ISSN: 2029-7955 / eISSN: 2029-7947

VILNIUS TECH
Vilnius Gediminas Technical University

JOURNAL of ARCHITECTURE & URBANISM

2025
Volume 49
Issue 1
Pages 1–10
https://doi.org/10.3846/jau.2025.21202

UNKNOWN INTERIORS OF ANCIENT EGYPT: PRODUCING BY ARTIFICIAL INTELLIGENCE IN THE CONTEXT OF LIGHT-SPACE RELATIONSHIP

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Article History:
- received 04 April 2024
- accepted 08 January 2025

Abstract. This study presents a design method aimed at visualizing cultural heritage through the architecture of ancient Egypt using modern technologies. With the deepening of the digital age, the use of digital technology and artificial intelligence in cultural heritage research has become an important tool for renewing and disseminating period architecture. The reason for choosing the interior spaces of ancient Egypt as a sample in this study is that, in addition to leaving a rich heritage in the field of architecture, ancient Egypt offers distinct period architecture in terms of space-light relationship. As a result of literature review, keywords related to architecture and the relationship between space and light in the Ancient Period were identified, and the study was visualized using the state-of-the-art artificial intelligence technology of today, namely human-computer interaction combined with text-to-image technology. The motivation and aim of this study is to demonstrate the role of reanimating cultural heritage like ancient period architectures in the computer environment based on interpretation, contributing to architectural sustainability, and spreading to future periods.

Keywords: architectural visualization, human-computer interaction, artificial intelligence, space-light, ancient Egypt, architectural design.

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1. Introduction

Designers and builders create visual representations of spaces and structures using drawings, which convey aesthetic and technical aspects of their ideas. Three-dimensional models, now primarily created digitally, have become a more efficient way to visualize architectural designs (Dunn, 2014). Virtual reconstructions are increasingly being used in archaeology, enabling researchers to analyze not only the width and length but also the height and three-dimensional shape of excavated spaces (Rossi, 2020). In this context, the transition from drawings to digital three-dimensional models significantly contributes to the more effective visualization and understanding of architectural designs. Additionally, the increasing prevalence of virtual reconstructions in archaeology will aid in a more in-depth analysis and comprehension of excavation sites. Consequently, the utilization of technology in architectural and archaeological research will enrich knowledge.

However, archaeological remains often don't provide enough information about a building's elevation, leading to reconstructions based on a mix of interpretations and assumptions. Virtual reconstructions have the advantage of being easily modifiable, and multiple versions can be suggested based on the available data and interpretations (Momigliano, 1987; Rossi, 2020).

Accurately reconstructing the volume of a poorly preserved ancient building is challenging and requires attention to the third dimension. The final perception of the building depends on how the plan and volume are combined. Precisely measuring the remaining structures is crucial, and when data is lacking, it's important to clearly state the assumptions made in the reconstruction process (Rossi, 2019).

In addition, transforming cultural heritage into digital form involves multiple aspects (Pavlidis et al., 2007). Xu et al. (2022) employed advanced design technology to create two-dimensional digital animations. They merged various technological tools, including software, character design, scene creation, color coordination, storyboard development, animation production, post-processing, and audio effects across eight dimensions (Zeng et al., 2023). The amalgamation of these multifaceted technologies led to digital animations that were more immersive, interactive, and informative in transmitting information. Teresa Pimentel and Branco (2005) also conducted relevant studies. They incorporated ancient embryonic scripts and the Phaistos disk as visual representations in an interactive multimedia art exhibit focused on the history of writing and printing techniques. By integrating narrative evolution, visual design, animation, interactive hardware installation, and sound effects across five dimensions, they created

new opportunities for the display of printing methods (Pimentel & Branco, 2005). This demonstrates that digitizing cultural heritage goes beyond the application of a single technology; instead, it embodies the convergence of diverse knowledge and technologies (Zeng et al., 2023).

