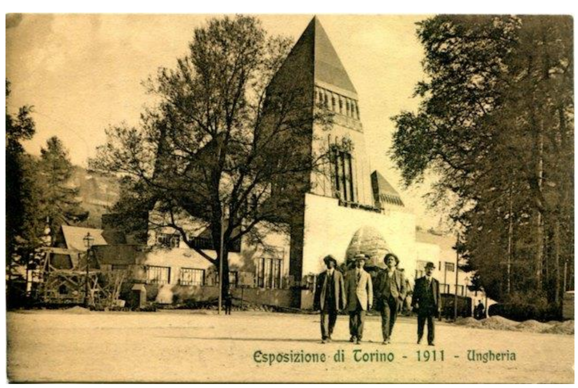


Figure 18: North view of the Pavilion of Hungary, https://italyworldsfairs.org/mainpage.html

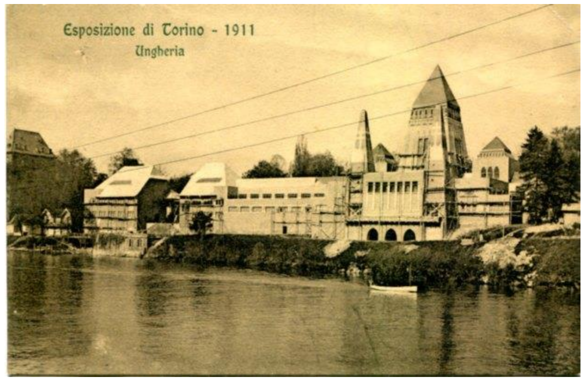


Figure 19: South view of the Pavilion of Hungary, https://italyworldsfairs.org/mainpage.html

Historical symbolism played a significant role in this project. In addition to the towers mentioned earlier, at the entrance, there were bas-reliefs depicting "The Wedding of Attila" and "The Coronation of King Saint Stephen." The entrance, covered by a dome, was guarded on the sides by ancient warrior deities reminiscent of the grand Eastern portals preserved in Hungary. Upon entering the central hall, known as the "Gallery of Celebrations," designed in the shape of a central nave of a cathedral, visitors were greeted with a unique light created by colored glass placed in the upper part of the nave itself. In the center of the hall, visitors could admire the busts of Emperor Franz Joseph, King of Hungary, and Vittorio Emanuele III, created by the sculptor Edoardo Telos. Passing the two royal statues and the waterfalls behind them, visitors arrived at the hall showcasing the exhibition of the city of Budapest.

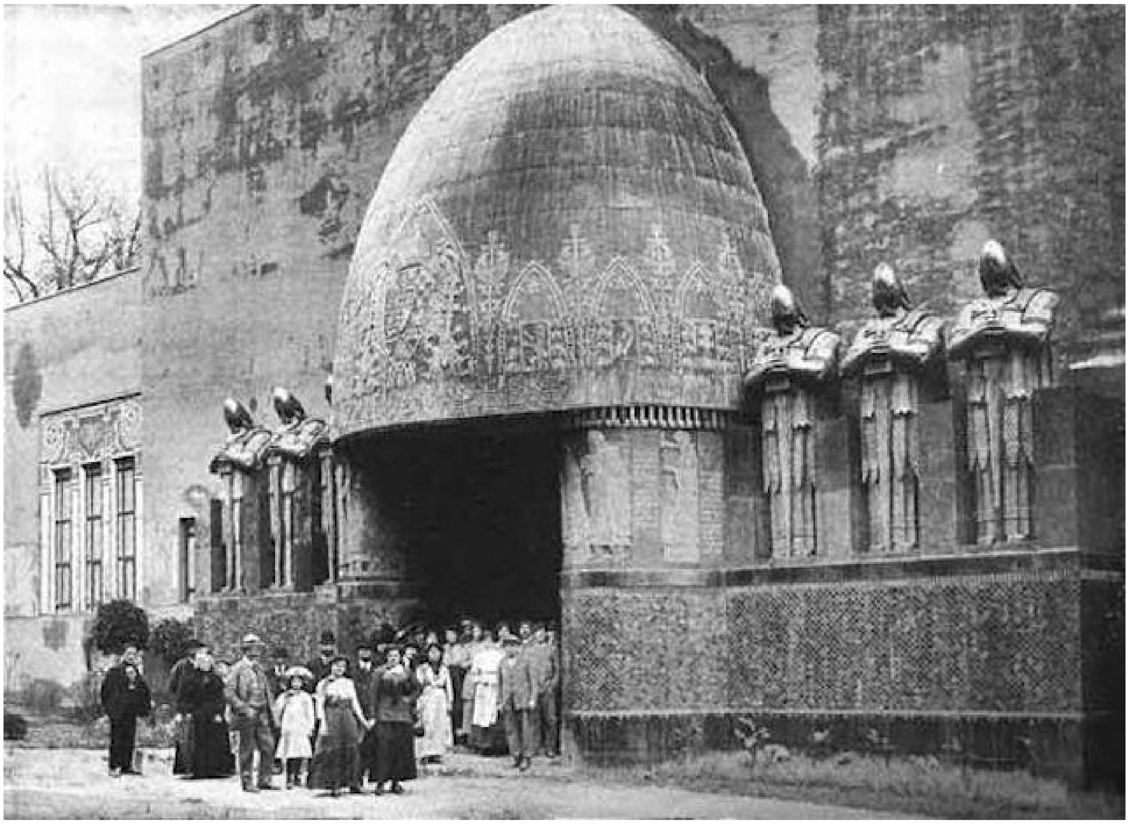


Figure 20: The main entrance of the Pavilion of Hungary from the south side in the Valentino park, https://italyworldsfairs.org/mainpage.html

The Significance and Documentation of the Pavilion of Hungray: Insights from Official Publications and Additional Sources

The Pavilion of Hungary holds significant historical and architectural importance within the context of the Turin Exhibition of 1911. Official publications and additional sources provide valuable insights into the significance and documentation of this remarkable structure. Two notable references, the "Exposition Internationale de Turin 1911: Catalogue de l'Exposition de l'Industrie et de l'Agriculture des Pays de la Couronne Hongroise" (International Exhibition of Turin 1911: Catalogue of the Exhibition of Industry and Agriculture of the Hungarian Crown Lands) published by Comité and "Torino 1911: La favolosa esposizione" (Torino 1911: The fabulous exhibition) by Carlo Morlondo, shed light on the Pavilion of Hungary.

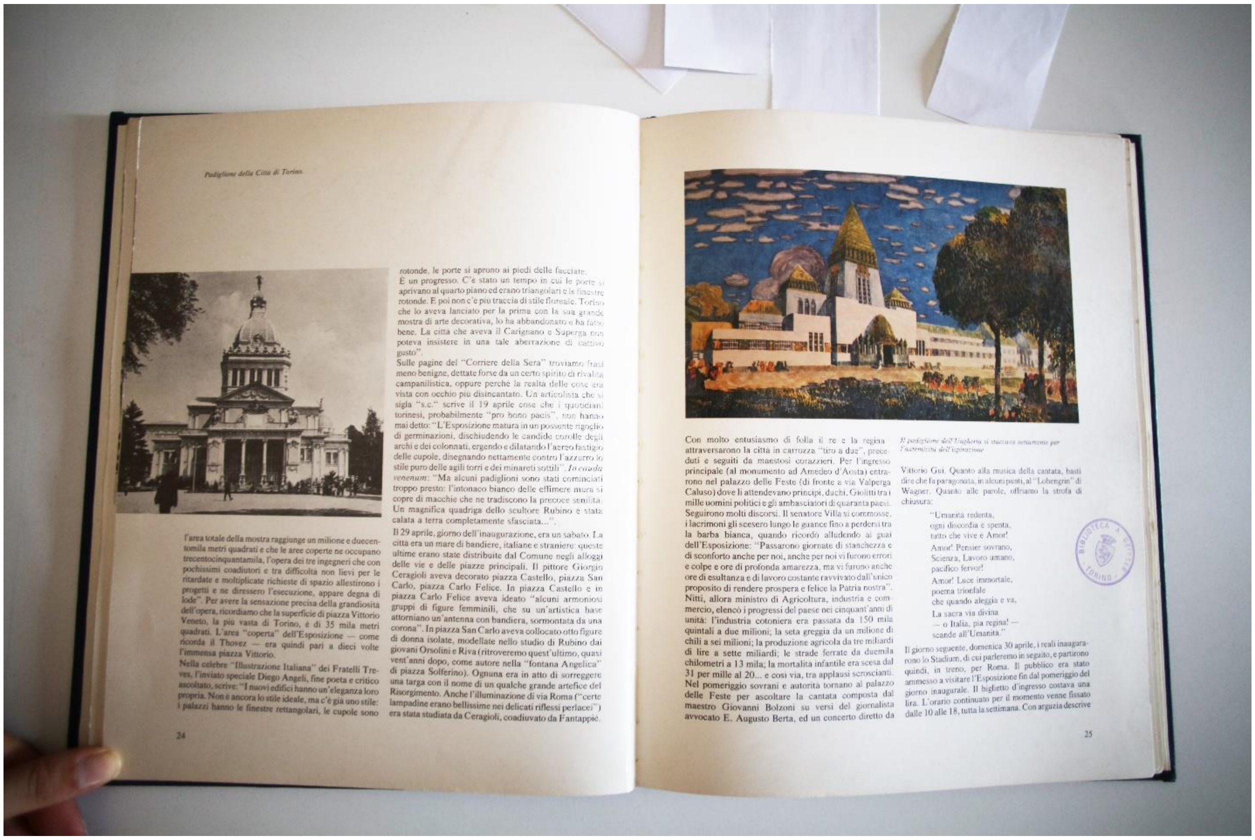


Figure 21: Exposition Internationale de Turin 1911: Catalogue de l'Exposition de l'Industrie et de l'Agriculture des Pays de la Couronne Hongroise

The Catalogue of the Exhibition, published by Comité in 1911, presents a comprehensive overview of the Pavilion of Hungary and its role within the broader exhibition. This catalogue, housed in the Ioteca Civica Torino, provides detailed information about the Pavilion's architectural design, size, and unique characteristics. It offers insights into the significance of the Pavilion within the Hungarian Crown Lands' industrial and agricultural sectors, showcasing its contribution to the exhibition's theme.

Carlo Morlondo's "Torino 1911: La favolosa esposizione" further explores the Pavilion of Hungary as part of the larger Turin Exhibition. This publication, belonging to the Momenti d'arte in Piemonte series and published by Daniela Piazza Editore, delves into the Pavilion's artistic and cultural value. It examines the Pavilion's architectural style, its visual appeal, and its representation of Hungarian national identity during that time. Morlondo's work contributes to our understanding of the Pavilion's place within the broader artistic and cultural context of the Turin Exhibition.

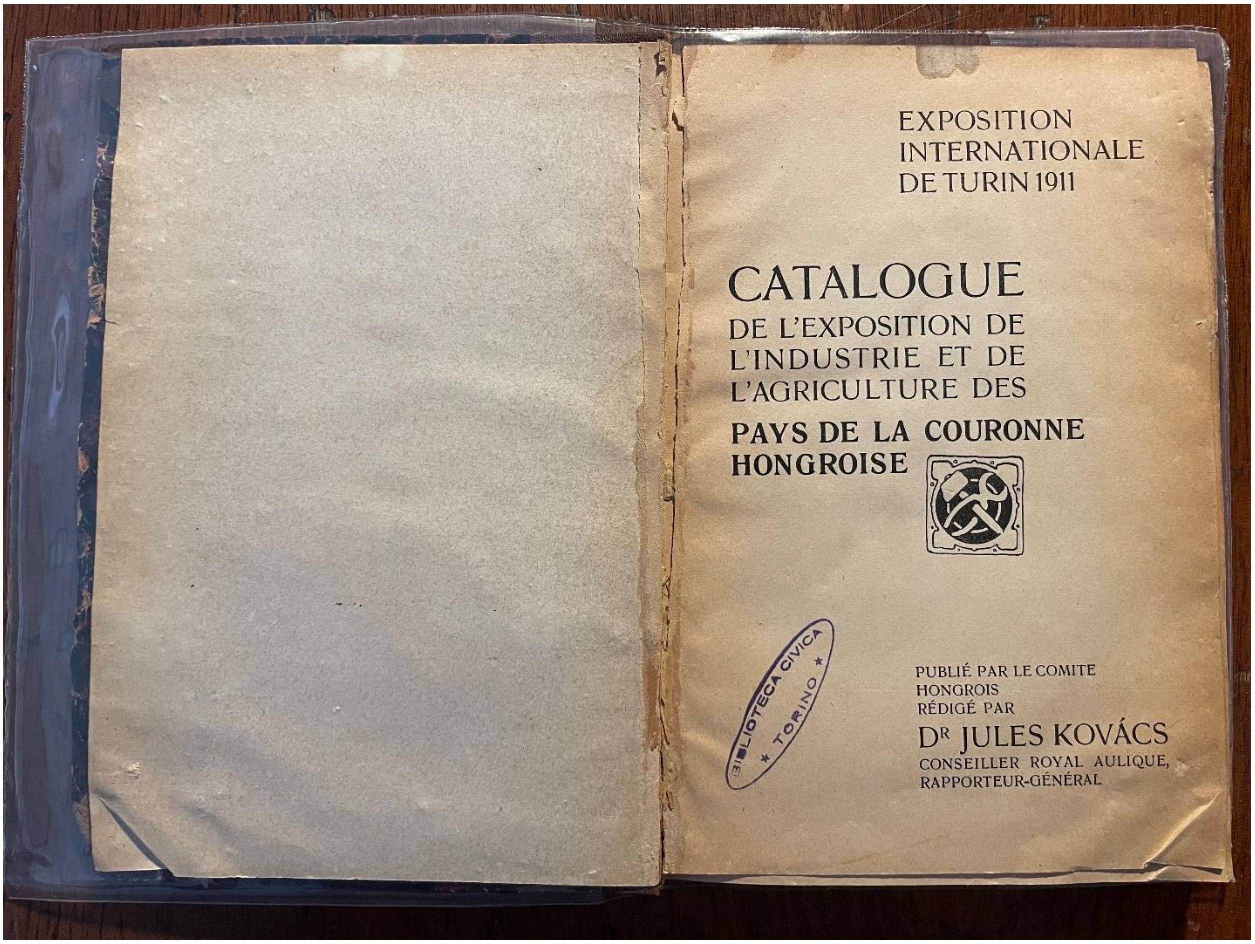


Figure 22: Torino 1911: La favolosa esposizione

By examining these official publications and additional sources, we gain insights into the historical significance and documentation of the Pavilion of Hungary. They highlight the Pavilion's architectural attributes, its role within the Hungarian Crown Lands' industrial and agricultural sectors, and its artistic and cultural value. The combination of these sources deepens our understanding of the Pavilion's significance within the Turin Exhibition of 1911 and its lasting impact on the field of architecture and design.

The Pavilion of Hungary: A Striking Blend of History and Architectural Beauty at the Turin Exhibition 1911

The Hungarian Pavilion at the 1911 Torino International Exhibition showcased a remarkable display of craftsmanship and artistic design (E. F., 1910). The pavilion's walls were adorned with costly trappings, including crafted leathers, weapons, rare fabrics, and hammer-shaped metals in chandeliers and vases, emphasizing the intrinsic value and precision of the exhibited items (E. F., 1910; "Il cantiere architettonico dell'Esposizione," 1910). The pavilion's two fountains, known as "water courts," were a wonder in themselves, featuring water falling into big eosin basins with bold naked golden ceramics at their center (E. F., 1910). The entryway was protected by a massive copper helmet-shaped dome, adding a grandiose touch to the pavilion's exterior (E. F., 1910; "La Cronaca Fotografica dei lavori dell'Esposizione," 1910).

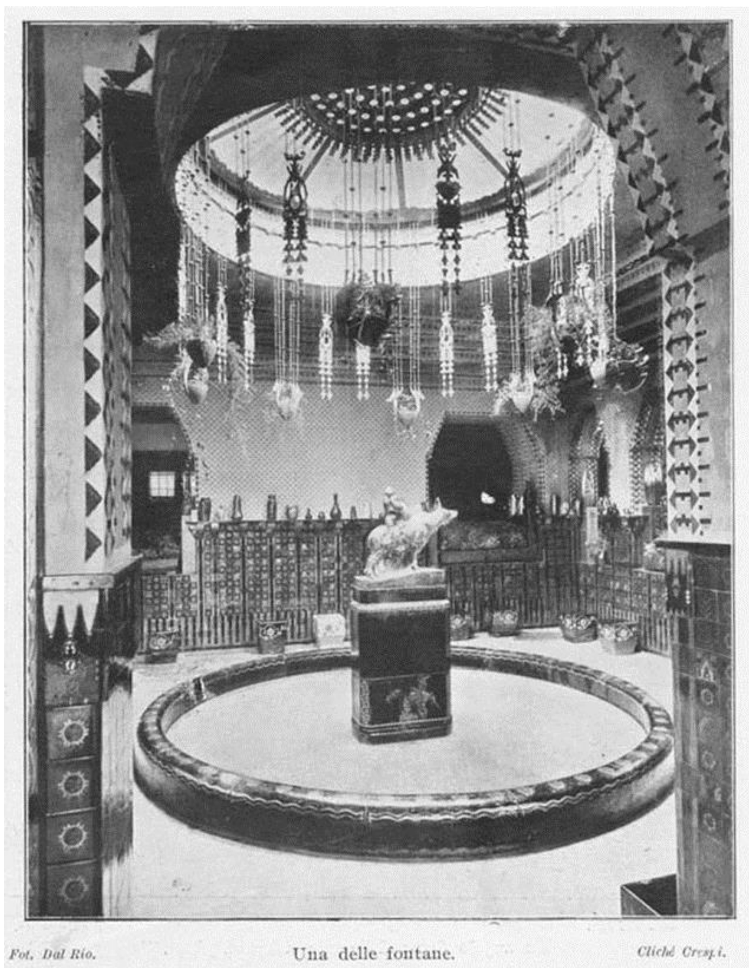


Figure 23: The main Hall of the Pavilion of Hungary, https://italyworldsfairs.org/mainpage.html

Constructed primarily from wood, the Hungarian Pavilion exuded a distinct charm and aesthetic appeal (Cornaglia, 2000). The entrance pillars were adorned with bas-reliefs made of glazed tiles, depicting scenes such as the coronation of Saint Stephan and the wedding of Attila (Cornaglia, 2000). Large windows with paintings by Miksa Róth allowed golden, violet, and blue rays to illuminate the interior, creating reflections reminiscent of precious stones (Cornaglia, 2000). The pavilion incorporated elements of Arabian Spain, with water features and muffled atmospheres in adjacent rooms, while the entrance showcased a vibrant display of colors with its mighty trunks colored in green, blue, and flame red (Cornaglia, 2000).

Modifications were made to the original version of the pavilion, including the addition of two truncated pyramids on the sides of the central one, emphasizing linearity (Cornaglia, 2000). Visitors entering the pavilion were greeted by a grand hall adorned with blue decorations and primitive Hungarian motifs inspired by warrior adornments, fabrics, embroideries, and jewels found in tombs (Cornaglia, 2000). Two covered courtyards separated the entrance from the area dedicated to the city of Budapest, featuring skylights decorated with metal pendants and basins adorned with black glazed ceramics and golden arabesques (Cornaglia, 2000). The pavilion's design incorporated trapezoidal and parabolic openings, typical of Hungarian architecture at the time (Cornaglia, 2000).

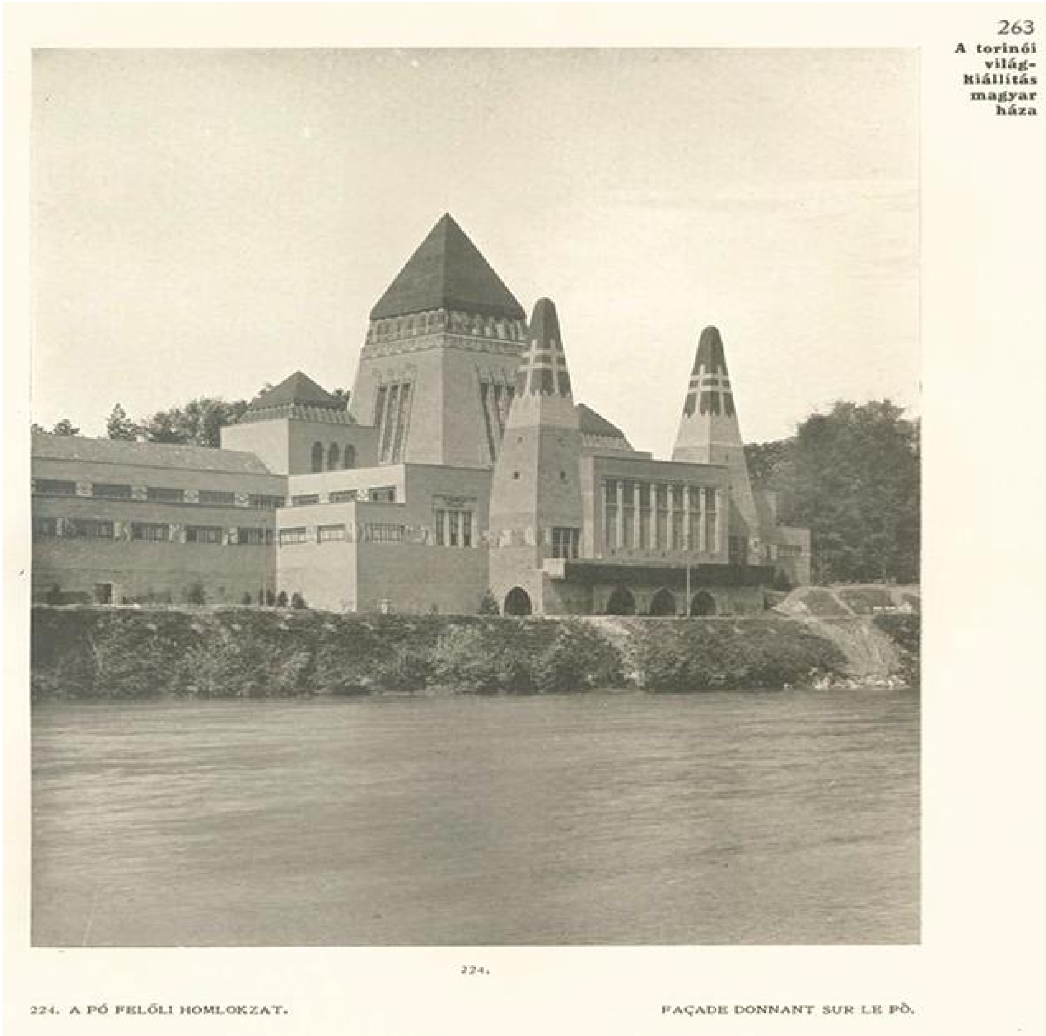


Figure 24: The south view of the Pavilion of Hungary the connection of two truncated pyramids on the sides of the central one, https://italyworldsfairs.org/mainpage.html

Figure 25: Grand hall of the Pavilion of Hungary, https://italyworldsfairs.org/mainpage.html

Symbolizing the independent spirit and roots of Hungary, the Hungarian Pavilion featured three tents representing the mountains of the Tatras and Attila's royal tent (Cornaglia, 2000). The entrance of the pavilion was decorated with stylized hero figures painted on yellow walls, transitioning to noble green bronze and mirrored by six warriors of similar color (Cornaglia, 2000). Sculptures depicting the coronation of Saint Stephan framed the entrance pilasters, further connecting the pavilion to the myth of the origin of the Hungarian nation (Cornaglia, 2000). The use of large glass windows crafted by Roth Miksa emitted a mesmerizing glow, casting colorful rays that illuminated objects with the brilliance of precious stones (Cornaglia, 2000).

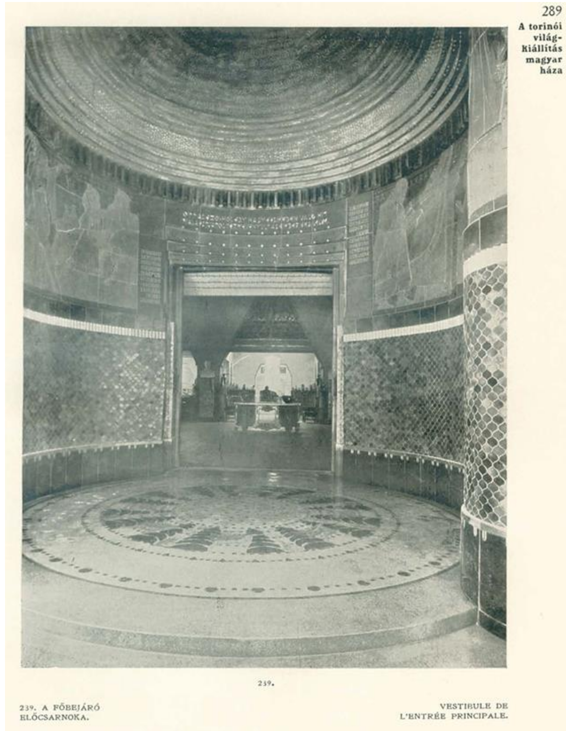


Figure 26: The entrance of the pavilion which is followed by the entrance of main hall, https://italyworldsfairs.org/mainpage.html

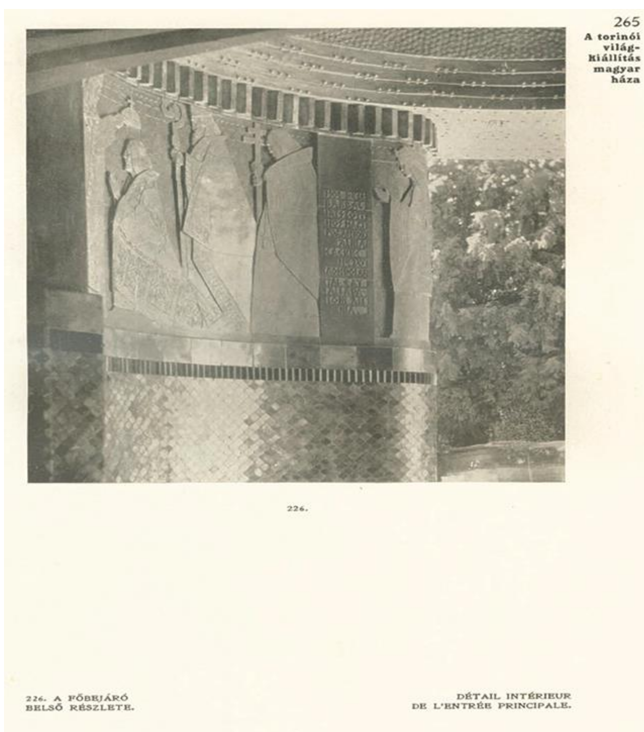


Figure 27: Stylized hero figures painted on yellow walls on the entrance of the pavilion, https://italyworldsfairs.org/mainpage.html

Changes made to the pavilion included the addition of two side pyramids and the removal of the gable roof solution facing the road, while a tower was designed on the side of the twin towers surrounding a small space (Cornaglia, 2000). Inside the pavilion, a 42-meter-high hall adorned with blue decorations showcased ancient Hungarian motifs, and two covered courtyards featured circular basins with water flowing and adorned with black glazed ceramics and golden arabesques (Cornaglia, 2000). The pavilion also included galleries on the first floor, offering visitors a view of the public square (Cornaglia, 2000).

The Hungarian Pavilion at the 1911 Torino International Exhibition represented a unique blend of architectural design, craftsmanship, and cultural symbolism, captivating visitors with its aesthetic appeal and intricate details (E. F., 1910; "La Cronaca Fotografica dei lavori dell'Esposizione," 1910; "A turini kiállítás magyar pavillonja," 1910; "A turini világkiállítás magyar háza," 1911; Cornaglia, 2000).

Figure 28: Decoration details of the pavilion, https://italyworldsfairs.org/mainpage.html

THE PROCESS OF DIGITAL RECONSTRUCTION

The available visual material for the project is limited, consisting mostly of postcards, sketches, and a few photos from the 1910s. However, these images suffer from various limitations such as insufficient quantity, lack of diverse perspectives, poor image quality, inconsistent data sources, and a lack of contextual understanding. Consequently, relying solely on these historical images for the digital reconstruction process is not suitable. The subsequent explanation will provide a more detailed account of these constraints and their impact on the project.

Limitations in Visual Data: Insufficient Quantity, Coverage, and Diverse Perspectives

Insufficient quantity and coverage, combined with a lack of diverse perspectives and viewpoints, posed significant limitations in the project's digital reconstruction of the historical building.

One of the primary limitations encountered was the insufficient quantity and coverage of visual data, which had a profound impact on the accuracy and completeness of the reconstruction. Due to the limited visual material available, there was a scarcity of images or viewpoints necessary for an accurate representation. This resulted in incomplete and inaccurate reconstructions, as critical architectural details may have been overlooked or not adequately captured. The limited visual material also presented challenges in obtaining comprehensive coverage of the entire building, leading to missing or poorly represented sections within the reconstruction. As a consequence, the overall accuracy and detail of the reconstruction were compromised, hindering a comprehensive understanding of the architecture and spatial layout.

Figure 29: The south view of the pavilion covered by the trees, https://italyworldsfairs.org/mainpage.html

Furthermore, the lack of diverse perspectives and viewpoints emerged as another significant limitation. The limited visual material restricted the availability of images captured from different angles or viewpoints, making it challenging to accurately capture the full geometry and intricate details of the building. This limitation resulted in notable gaps and inconsistencies in the reconstruction, leading to incomplete representations. The team faced difficulties in achieving a comprehensive and detailed model due to the inability to capture the heritage site from multiple viewpoints. The scarcity of diverse visual references hindered the team's ability to adequately represent certain areas or features, compromising the overall accuracy and detail of the reconstruction.

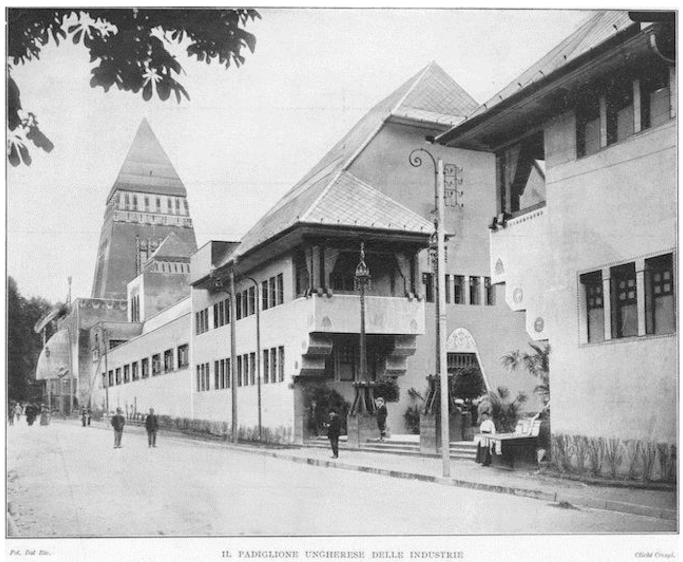


Figure 30: The western part of the Pavilion Which there was no complete photo of it or covered by the trees, https://italyworldsfairs.org/mainpage.html

The combination of insufficient quantity and coverage, along with the lack of diverse perspectives and viewpoints, underscored the challenges faced in the project. Overcoming these limitations required innovative strategies and alternative approaches to compensate for the scarcity of visual data and viewpoints, ensuring a more faithful and comprehensive digital reconstruction of historical buildings. Acquiring a more extensive and diverse range of visual material becomes crucial in achieving a more accurate and detailed representation of these significant structures.

Image quality and condition:

The project faced a notable constraint due to the quality and condition of the historical visual material, which had a substantial impact on the accuracy and reliability of the photogrammetric process and subsequent digital reconstruction. The visual data utilized in the project exhibited various limitations, including degradation, damage, and poor quality. These issues encompassed faded colors, blurriness, and distortion. These factors presented numerous challenges and constraints throughout the reconstruction process. The degraded or low-quality state of the historical visual data, resulting from factors such as aging, damage, or deterioration, posed a significant obstacle in extracting precise information for the reconstruction efforts. Such visual data often contained noise, blur, and other artifacts that affected the fidelity and clarity of the resulting reconstructed model. The presence of these imperfections made it arduous to capture intricate details and acquire accurate measurements crucial for photogrammetric reconstruction.

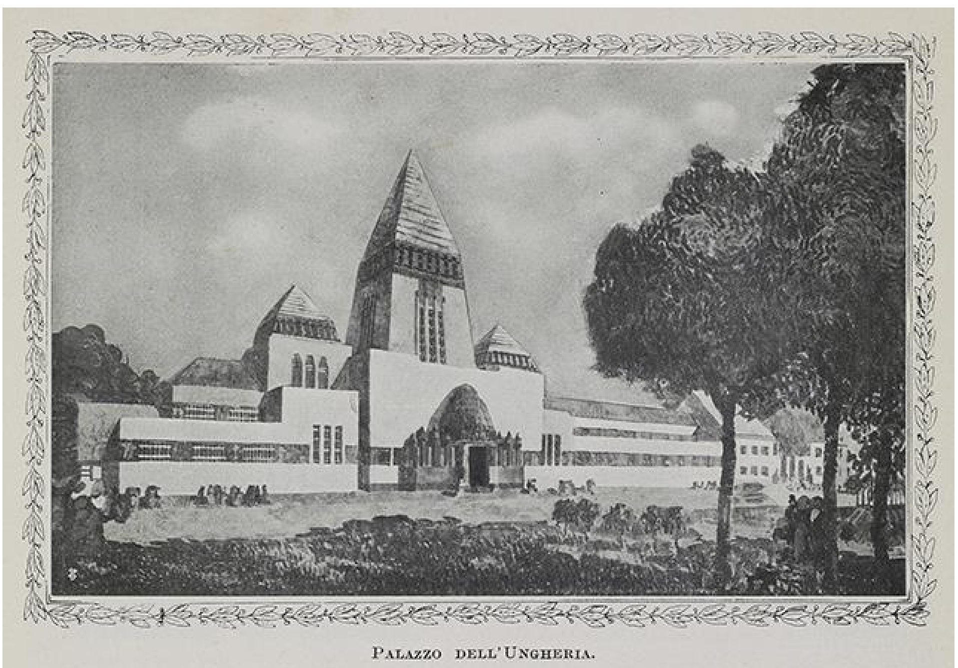


Figure 31: The lowest quality documents of the pavilion, https://italyworldsfairs.org/mainpage.html

Inconsistent data sources:

Data source inconsistencies presented a significant challenge in the project, introducing complexities in integrating and aligning the limited visual material used for the reconstruction. The available visual data encompassed images with varying resolutions, and diverse formats, making the seamless merging and alignment of data a demanding task. The use of visual material spanning different time periods resulted in variations in architectural features, structural elements, and the overall appearance of the historical building. This temporal disparity posed a hurdle in accurately reconstructing the building's original form and dimensions. Additionally, the diverse resolutions and formats of the images added to the challenge of integrating the data. Aligning visual material with different resolutions and formats required meticulous attention to detail and the implementation of sophisticated techniques to maintain consistency and accuracy throughout the reconstruction process. Furthermore, the inconsistent nature of the data sources extended to variations in image quality, further complicating the integration process. Ensuring a coherent and accurate reconstruction necessitated careful consideration of data preprocessing, calibration, and alignment techniques to harmonize the disparate visual material and minimize discrepancies in the final reconstructed model. Overcoming these challenges required a thorough understanding of the strengths and limitations of each data source, along with the use of robust methodologies to achieve a cohesive and precise reconstruction outcome.

Figure 32: Different postcards of the same view of the pavilion but with various colors which were made misunderstanding, https://italyworldsfairs.org/mainpage.html

Interpretation and contextual understanding:

The process of analyzing and comprehending the colors and materials used in the Pavilion of Hungary despite the limitations of black and white photographs and subjective depictions. Since the photographs of the pavilion were only available in black and white, they do not provide direct information about the actual colors used in the building. However, colors are expressed in depictions, such as illustrations or artistic representations of the pavilion.

However, it is important to note that depictions are subjective and can vary in their accuracy and level of detail. Therefore, relying solely on depictions may not provide a reliable source of information about the colors and materials of the pavilion.

To overcome this challenge, an analysis of the texts related to the pavilion becomes crucial. By examining written descriptions, accounts, and documents about the Pavilion of Hungary, researchers can gather valuable information about the colors and materials used in its construction. These textual sources can provide insights into the original intentions, design choices, and historical context of the pavilion, shedding light on the colors and materials that were likely employed.

Additionally, a comparison with graphical documentation can be undertaken to enhance the understanding of the pavilion's colors and materials. This involves examining other visual representations, such as architectural drawings, plans, or other graphic materials related to the pavilion. By comparing these graphical documents with the texts, researchers can cross-reference the information and validate the accuracy of the colors and materials identified.

By combining textual analysis and comparative study of graphical documentation, researchers can gain a more comprehensive and contextual understanding of the colors and materials used in the Pavilion of Hungary. This approach allows them to go beyond the limitations of black and white photographs and subjective depictions, enabling a more informed interpretation of the pavilion's original appearance.

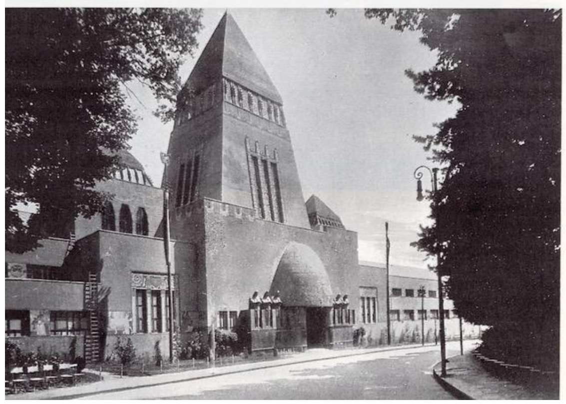
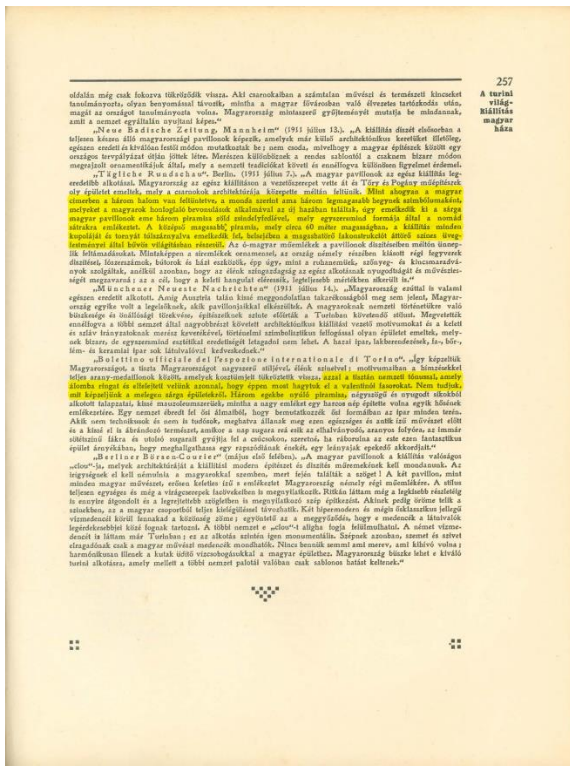


Figure 33: Three pyramids with just black and white colours, https://italyworldsfairs.org/mainpage.html



257

A turini világ-kiállítás magyar háza

oldalán még csak fokozva tükröződik vissza. Aki csarnokaiban a számtalan művészi és természeti kincseket tanulmányozta, olyan benyomással távozik, mintha a magyar fővárosban való élvezetes tartózkodás után, magát az országot tanulmányozta volna. Magyarország mintaszerű gyűjteményét mutatja be mindannak, amit a nemzet egyáltalán nyujtani képes."

„Neue Badische Zeitung, Mannheim" (1911 július 13.). „A kiállítás díszét elsősorban a teljesen készen álló magyarországi pavillonok képezik, amelyek már külső architektónikus keretüket illetőleg, egészen eredeti és kiválóan festői módon mutatkoztak be; nem csoda, mivelhogy a magyar építészek között egy országos tervpályázat útján jöttek létre. Merészen különböznek a rendes sablontól a csaknem bizarr módon megrajzolt ornamentikájuk által, mely a nemzeti tradiciókat követi és ennélfogva különösen figyelmet érdemel.

„Tägliche Rundschau". Berlin. (1911 július 7.). „A magyar pavillonok az egész kiállítás legeredetibb alkotásai. Magyarország az egész kiállításon a vezetőszerepet vette át és Tőry és Pogány műépítészek oly épületet emeltek, mely a csarnokok architektúrája közepette méltán feltűnik. Mint ahogyan a magyar címerben a három halom van feltüntetve, a monda szerint ama három legmagasabb hegynek szimbólumaként, melyeket a magyarok honfoglaló bevonulásuk alkalmával az új hazában találtak, úgy emelkedik ki a sárga magyar pavillonok eme három piramisa zöld zsindelyfedlével, mely egyszersmind formája által a nomád sátrakra emlékeztet. A középső magasabb piramis, mely circa 60 méter magasságban, a kiállítás minden kupoláját és tornyát túlszárnyalva emelkedik fel, belsejében a magasbatörő fakonstrukciót áttörő színes üvegfestményei által bűvös világításban részesül. Az ó-magyar műemlékek a pavillonok díszítéseiben méltón ünneplik feltámadásukat. Mintaképpen a síremlékek ornamensei, az ország némely részében kiásott régi fegyverek díszítései, lószerszámok, bútorok és házi eszközök, épp úgy, mint a ruhaneműek, szőnyeg- és kincsmaradványok szolgáltak, anélkül azonban, hogy az élénk színgazdagság az egész alkotásnak nyugodtságát és művésziességét megzavarná; az a cél, hogy a keleti hangulat éressék, legteljesebb mértékben sikerült is."

„Münchener Neueste Nachrichten" (1911 július 14.). „Magyarország ezúttal is valami egészen eredetit alkotott. Amíg Ausztria talán kissé meggondolatlan takarékosságból meg sem jelent, Magyarország egyike volt a legelsőknek, akik pavillonjaikkal elkészültek. A magyaroknak nemzeti történetükre való büszkesége és önállósági törekvése, építészeiknek szinte előírták a Turinban követendő stílust. Megvetették ennélfogva a többi nemzet által nagyobbrészt követett architektónikus kiállítási vezető motivumokat és a keleti és szláv irányzatoknak merész keverékével, történelmi szimbolisztikus felfogással olyan épületet emeltek, melynek bizarr, de egyszersmind esztétikai eredetiségét letagadni nem lehet. A hazai ipar, lakberendezések, fa-, bőr-, fém- és keramiai ipar sok látnivalóval kedveskednek."

„Bolettino ufficiale del l'espozione internationale di Torino". „Így képzeltük Magyarországot, a tiszta Magyarországot nagyszerű stiljével, élénk színeivel; motivumaiban a hímzésekkel teljes arany-medaillonok között, amelyek kosztümjeit tükröztetik vissza, azzal a tisztán nemzeti tónussal, amely álomba ringat és elfelejteti velünk azonnal, hogy éppen most hagytuk el a valentinói fasorokat. Nem tudjuk, mit képzeljünk a melegen sárga épületekről. Három egekbe nyúló piramisa, négyszögű és nyugodt síkokból alkotott talapzatai, kissé mauzoleumszerűek, mintha a nagy emléket egy harcos nép építette volna egyik hősének emlékezetére. Egy nemzet ébredt fel ősi álmaiból, hogy bemutatkozzék ősi formáiban az ipar minden terén. Akik nem technikusok és nem is tudósok, meghatva állanak meg ezen egészséges és antik ízű művészet előtt és a kissé el is ábrándozó természet, amikor a nap sugara reá esik az elhalványodó, aranyos folyóra, az immár sötétszínű fákra és utolsó sugarait gyújtja fel a csúcsokon, szeretné, ha ráborulna az este ezen fantasztikus épület árnyékában, hogy meghallgathassa egy rapszódiának énekét, egy leányajak epekedő akkordjait."

„Berliner Börsen-Courier" (május első felében). „A magyar pavillonok a kiállítás valóságos „clou"-ja, melyek architektúráját a kiállítási modern építészet és díszítés műremekének kell mondanunk. Az irigységnek el kell némulnia a magyarokkal szemben, mert fején találták a szöget! A két pavillon, mint minden magyar művészet, erősen keleties ízű s emlékeztet Magyarország némely régi műemlékére. A stílus teljesen egységes és még a virágcserepek lacövekeiben is megnyilatkozik. Ritkán láttam még a legkisebb részletéig is ennyire átgondolt és a legrejtettebb szögletben is megnyilatkozó szép építkezést. Akinek pedig öröme telik a színekben, az a magyar csoportból teljes kielégüléssel távozhatik. Két hipermodern és mégis ősklasszikus jellegű vízmedencéi körül fennakad a közönség zöme; egyöntetű az a meggyőződés, hogy e medencék a látnivalók legérdekesebbjei közé fognak tartozni. A többi nemzet e „clou"-t aligha fogja felülmulhatni. A német vízmedencét is láttam már Turinban; ez az alkotás szintén igen monumentális. Szépnek azonban, szemet és szívet elragadónak csak a magyar művészi medencék mondhatók. Nincs bennük semmi ami merev, ami kihívó volna; harmónikusan illenek a kutak üdítő vízcsobogásukkal a magyar épülethez. Magyarország büszke lehet e kiváló turini alkotásra, amely mellett a többi nemzet palotái valóban csak sablonos hatást keltenek."

Figure 34: A turini világkiállítás magyar háza

According to mythology, these three pyramids of yellow Hungarian pavilions stand out with their green shroud, which at the same time create the nomadic emblem, as a symbol of the three highest mountains reminiscent of tents, just as the three mounds do in the Hungarian coat of arms. The taller pyramid in the middle, which rises at an altitude of about 60 meters, surpassing all the domes and towers of the exhibition, is enchanted by its colorful glass paintings that break through the high-rise wooden structure ("A turini világkiállítás magyar háza," 1911).

Figure 35: Three pyramids colorized (Author)

Bridging the Gap: A Comprehensive Approach to the Reconstruction of the Pavilion of Hungary

In the case of the Pavilion of Hungary, the archival search has yielded a limited number of drawings, leaving significant gaps in the available visual material. However, the remarkable find of a substantial collection of technical drawings, notable for their comprehensive metric content and meticulous attention to detail, provides a compelling basis for initiating a 3D modeling endeavor, utilizing the original drawings as a fundamental reference point. Nevertheless, it is crucial to recognize that discrepancies between the data sources may emerge as the project progresses. It is important to note that the technical documentation primarily represents the project phase, outlining the intended design and specifications. As a result, variations between the designed structure and the actual built form are likely to manifest, which can be discerned through the examination of historical images. The utilization of such visual evidence becomes invaluable in identifying deviations and bridging the gaps between the intended vision and the physical realization of the Pavilion. By meticulously considering these discrepancies and employing a comprehensive approach that integrates both the technical documentation and historical imagery, the project can strive for a more accurate and faithful reconstruction of the Pavilion of Hungary.

The findings derived from the extensive research on historical data have exerted a profound influence on the entirety of the project, prompting the development of a comprehensive combined workflow that harnesses the strengths of both technical drawings and images. This meticulously crafted approach encompasses multiple stages, each tailored to fulfill specific objectives, ensuring a robust and accurate reconstruction process.

Gathering and examining data

In the initial stage of the research process, the focus is on gathering and examining data from various historical sources. This crucial step involves thoroughly collecting and analyzing diverse information to establish a strong knowledge foundation and gain valuable insights. Following data collection, a significant task involves comparing both images and drawings, as they often lack detailed descriptions such as annotation reporting data or project/survey drawings that specify the represented buildings or portions. Consequently, it becomes necessary to integrate different visual documentation to comprehend the content and verify the as-built composition of the architecture. For instance, in the case of the Pavilion of Hungary, a change in the design of the towers and ledges is noticeable in two different drawings at varying scales, with the image confirming the configuration depicted in the 1:100 scale drawing, further supported by a meticulous and reliable sketch. This meticulous observation enables the operator to select the most reliable drawings for consideration. Subsequently, data analysis and the digitization process of delicate XX-century drawings become crucial factors influencing the final metric quality of the 3D models.

In the initial stage of the project, a meticulous analysis of the maps, with a special focus on the ground floor map, unveiled a notable absence of details concerning changes in the height code and the existence of staircases in different sections of the building. This discovery was particularly striking when comparing it to the surrounding area of Valentino Park, which exhibited a significant topographical variation. The discrepancy became evident through a comprehensive examination of photographs taken from various vantage points of the building.

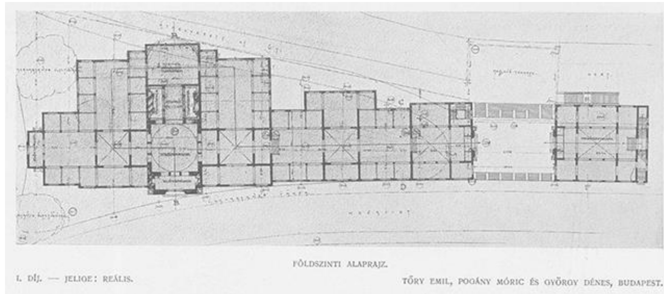


Figure 36: First floor, https://italyworldsfairs.org/mainpage.html

Of particular interest was the journey of a visitor entering from the northeast through the main entrance and progressing towards the northwest. This trajectory provided a clear visual representation of the height fluctuations within the structure. Similarly, when observing the south-facing view of the building along the riverbank, a discernible difference in elevation could be observed. It was perplexing, however, that these distinct variations in height were not accounted for in the provided maps.

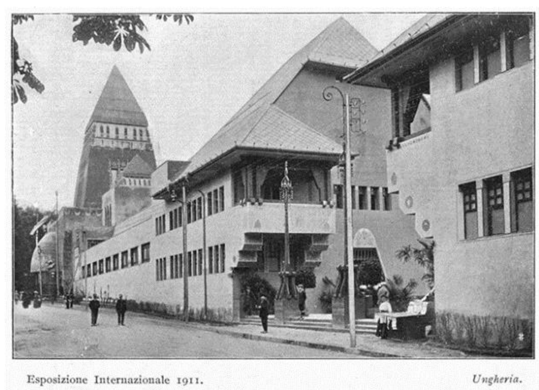


Figure 37: The northwest view of the pavilion, https://italyworldsfairs.org/mainpage.html

Figure 38: The southwest view of the pavilion, https://italyworldsfairs.org/mainpage.html

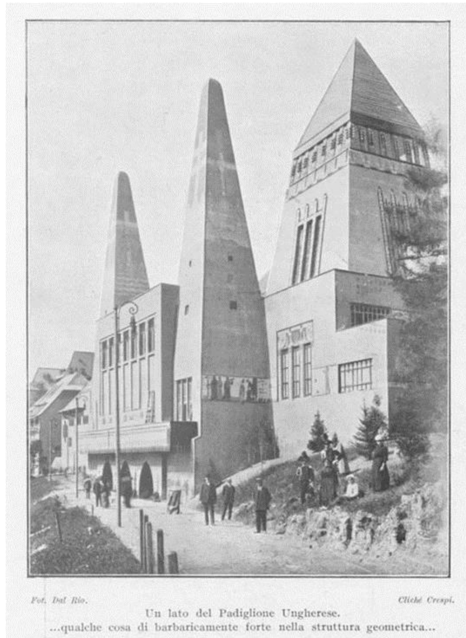


Figure 39: The southeast view of the pavilion, https://italyworldsfairs.org/mainpage.html

Moreover, During the process of creating 2D digital representations with pictures and drawings in AutoCAD, several challenges arose when attempting to find the exact and accurate dimensions of details in photos and compare them with the correct dimensions. One of the main problems encountered was the issue of image quality. In some cases, the photos used for reference had low resolution, blurriness, or distortions, making it difficult to determine precise dimensions. To overcome this, efforts were made to obtain higher-quality images whenever possible.

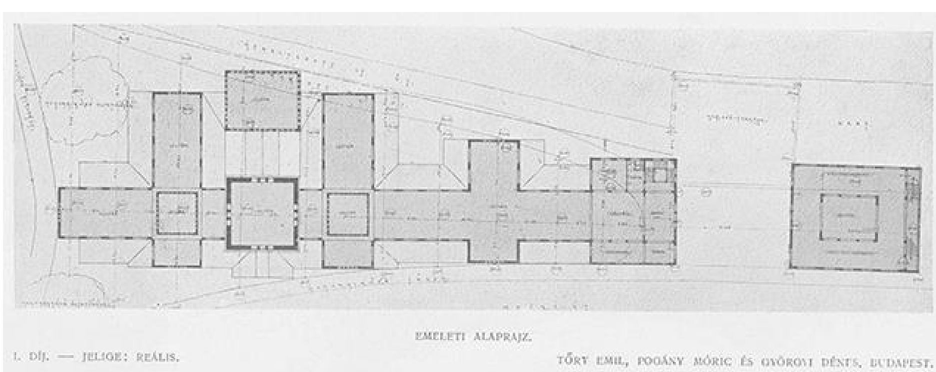


Figure 40: The second floor of the Pavilion with low quality and as only source, https://italyworldsfairs.org/mainpage.html

Transforming black and white drawings and photographs into colorized format

The colorization process was facilitated by selecting a reputable colorizing website that utilized AI algorithms trained on extensive datasets. Notably, platforms such as "https://hotpot.ai/colorize-picture" and "https://www.img2go.com/colorize-image" were stood out for their user-friendly interfaces, which simplified the colorization process for users of varying technical levels. Users were guided through the steps of uploading and initiating the colorization, ensuring a smooth and seamless experience.

To achieve accurate and visually appealing colorizations, advanced AI algorithms were specifically trained for colorization. Extensive training was undergone by these algorithms on datasets containing both colored and black and white images, enabling them to learn patterns, textures, and color relationships. This expertise resulted in the generation of plausible colorizations that remained faithful to the original context.

Efficiency was also prioritized in the platforms that were recommended. Leveraging cloud-based infrastructure and optimized algorithms, these websites delivered prompt execution of the colorization process, minimizing waiting times and providing quick results.

In addition to facilitating the overall process, guidance was provided on customization and refinement options. Users were able to adjust parameters such as color intensity, saturation, and apply filters to achieve their desired outcomes. It was crucial to strike a balance between historical accuracy and artistic interpretation, ensuring that the colorized images aligned with the user's preferences.

Throughout the process, the recognition of inherent limitations in the colorization process was emphasized. Once the AI algorithms processed the image, users were presented with a preview of the colorized version. The importance of approaching these images as interpretations rather than absolute representations of historical reality was stressed, considering the algorithms' inability to fully replicate the original photographer or artist's intentions.

Finally, users had the opportunity to download the colorized images for preservation or share them with others. By doing so, these transformed images served as valuable visual aids in historical research, contributing to a deeper understanding of the past and engaging a broader audience.

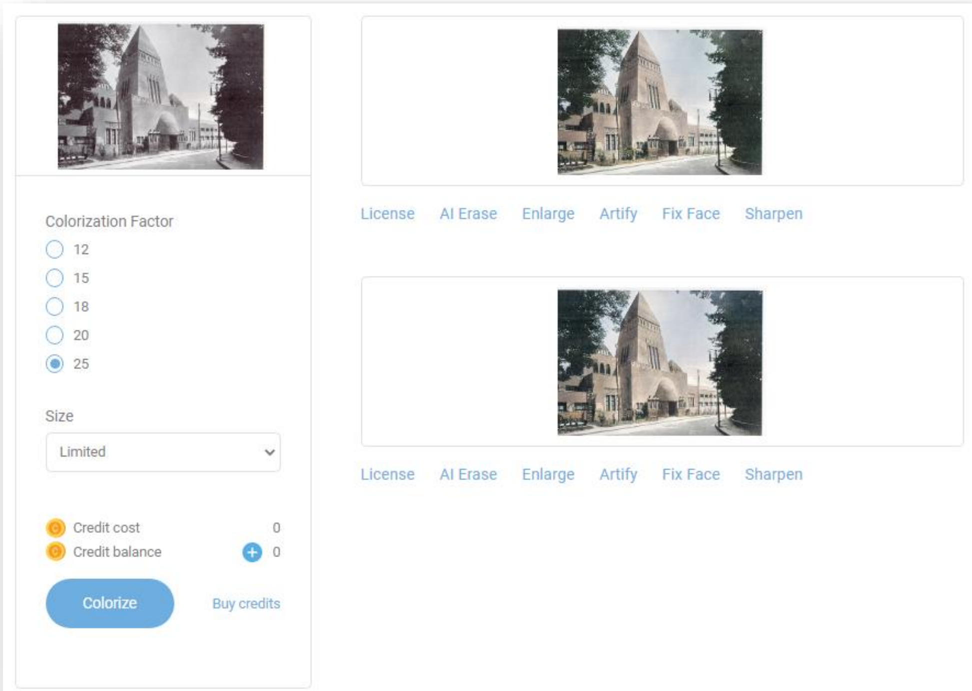


Figure 41: The process of colorize black and white pictures which it has different factors for changing the quality, https://hotpot.ai/colorize-picture

Figure 42: Black and white picture of the exterior view of the pavilion, https://italyworldsfairs.org/mainpage.html

Figure 43: Colorization picture of the exterior view of the pavilion, https://hotpot.ai/colorize-picture

Figure 44: Black and white picture of the interior view of the pavilion, https://italyworldsfairs.org/mainpage.html

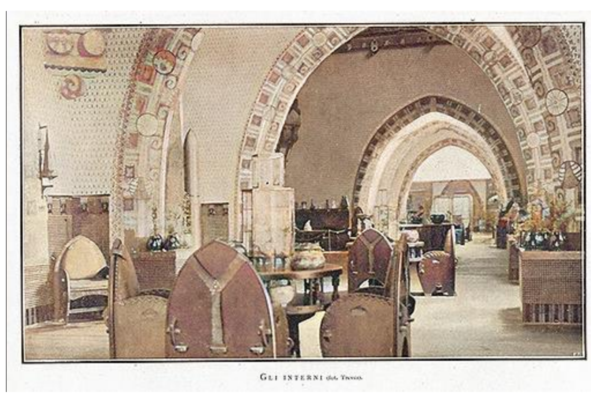


Figure 45: Colorization picture of the interior view of the pavilion, https://www.img2go.com/colorize-image

Creating 2D digital representations and verifying technical drawings

The process of creating two-dimensional digital representations and confirming technical drawings with images and drawings in AutoCAD was conducted as follows:

The data was imported into AutoCAD software, where the technical drawings and images were scanned or converted into digital format and imported for further analysis and manipulation. Each detail and element present in the physical drawings and images was manually redrawn in the software using AutoCAD, resulting in accurate two-dimensional digital representations.

To ensure accuracy, dimensions and annotations were added to the digital representations, involving precise measurement and labeling to provide necessary information for future reference. The digital representations were verified by comparing them with the original images and technical drawings. By overlaying the digital representations onto the images and drawings, discrepancies or inconsistencies were analyzed and assessed, ensuring accuracy and fidelity.

Findings and observations from the verification process were carefully documented, noting any variations or deviations between the digital representations and the original sources. This documentation served as valuable evidence of accuracy and reliability. Throughout the research, a strong emphasis was placed on maintaining the integrity and fidelity of the original drawings and images, involving meticulous attention to detail and precise measurements to ensure an accurate representation of the data.

In conclusion, the process of creating two-dimensional digital representations and confirming technical drawings with images and drawings in AutoCAD followed a thorough and systematic approach. Through careful data collection, digitization, verification, and documentation, accurate and reliable digital representations were created, serving as valuable references for further analysis and research.

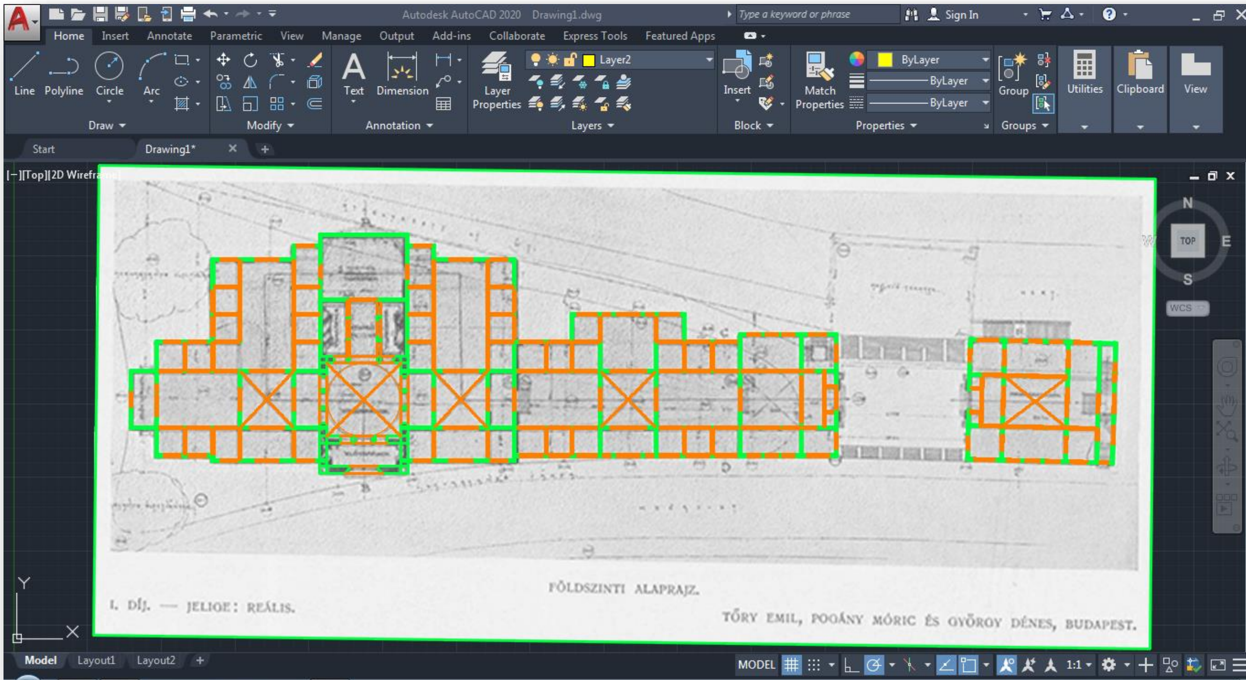


Figure 46: The process of producing 2D Map (Author)

Creating 3D Models from Pictures and 2D Plans in AutoCAD

The process of producing 3D modeling in AutoCAD based on pictures and 2D plans began with the reference materials being imported into the software. This involved the insertion of pictures and plans as backgrounds or the attachment of external files to the drawing. The purpose of this importation was to provide a visual guide and ensure accuracy in the modeling process.

Once the reference materials were imported, the workspace in AutoCAD for 3D modeling was set up. This included the configuration of units to match the scale of the reference materials and the adjustment of viewports to accommodate the 3D modeling environment.

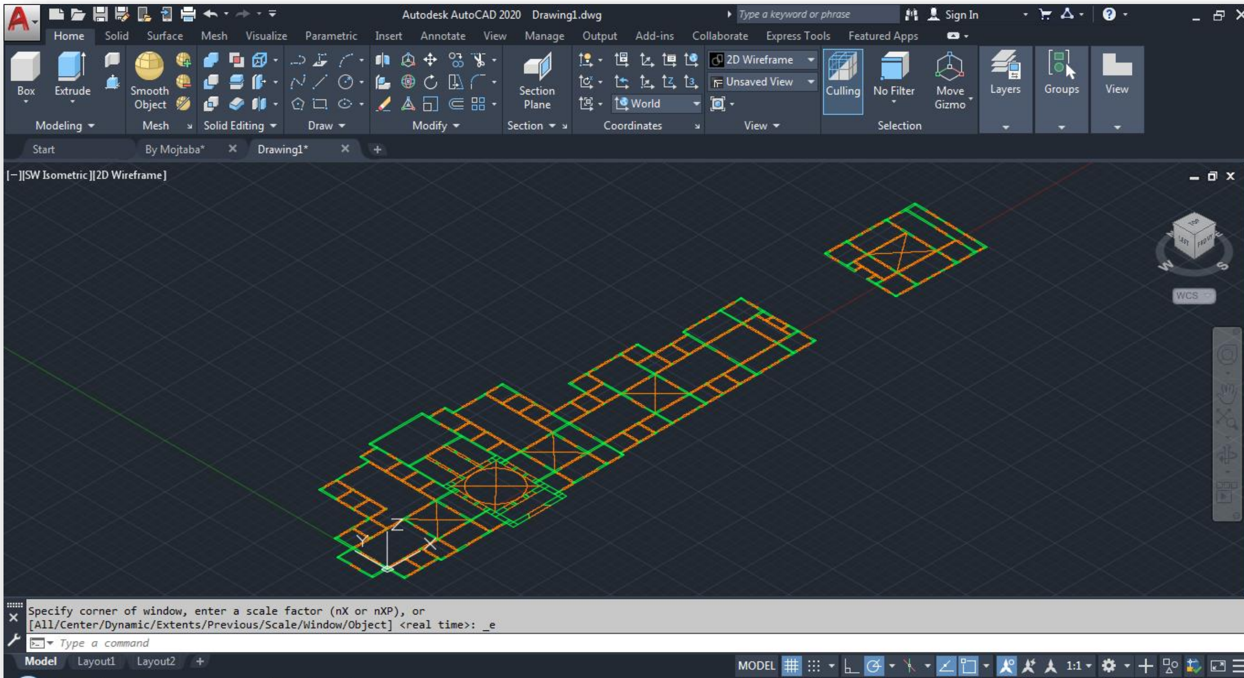


Figure 47: The first step of 3D modeling in AutoCAD by converting the program and features with 3D model (Author)

With the workspace prepared, the modeling process was initiated by creating basic 3D shapes in AutoCAD. These shapes served as placeholders for the main components of the model. Starting points included common geometric shapes such as cubes, spheres, cylinders, or cones. The sizes and proportions of these shapes were determined based on the dimensions specified in the reference materials.
The next step involved the positioning and scaling of the basic shapes. The goal was to align the shapes with the corresponding features in the pictures and 2D plans. Accurate placement and proportionality of the 3D model were achieved through careful observation and adjustment. Constraints and relationships could be applied to maintain the intended dimensions and proportions during modifications.
Following the positioning of the basic shapes, the modeling process continued with extruding and modifying. AutoCAD provided tools for extruding 2D profiles to create 3D objects. By extending the shapes along specific directions, solid bodies were formed. This step added depth and volume to the model, transforming it from a flat representation to a three-dimensional structure.

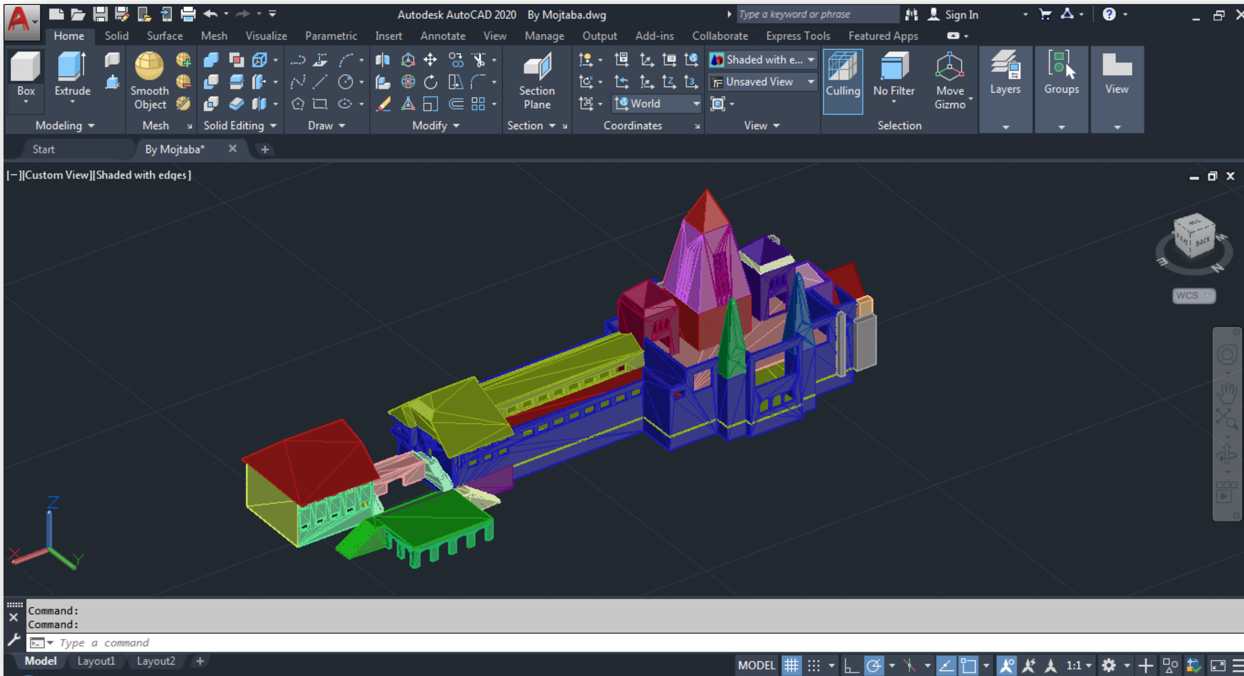


Figure 48: The second step by making the fundamental model of the Pavilion (Author)

The refinement of the model was an iterative process that involved making adjustments to the overall proportions, angles, and positioning of the components. This step aimed to achieve a preliminary representation of the object or structure. While intricate details were lacking at this stage, the model provided a foundation for further development and refinement in subsequent stages of the modeling process.

Once the basic 3D model was complete, it could be saved and exported in a suitable format. AutoCAD allowed users to save the file and export it for further refinement or use in other software. At this point, the model served as a starting point for adding finer details, textures, and other elements to create a more realistic and detailed representation.

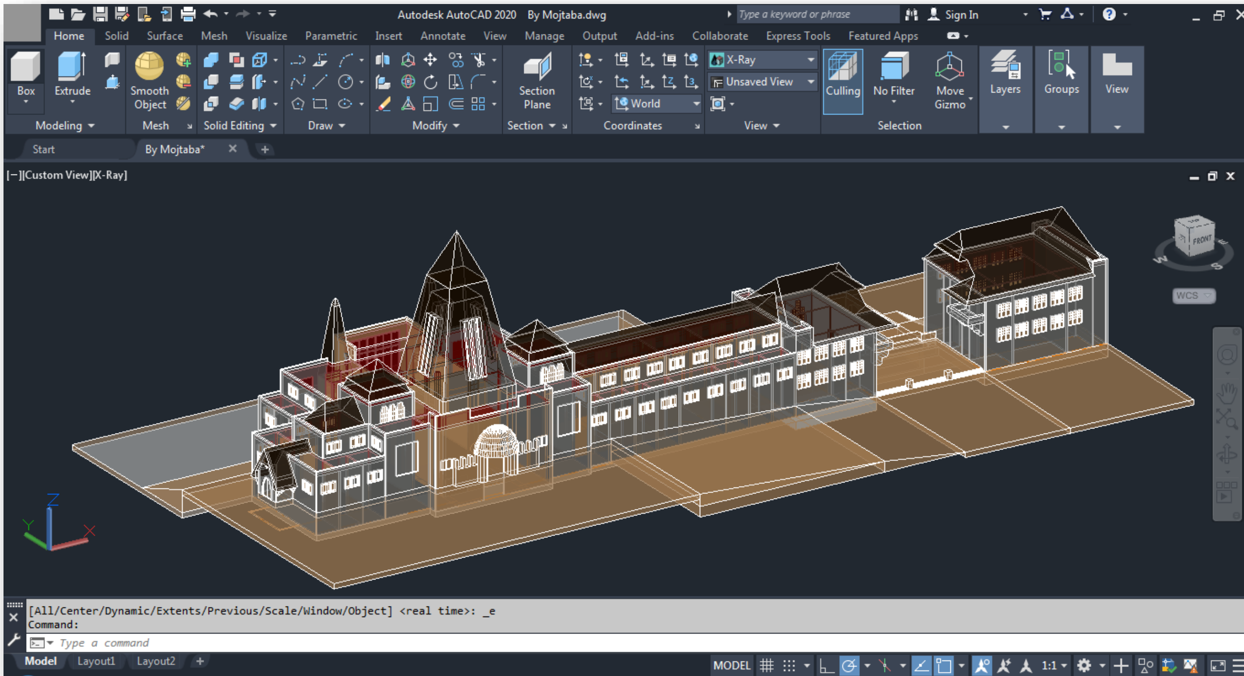


Figure 49: The final step of production in AutoCAD (North View) (Author)

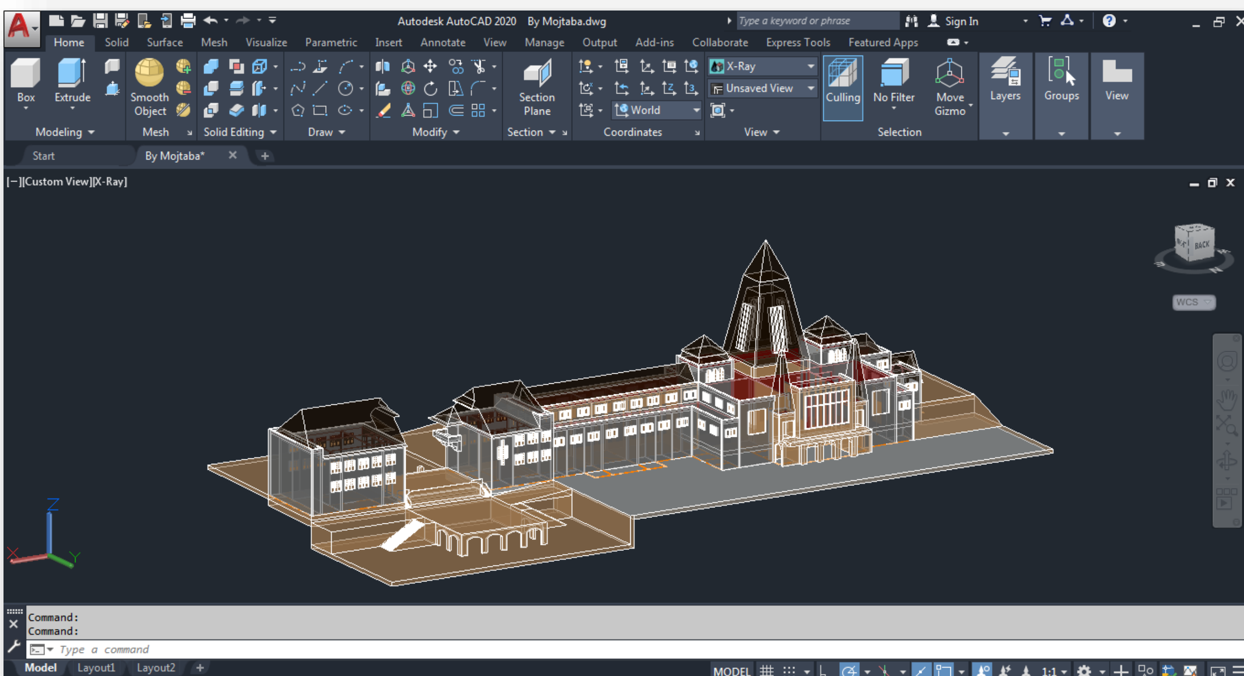


Figure 50: The final step of production in AutoCAD (South View) (Author)

In summary, the process of producing 3D modeling in AutoCAD based on pictures and 2D plans involved the importation of reference materials, the setup of the workspace, the creation of basic shapes, the positioning and scaling of the shapes, the extrusion and modification of the shapes, the refinement of the model, and finally the saving and exporting of the 3D model. The focus of the initial stages was on creating the basic structure without intricate details, laying a solid foundation for further development and enhancement of the 3D model.

Enhancing 3D Models with Detailed Realism: Importing and Refining in 3Ds Max Studio

The complexly detailed 3D model, initially created in AutoCAD with base models lacking in detail, underwent a process of improvement by being imported into 3Ds Max Studio. This step allowed the utilization of advanced features and a more powerful toolset to modify and add fine details to the model. By importing the model into 3Ds Max Studio, a more comprehensive and realistic representation could be achieved by combining visual elements from images, posters, and colors.
Upon importing the model into 3Ds Max Studio, the analysis of reference materials such as images, posters, and colors was undertaken to identify specific details that needed to be added. This involved the study of textures, colors, patterns, and other visual features found in the reference materials. The incorporation of these details played a decisive role in achieving a high level of realism and accuracy in the final model.

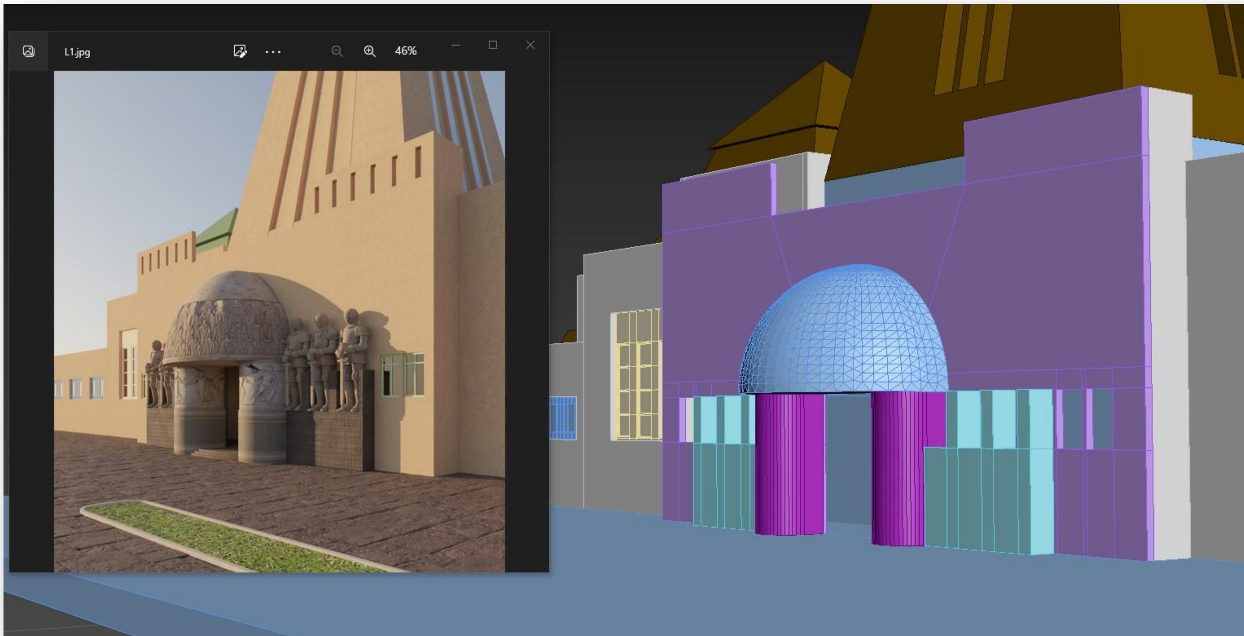


Figure 51: Starting with the main entrance and improving the primary model with realistic detail with inspiration from the documentary data (Author)

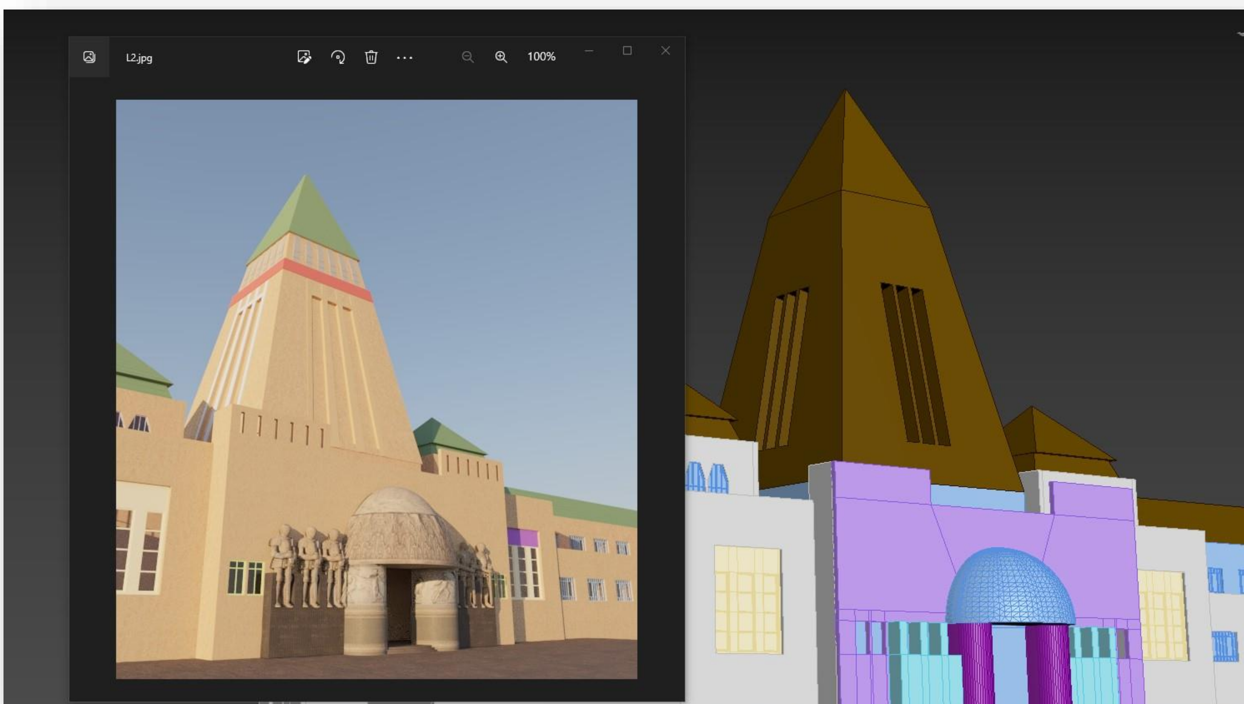


Figure 52: Continuing the process with the input side volumes like a pyramid (Author)

Subsequently, the various tools and features provided by 3Ds Max Studio were utilized to add the desired details. This entailed sculpting or manipulating the model geometry to accurately recreate complex shapes, textures, and lines. Advanced techniques such as bump mapping, displacement mapping, and normal mapping were employed to create realistic surface details, including wrinkles, ridges, and fine textures. These techniques contributed to simulating light interactions, thereby creating depth and realism in the model.

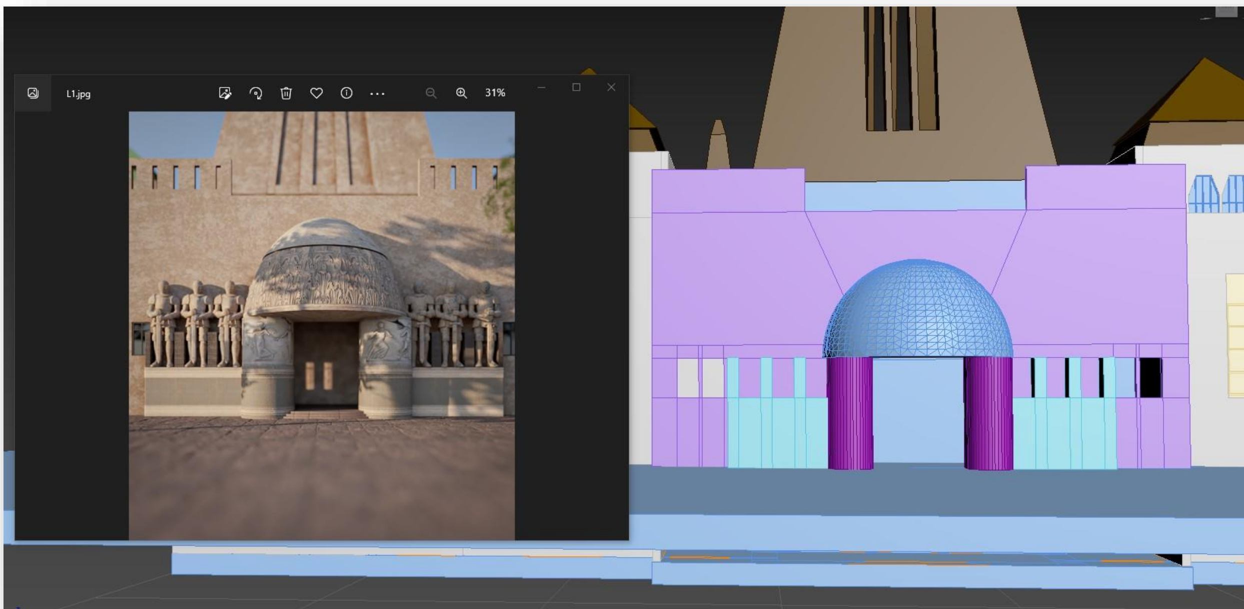


Figure 53:: Testing material according to the documentary data and the shape of the objects (Author)

The process also involved the combination of material properties and shaders to enhance the visual appearance of the model. Different materials were applied to different parts of the model, replicating the real-world properties of the displayed objects. This encompassed the addition of reflective surfaces, transparency, and other material properties that enhanced the realism and overall accuracy of the model.

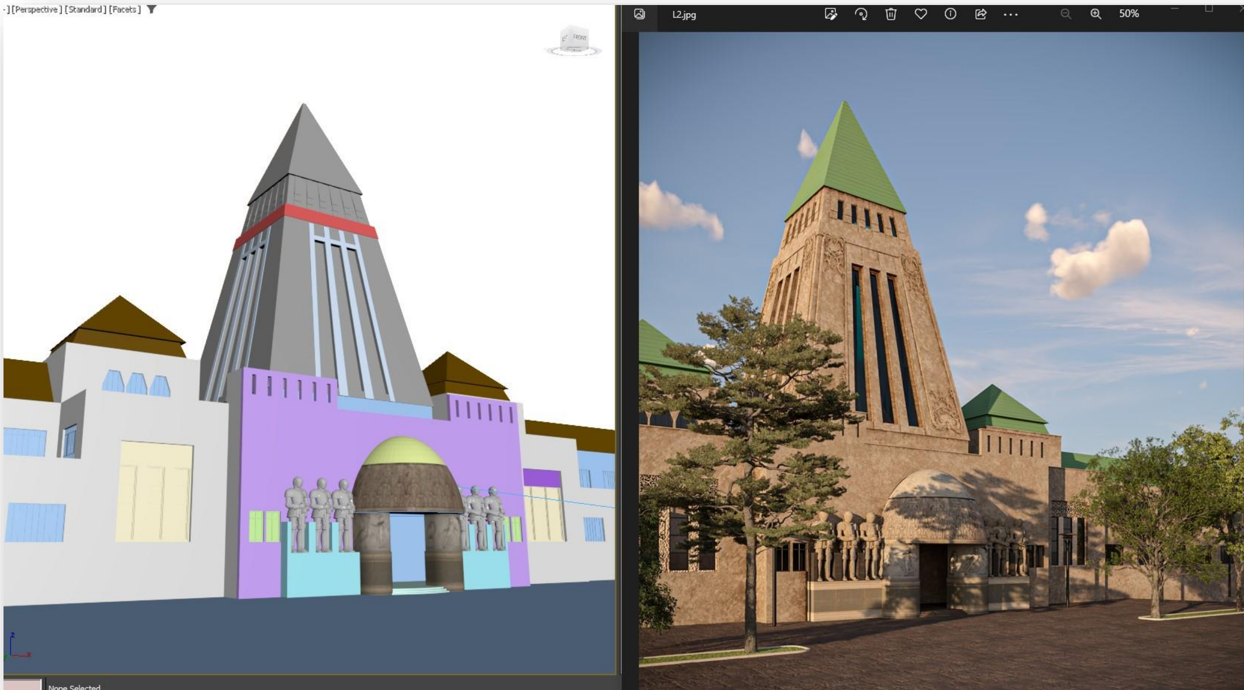
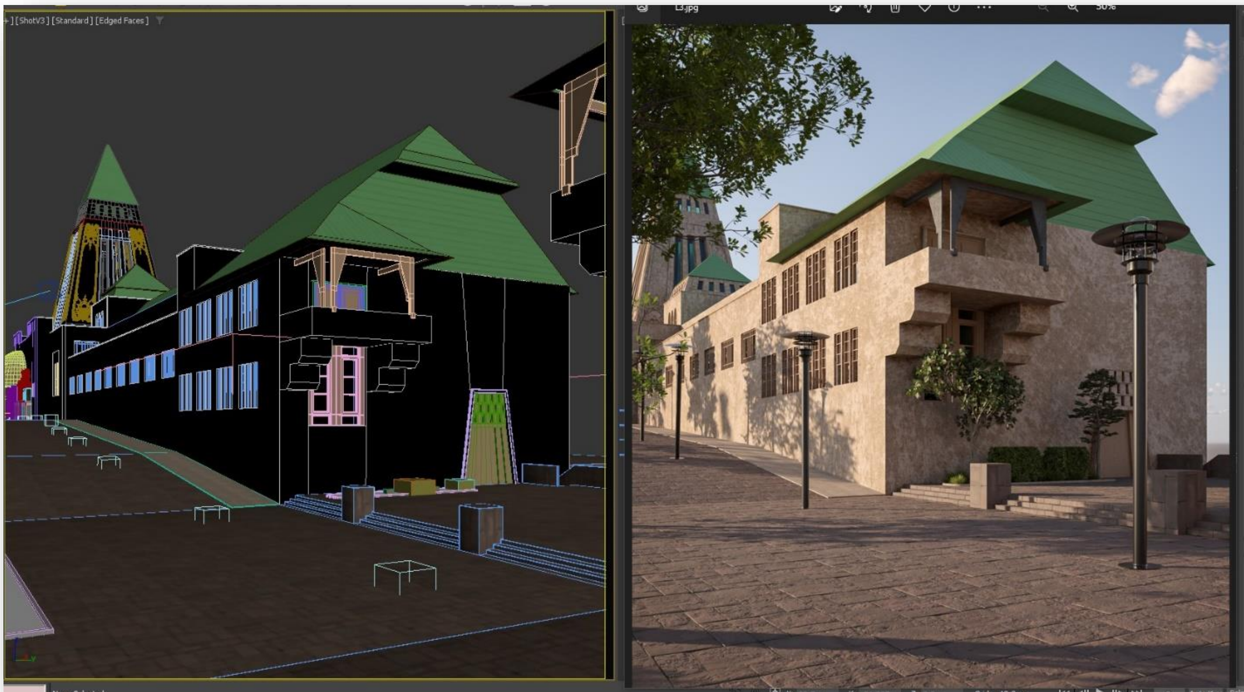


Figure 54: Making the model realistic by importing materials and carved motifs (Author)

Throughout the process, constant evaluation and comparison with reference materials, including texts and colorized images, were necessary to ensure that the added details corresponded to the desired level of accuracy. Iterative corrections and adjustments were made to fine-tune the model and achieve the desired level of realism and accuracy.

In conclusion, the process of improving a 3D model with detailed elements involves the importation of the base model from AutoCAD into 3Ds Max Studio, the study of reference materials, and the utilization of advanced tools and techniques to add complex details. By combining elements from images, posters, and colors, the model can attain a higher level of realism, accuracy, and visual appeal.



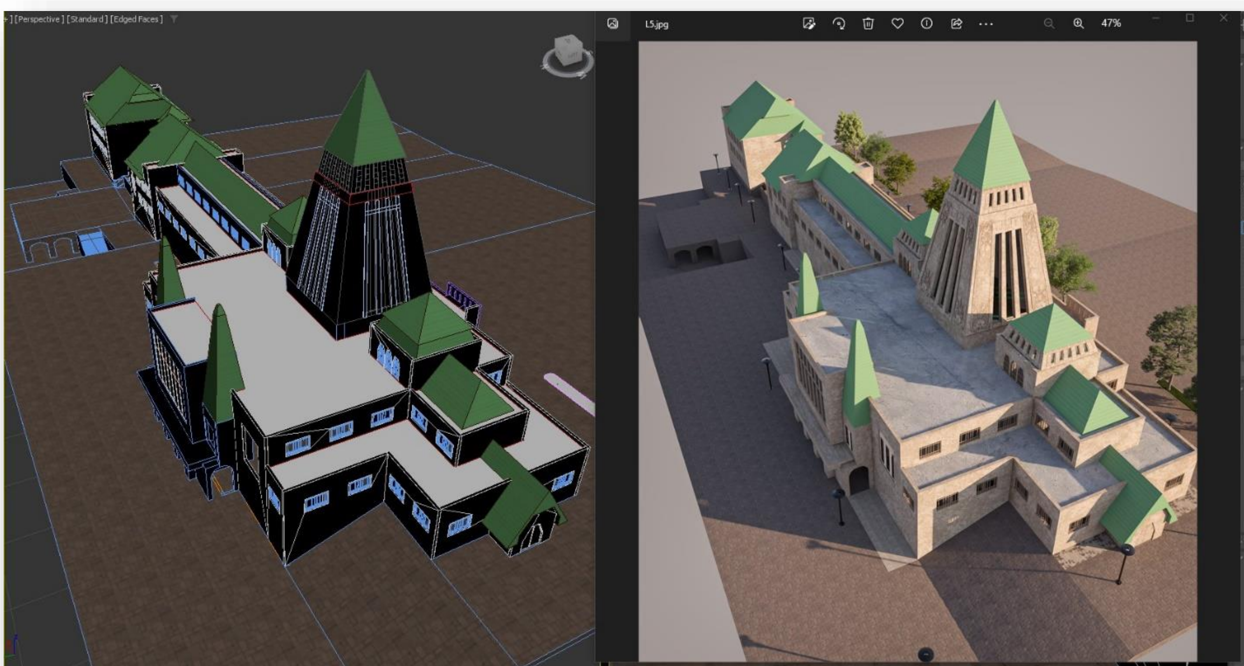


Figure 55: Performing similar operations for other external parts of the building (Author)

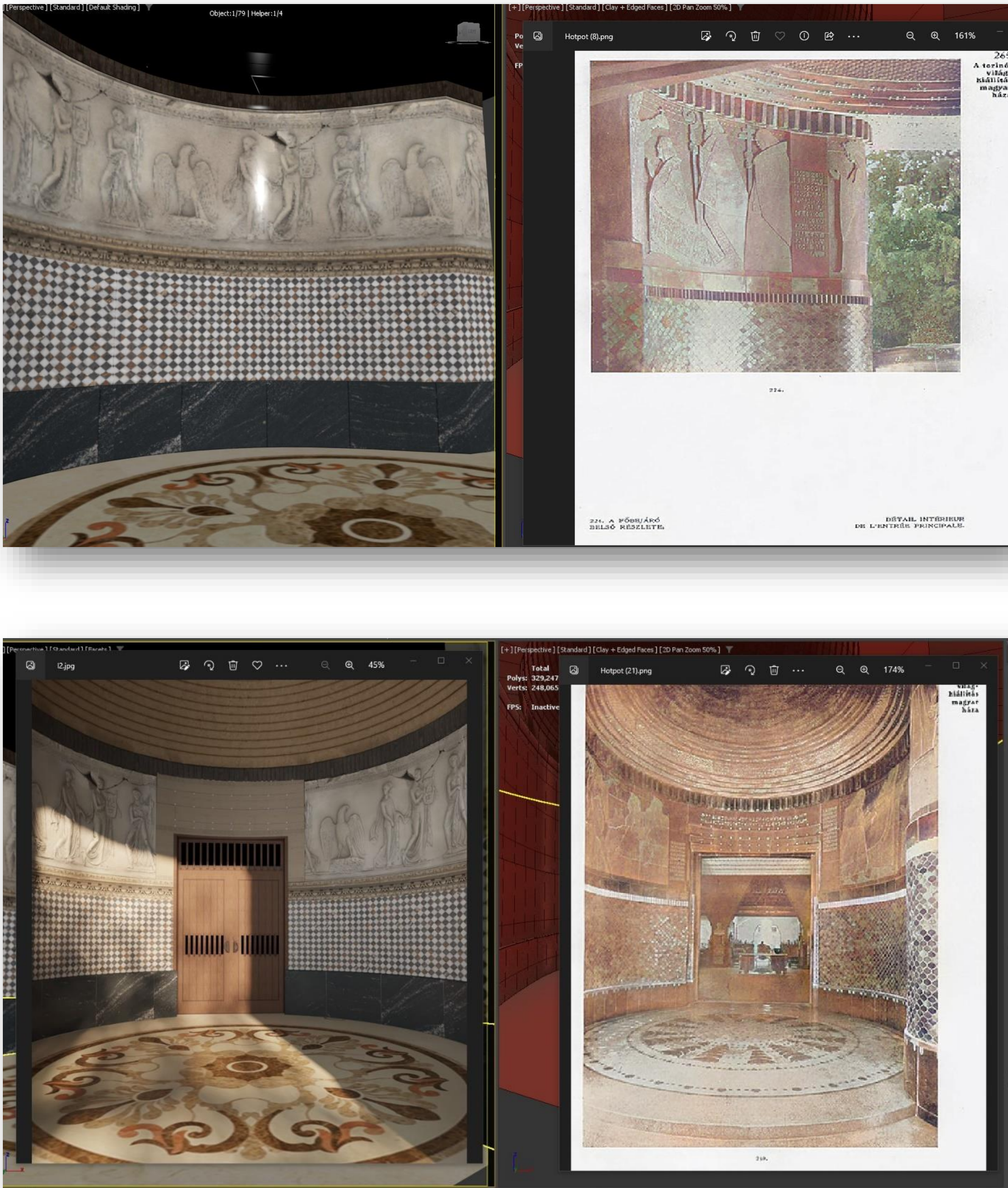


Figure 56: Modeling internal parts of the entrance like external parts based on historical images (Author)

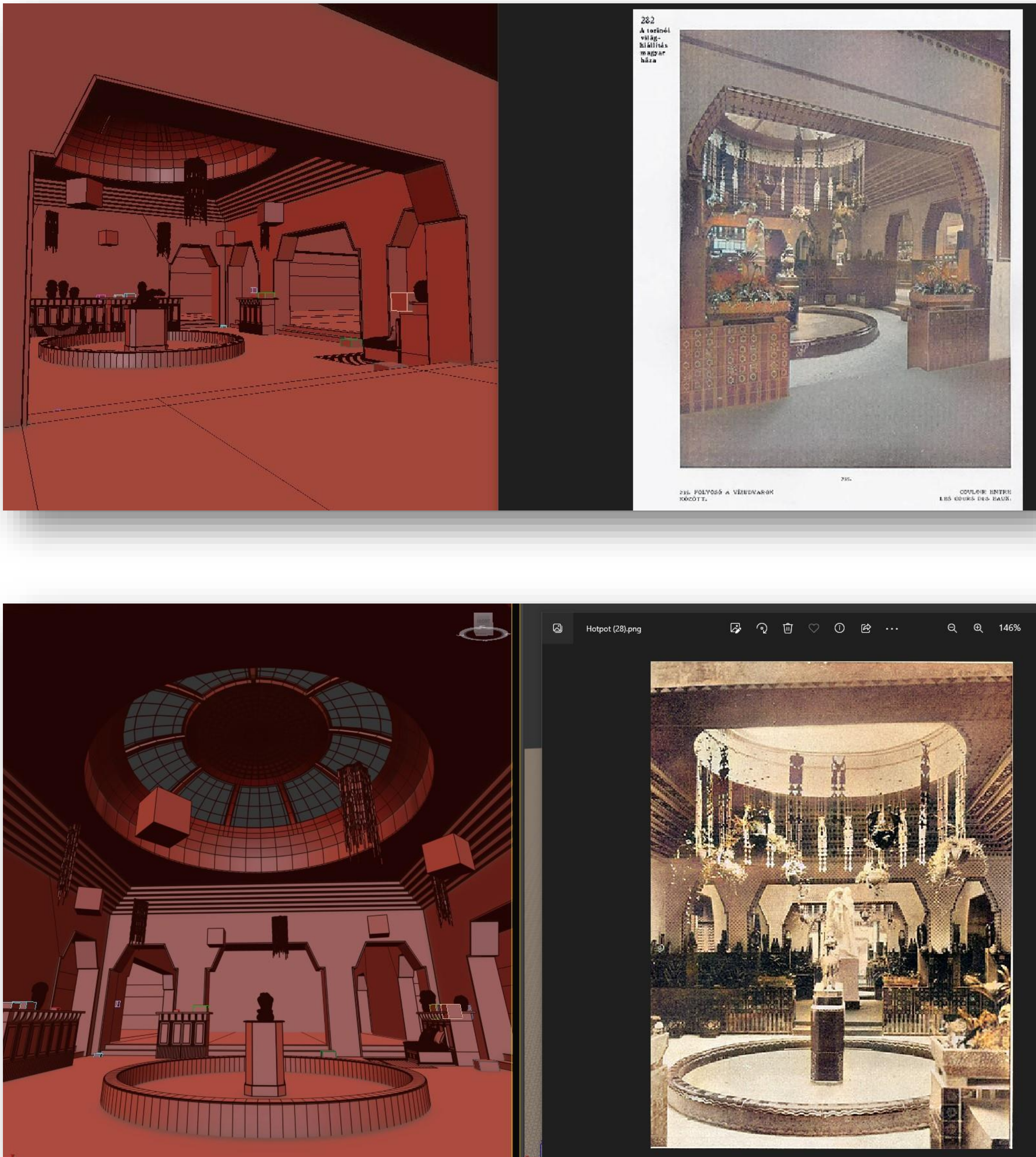


Figure 57: Modeling the main hall with fountain and pool like external parts based on historical images (Author)

Transforming 3D Models: The Art of Visualizing Realism

The visualization of 3D models is a crucial aspect of architectural and design projects, as it enables professionals to present their concepts and ideas in a visually stunning and realistic manner. This comprehensive process involves creating and rendering detailed models to showcase architectural beauty and engage viewers in immersive experiences.

One of the key benefits of utilizing tools like 3Ds Max Studio and V-Ray in the rendering process is the ability to achieve highly realistic and visually appealing presentations. These software applications offer advanced rendering techniques that simulate the behavior of light, materials, and textures, resulting in lifelike representations of architectural structures. By accurately capturing the interplay of light and shadow, as well as the intricate details of materials and textures, these rendering tools create visuals that closely resemble the final built environment.

Moreover, adjusting lighting and camera settings during the rendering process plays a vital role in enhancing the overall visual impact of the 3D models. By strategically placing virtual lights and fine-tuning their properties, designers can emphasize specific architectural features, create desired atmospheres, and highlight focal points within the scene. Additionally, camera settings, such as field of view and composition, contribute to the storytelling aspect of the visualization, guiding the viewer's attention and conveying the intended narrative of the design.

By incorporating these advanced rendering techniques, adjusting lighting and camera settings, and applying post-production enhancements, the visualization of 3D models becomes a powerful tool for architectural and design professionals. It not only allows them to communicate their ideas effectively but also enables clients, stakeholders, and the general public to fully comprehend and appreciate the envisioned spaces. These visually stunning and realistic presentations facilitate better decision-making, inspire confidence in the design proposals, and create a strong emotional connection with the audience. Ultimately, the visualization process enhances the overall design experience and contributes to the successful realization of architectural projects.

The Rendering and Post-Production Process for Creating a Realistic and Captivating Presentation of the Pavilion of Hungary's Exterior

The process of rendering the model of the Pavilion of Hungary as the exterior part, which was modeled in 3Ds Max Studio and rendered through V-Ray, involved several steps to achieve a visually stunning and realistic presentation. Additionally, post-production techniques using software like Photoshop further enhanced the picture with JPG format as the final presentation.

To begin, the model of the Pavilion of Hungary was meticulously created in 3Ds Max Studio, incorporating the architectural details, materials, textures, and lighting that accurately represented the real structure. This involved modeling the pavilion's exterior walls, roofs, windows, doors, and any other architectural elements unique to the design. Once the model was complete, the rendering process began using V-Ray, a powerful rendering engine. The renderer calculated how light interacted with the model's surfaces, creating soft shadows, reflections, and ambient occlusion, which contributed to the final visual quality.

During the rendering process, various parameters were fine-tuned to achieve the desired result. These included adjusting the camera settings on the 3Ds max Studio, such as focal length and depth of field, to create a compelling composition. Additionally, lighting parameters, such as the position, intensity, and color temperature of light sources, were adjusted to create the desired mood and atmosphere. Furthermore, additional elements could be added to the image to enhance its visual impact. This may have included adding people, vegetation, vehicles, or other contextual elements to provide a sense of scale and liveliness to the scene. These elements could have been sourced from stock images or created digitally to seamlessly integrate into the final composition.

Finally, post-production involved fine-tuning the composition and adding visual effects or filters to enhance the overall presentation. This may have included adding depth of field effects, vignetting, or subtle lens flares to create a more cinematic and immersive atmosphere. The result of the rendering and post-production process was a visually stunning and realistic representation of the Pavilion of Hungary's exterior. The final image showcased the architectural details, materials, and lighting in a visually appealing and engaging manner. This presentation could have been used for various purposes, such as marketing materials, architectural visualizations, or presentations to clients or stakeholders.

In summary, the process of rendering the model of the Pavilion of Hungary as the exterior part involved creating a detailed 3D model in 3Ds Max Studio, rendering it through V-Ray to achieve realistic lighting and materials, and applying post-production techniques using software like Photoshop to enhance the final presentation. This comprehensive process resulted in a visually stunning and immersive representation of the Pavilion of Hungary, showcasing its architectural beauty and capturing the attention of viewers.

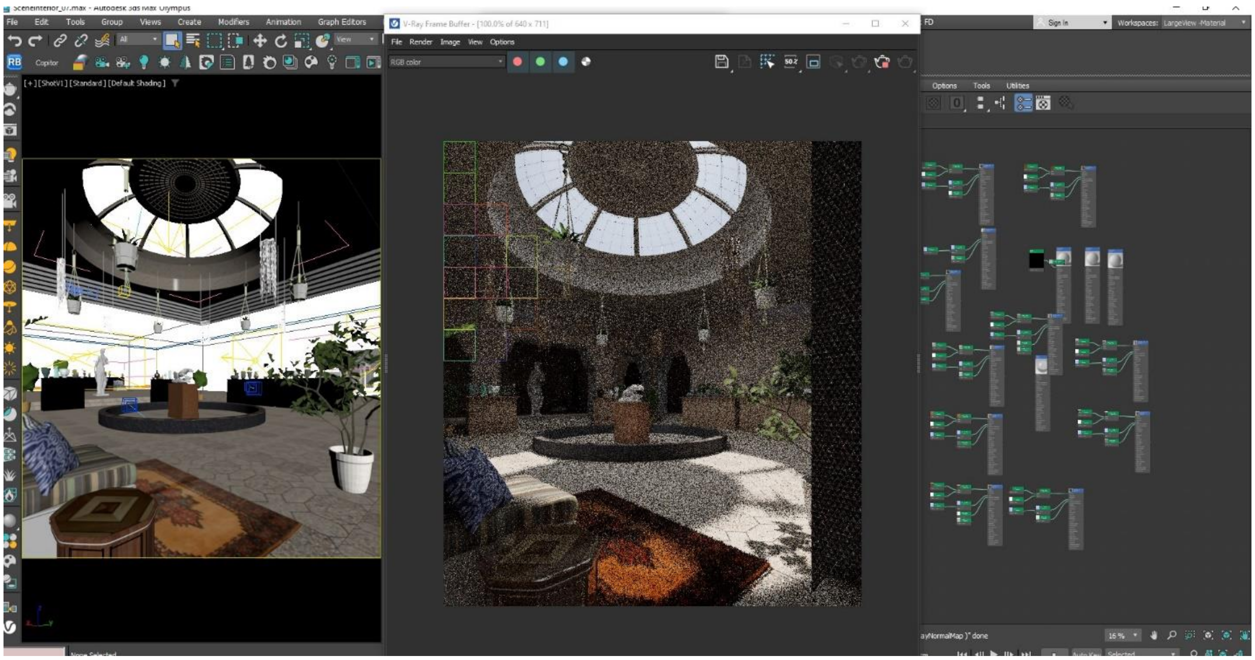


Figure 58: Rendering process from the interior part by the 3Ds max studio and V-ray (Author)

Creating an Immersive and Interactive AR Experience: Rendering the Main Hall of the Pavilion of Hungary for 360-Degree Augmented Reality on Smartphones

In the process of creating an immersive and interactive augmented reality (AR) experience, the main hall of the Pavilion of Hungary was rendered using 3Ds Max software. This rendering aimed to provide a 360-degree AR experience on smartphones, allowing users to explore and interact with the virtual representation of the main hall.

To begin, the 3D model of the main hall was meticulously created in 3Ds Max. This involved modeling the architectural elements, interior details, textures, and lighting that accurately represented the real structure. The dimensions and proportions of the main hall were carefully considered to ensure an accurate and realistic virtual representation.

Once the model was complete, the rendering process in 3Ds Max commenced. Advanced rendering techniques were employed to achieve realistic lighting, materials, and textures. Global illumination and accurate light sources were applied to create realistic shadows, reflections, and ambient lighting within the virtual environment. These techniques were crucial in establishing a sense of realism and immersion in the AR experience. After the initial rendering, additional post-processing effects were applied to enhance the visual quality and realism of the main hall. This included adjusting the color balance, contrast, and saturation to create a visually appealing and vibrant environment. Additionally, effects such as depth of field, motion blur, and lens flares were added to further enhance the immersive nature of the AR experience. Furthermore, interactive elements were integrated into the AR experience. This involved adding interactive hotspots or markers within the virtual main hall, allowing users to tap or interact with specific objects or areas to trigger additional information or interactive features. These interactive elements added depth and engagement to the AR experience, providing users with a more interactive and immersive exploration of the Pavilion of Hungary's main hall.

Once the rendering and interactive elements were finalized, the 3Ds Max software allowed for the export of the AR-ready content. This content could then be integrated into AR applications or platforms that support 360-degree AR experiences, allowing users to download the app, scan a marker or trigger, and access the immersive AR experience of the Pavilion of Hungary's main hall on their smartphones.

In summary, the process of creating an immersive and interactive AR experience involved rendering the main hall of the Pavilion of Hungary using 3Ds Max software. Through meticulous modeling, realistic rendering techniques, post-processing effects, and the integration of interactive elements, a visually stunning and engaging AR experience was crafted. This allowed users to explore and interact with the virtual representation of the main hall, providing an immersive and interactive glimpse into the architectural beauty of the Pavilion of Hungary.

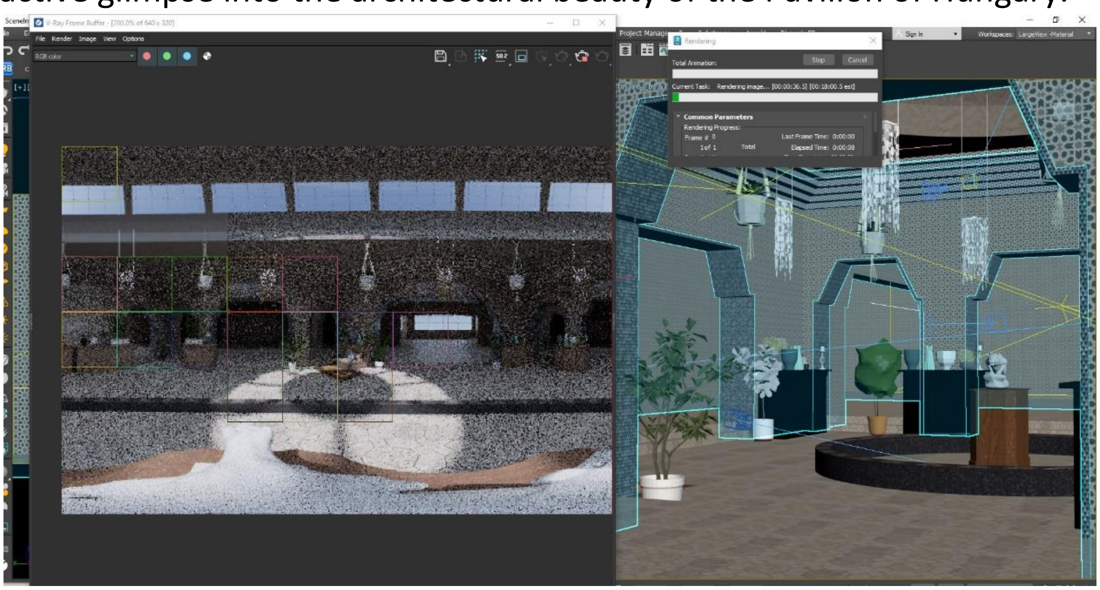


Figure 59: Rendering process from the interior part by the 3Ds max studio and preparation for the 360 degrees (Author)

CONCLUSION

In conclusion, the preservation of documentary legacy, the implementation of preservation strategies, advancements in 3D modeling and digital technologies, and the integration of immersive technologies contribute to the protection, availability, and enhanced understanding of our cultural heritage for present and future generations. Preserving documentary legacy holds immense significance as it safeguards our cultural heritage, promotes education, and provides insights into our past. Adverse environmental factors pose a threat to this legacy, making preservation strategies such as materials conversion and conservation activities necessary. Documentary heritage serves as a concrete form of disseminating information, reflecting our culture and history, and emphasizes the vital role preservation plays in maintaining our collective memory. Access to and understanding of documentary heritage are essential for individuals from various fields, including historians, academics, scientists, archivists, and the general public.

Strategies for protecting documentary legacy involve a range of methodologies and principles aimed at preserving and enhancing accessibility. Repairing, cleaning, photocopying, and digitization are key techniques used to mitigate the harmful effects of biological agents, environmental factors, and human impacts on documentary heritage. Digitization enables the creation of automated inventories and facilitates easier organization, retrieval, and user interaction. Adherence to UNESCO standards and a focus on accessibility considerations ensure the availability and usefulness of digital historical materials.

Advancements in 3D modeling and digital technologies have revolutionized the study and preservation of historical architecture. Immersive 3D digital models provide a more accurate and comprehensive understanding of structures, capturing their physical aspects as well as historical and cultural significance. Techniques such as reverse modeling, digital surface surveys, and laser scanning have enhanced building analysis and preservation. The ongoing development of new techniques continues to shape the field and promote effective preservation strategies.

AutoCAD, 3D Studio Max, and documentary sources have revolutionized map creation and architectural visualization. The integration of visual and documentary sources in AutoCAD enables the creation of accurate 2D maps, while 3D Studio Max enhances the realism and visual appeal of architectural models. The choice of rendering engine and the integration of immersive technologies such as AR and AR360 further enhance the visualization of 3D models, providing opportunities for stunning renderings and captivating experiences.

In the Turin 1911 Case study, the ambitious endeavor to digitally reconstruct the Turin 1911 World's Fair highlights the importance of combining traditional research methods with digital technologies. The project aims to recreate the lost universe of the fair, exploring its significance as a symbol of modernity, progress, and 20th-century ideology. The fair, celebrating Italy's fiftieth anniversary of Unification, showcased the country's cultural, industrial, and artistic achievements. With millions of visitors and impressive pavilions representing different nations, the fair left a lasting impact on the city and its architectural heritage.

However, the process of digital reconstruction faces challenges due to limited visual material from the 1910s. These limitations include insufficient quantity and coverage, lack of diverse perspectives and viewpoints, image quality and condition issues, inconsistent data sources, and a lack of interpretation and contextual understanding. Overcoming these challenges requires a more extensive and diverse range of visual material, alternative approaches, image enhancement techniques, preservation efforts, thorough data preprocessing, calibration, alignment techniques, and consultation with experts. By mitigating these challenges, the project aims to achieve a more faithful and accurate digital reconstruction of historical buildings, preserving their architectural legacy and providing a comprehensive understanding of their historical significance.

The comprehensive approach to the reconstruction of the Pavilion of Hungary exemplifies the meticulous nature of the project. Gathering and examining data from various historical sources, transforming black and white drawings and photographs into colorized format, creating 2D digital representations, verifying technical drawings, comprehending the overall structure, identifying recurring elements, and creating 3D models from pictures and 2D plans in AutoCAD are involved in the process. The 3D models are further enhanced with more detail in 3Ds Max Studio to achieve highly realistic and visually accurate representations.

The visualization of realism is crucial in the final stage of the process. Whether rendering the exterior part of a structure or creating an augmented reality experience for smartphones, attention to detail and post-production enhancements play a significant role. Tools like 3Ds Max Studio, V-Ray, and Photoshop are utilized to create visually stunning and realistic presentations. The exterior rendering involves incorporating architectural details and lighting in 3Ds Max Studio, using V-Ray for advanced rendering techniques, and applying post-production techniques in Photoshop to enhance the presentation. For the interior part, the model is optimized for augmented reality rendering, aligned with the physical space in an AR development platform, and interactive elements are added to create an immersive and interactive experience on smartphones.

In summary, the Turin 1911 project demonstrates the power of digital reconstruction in preserving and understanding historical events. Through a comprehensive approach that combines traditional research methods with digital technologies, the project aims to recreate the lost universe of the Turin 1911 World's Fair, shedding light on its significance as a symbol of modernity and progress. By addressing the challenges of limited visual material, meticulous data analysis, and visualization techniques, the project strives to achieve accuracy, fidelity, and immersive experiences in the reconstruction process. The project not only preserves architectural heritage but also provides valuable insights into the historical context and legacy of the fair. These efforts contribute to the protection, availability, and enhanced understanding of our cultural heritage for present and future generations.

Final Production

Figure 60: Final Model of the main entrance of the pavilion (Author)

Figure 61: Final Model of the south part and the exit of the main hall of the pavilion (Author)

Figure 62: Final Model of a perspective view from southeast of the pavilion (Author)

Figure 63: Final Model of a perspective view from northwest of the pavilion (Author)

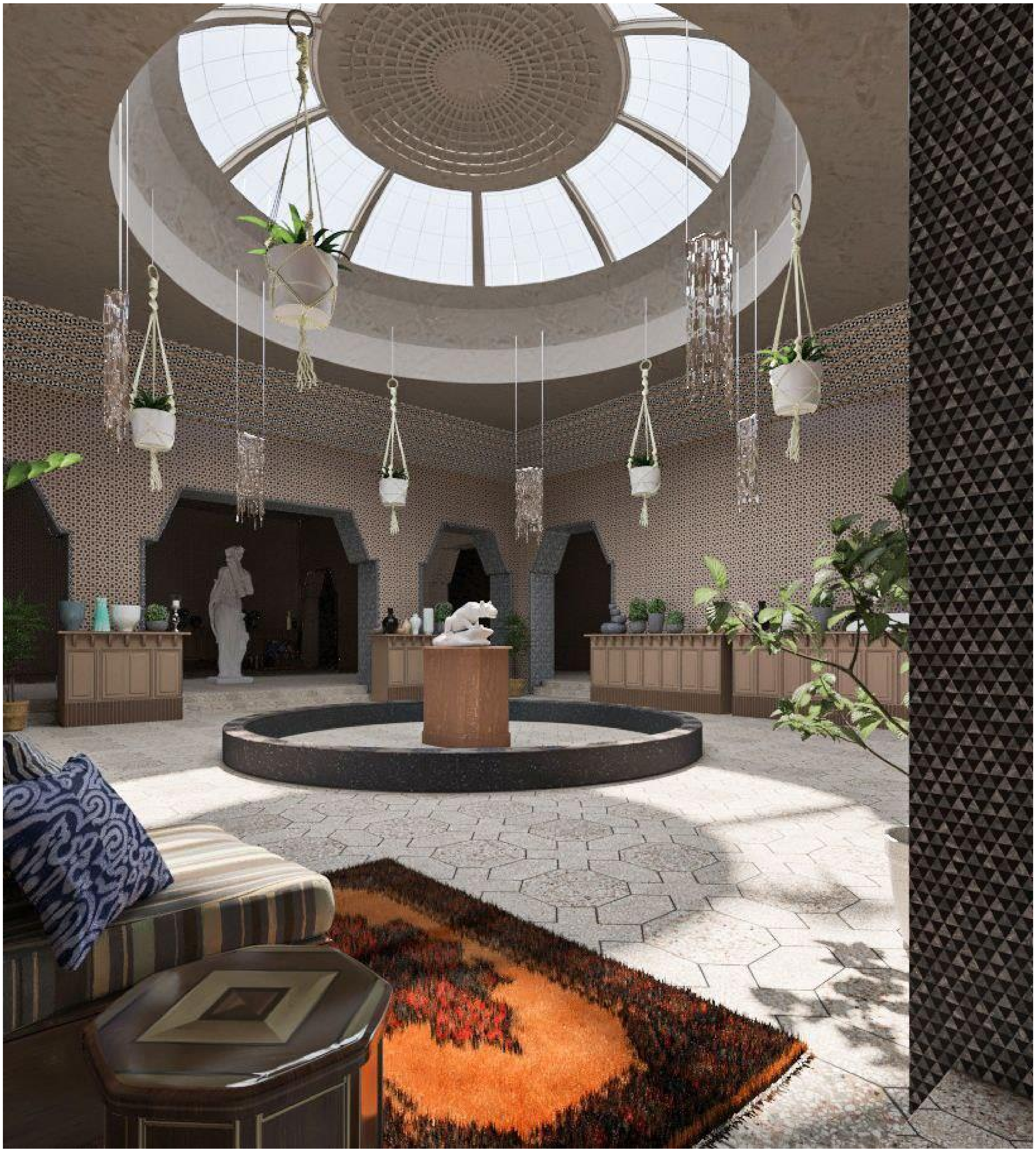


Figure 64: Final Model of the main hall with pool of the pavilion (Author)

Figure 65: Link to the AR presentation of the main hall of the Pavilion of Hungary (Author)

Figure 66: Final model of the entrance which is followed by the entrance of the main hall of the pavilion (Author)

BIBLIOGRAPHY

1. Adeeb, M., & Ghonaimy, R. (1997). Existing and Evolving Technologies for Long-Term Information Preservation and the Supporting Legal Requirements. International Information & Library Review, 29, 367-379.
2. Azuma, R. T. (1997). A survey of augmented reality. Presence: Teleoperators and Virtual Environments, 6(4), 355-385.
3. Barlow, H., Blakemore, C., & Weston-Smith, M. (1990). Pictorial instructions. In H. Barlow, C. Blakemore, & M. Weston-Smith (Eds.), Images and Understanding (pp. xx-xx). Cambridge University Press.
4. Billinghurst, M., & Duenser, A. (2012). Augmented reality in the classroom. In Proceedings of the IEEE International Symposium on Mixed and Augmented Reality (ISMAR) (pp. 223-224). IEEE.
5. Blanco, J. L., Dawson, A., & Reichert, G. (2020). AutoCAD 2021 3D Modeling. Goodheart-Willcox Publisher.
6. Boardman, D., & Woodcock, A. (2014). 3D Modeling in AutoCAD: Creating and Using 3D Models in AutoCAD 2000. Elsevier.
7. Bonney, G. (2020). Autodesk 3ds Max 2021 for Beginners: A Tutorial Approach. CADCIM Technologies.
8. Boston, G. (Ed.). (1998). Safeguarding the Documentary Heritage. Paris: UNESCO.
9. Boyd, K. (2020). Mastering Autodesk 3ds Max 2021: A Professional Modeling and Animation Guide. John Wiley & Sons.
10. Centofanti, M., Brusaporci, S., & Lucchese, V. (2014). Architectural Heritage and 3D Models. In P. Di Giamberardino et al. (Eds.), Computational Modeling of Objects Presented in Images (Lecture Notes in Computational Vision and Biomechanics 15). Springer International Publishing Switzerland. DOI: 10.1007/978-3-319-04039-4_2
11. Chiabrando, F., Coletta, C. D., Sammartano, G., Spanò, A., & Spreafico, A. (2018). "TORINO 1911" PROJECT: A CONTRIBUTION OF A SLAM-BASED SURVEY TO EXTENSIVE 3D HERITAGE MODELING. International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences, 42(2).
12. Chiabrando, F., Sammartano, G., Spanò, A., & Spreafico, A. (2019). Hybrid 3D Models: When Geomatics Innovations Meet Extensive Built Heritage

Complexes. ISPRS International Journal of Geo-Information, 8(3), 124. https://doi.org/10.3390/ijgi8030124
13. Cornaglia, P. (2000). Il Padiglione Ungherese All'esposizione internazionale di Torino del 1911 (The Hungarian Pavilion At the 1911 Turin International Exposition). Pavilion, Epiteszet. Muveszet. Tortenet, 89.
14. D'Auria, A. (2019). AutoCAD 3D Modeling: Exercise Workbook. Independently Published.
15. Della Coletta, C. (2006). World's Fairs Italian-Style: The Great Exhibitions in Turin and Their Narratives, 1860-1915. University of Toronto Press, Toronto, ON, Canada.
16. Dix, A. (2016). AutoCAD: Secrets Every User Should Know. Wiley.
17. D'Orazio, A. (2018). 3ds Max 2020: 3D Modeling, Animation, and Rendering. Peachpit Press.
18. Etheridge, J. (2017). AutoCAD For Dummies. John Wiley & Sons.
19. Evans, R. (1989). Architectural projection. In E. Blau & E. Kaufman (Eds.), Architecture and Its Image. Canadian Centre for Architecture.
20. Fatta, F. (2011). La rappresentazione dell'Africa romana. In M. Giovannini & F. Prampolini (Eds.), Spazi e culture del Mediterraneo, vol. 3 (pp. 221–240). Centro Stampa d'Ateneo.
21. Fiorillo, F., Remondino, F., Barba, S., Santoriello, A., De Vita, C. B., & Casellato, A. (2013). 3D digitization and mapping of heritage monuments and comparison with historical drawings. ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume II-5/W1, XXIV International CIPA Symposium, 2 – 6 September 2013, Strasbourg, France.
22. Gladfelter, D. W. (2020). AutoCAD 2021 and AutoCAD LT 2021: Essentials. Autodesk Official Press.
23. Gombrich, E. (1990). Pictorial instructions. In H. Barlow, C. Blakemore, & M. Weston-Smith (Eds.), Images and Understanding. Cambridge University Press.
24. Google Developers. (n.d.). ARCore. Retrieved from https://developers.google.com/ar
25. Gross, A., & Gennissen, J. (2015). 3ds Max in Architecture and Design Visualization: Hands-On Courseware for Intermediate/Advanced Users. CADnetwork.

26. Guidi, G., et al. (2010). Acquisizione 3D e modellazione poligonale. Milano: McGraw-Hill.
27. Hedstrom, M., & Montgomery, S. (1998). Digital Preservation Needs and Requirements in RLG Member Institutions. California: Research Libraries Group.
28. Kamatula, G.A., Mnkeni-Saurombe, N., & Mosweu, O. (2013). Role of Archives in the Promotion of Documentary Heritage. Journal of the Eastern and Southern Africa Regional Branch of the International Council on Archives, 32, 104-122.
29. Krtali, M., & Hasenay, D. (2012). Exploring a framework for comprehensive and successful preservation management in libraries. Journal of Documentation, 68(3), 353-377.
30. Krygiel, E., Nies, B., & McDermott, I. (2019). Mastering AutoCAD 2020 and AutoCAD LT 2020. John Wiley & Sons.
31. Kumar, S., Sethi, M., & Sharma, D. K. (2018). Reverse Engineering of 3D Models in AutoCAD. International Journal of Advanced Research in Computer Science, 9(6), 542-547.
32. La Cronaca Fotografica dei lavori dell'Esposizione. (1910, December). L’Esposizione di Torino: giornale ufficiale illustrato dell'Esposizione Internazionale delle industrie e del lavoro 1911, (12), 184. Retrieved from https://italyworldsfairs.org/galleries/image/641
33. Majumdar, S. (2005). Preservation and conservation of literary heritage: A case study of India. The International Information & Library Review, 37, 179-187.
34. Mkuwira, R. M. (2015). Preservation of documentary heritage in Malawi. Journal of the South African Society of Archivists, 48.
35. Morandín-Ahuerma, F., Romero-Fernández, A., Villanueva-Méndez, L., Santos Cabañas, E., Rodríguez-Garibay, G., & Esteban-Hernández, D. (2022). Conservation of the Historical Documentary Heritage of Teziutlan, Puebla, Mexico. International Journal of Research Publication and Reviews, 3(6), 3638-3641. ISSN 2582-7421.
36. Omura, G. (2020). Mastering AutoCAD 2021 and AutoCAD LT 2021. John Wiley & Sons.

37. Sawant, S. (2014). A study on preservation and conservation practices in academic libraries in Mumbai. Annals of Library and Information Studies, 61, 153-159.
38. Schmalstieg, D., & Hollerer, T. (2016). Augmented reality: Principles and practice. Addison-Wesley Professional.
39. Slater, M., & Wilbur, S. (1997). A framework for immersive virtual environments (FIVE): Speculations on the role of presence in virtual environments. Presence: Teleoperators and Virtual Environments, 6(6), 603-616.
40. Smith, J. (2019). Introduction to AutoCAD: 2D and 3D Design. John Wiley & Sons.
41. Srivastava, R., & Kumar, S. (1986). Preservation and Conservation Treatment. Lucknow Librarian, 28(1-4), 25-33.
42. Treves, G. (1911). Le Esposizioni del 1911: Torino, Roma, Firenze. Milano: Fratelli Treves.
43. United Nations Educational, Scientific and Cultural Organization (UNESCO). (2020). Accessible Digital Documentary Heritage: A set of Guidelines for the preparation of documentary heritage in accessible formats for persons with disabilities. 7, place de Fontenoy, 75352 Paris 07 SP, France.

SITOGRAPHY

1. (1911). Practical Guide to Visit the International Exhibition of Industries and Labor held in Turin to celebrate the 50th anniversary of the proclamation of the unity of Italy with Rome as the capital: April-November 1911. Turin: Ajassa e Ferrato. Available online at www.museotorino.it/view/s/34b956eefd2440ef97e1b7a11334848f
2. (1911). The Turin 1911 Exhibition. Official Illustrated Journal of the International Exhibition of Industries and Labor, Turin: Guido Momo.
3. 8th Wall. (n.d.). 8th Wall. Retrieved from https://www.8thwall.com/
4. A turini kiállítás magyar pavillonja. (1910). Magyar építőművészet, 8(6), 16-32. Retrieved from http://misc.bibl.u-szeged.hu/16287/1/1910-08-06_OCR_A1b.pdf
5. A turini világkiállítás magyar háza. (1911). Magyar iparművészet, 14(6), 253-257. Retrieved from https://epa.oszk.hu/01000/01059/00090/pdf/magyar_iparmuveszet_EPA01059_14_06_1911_253-257.pdf
6. A-Frame. (n.d.). A-Frame. Retrieved from https://aframe.io/
7. Apple Developer. (n.d.). ARKit. Retrieved from https://developer.apple.com/augmented-reality/arkit/
8. Autodesk AutoCAD. Retrieved from https://www.autodesk.com/products/autocad/overview
9. Autodesk. (n.d.). 3ds Max Features. Retrieved from https://www.autodesk.com/products/3ds-max/features
10. Autodesk. (n.d.). 3ds Max. Retrieved from https://www.autodesk.com/products/3ds-max/
11. Chaos Group. (n.d.). V-Ray for 3ds Max. Retrieved from https://www.chaosgroup.com/vray/3ds-max
12. E. F. (1910, August). Il cantiere architettonico dell'Esposizione. L'Esposizione di Torino: giornale ufficiale illustrato dell'Esposizione Internazionale delle industrie e del lavoro 1911, (8), 113-116. Retrieved from https://italyworldsfairs.org/galleries/image/554
13. Epic Games. (n.d.). Unreal Engine. Retrieved from https://www.unrealengine.com/
14. Giorgio Pelassa. (n.d.). Once upon a time Torino 1911. Retrieved from https://www.facebook.com/giorgio.pelassa.3/

15. Pelassa, G. (n.d.). Once Upon a Time Torino 1911. Retrieved from https://www.facebook.com/giorgio.pelassa.3/
16. Pocobelli, D. P., Boehm, J., Bryan, P., Still, J., & Grau-Bové, J. (2018). BIM for heritage science: a review. Heritage Science, 6, 30. https://doi.org/10.1186/s40494-018-0191-4
17. Ricoeur, P. (2008). Architettura come narrazione. In E. Rocca (Ed.), Estetica e architettura. Bologna: Il Mulino.
18. UNESCO. (2010). Safeguarding the documentary heritage of humanity. Retrieved from http://unesdoc.unesco.org/images/0018/001877/187733e.pdf (Accessed October 20, 2014).
19. Unity Technologies. (n.d.). Unity. Retrieved from https://unity.com/
20. Unreal Engine. (n.d.). Unreal Engine. Retrieved from https://www.unrealengine.com/
21. Vuforia. (n.d.). Vuforia. Retrieved from https://www.ptc.com/en/products/augmented-reality/vuforia

LIST OF Figures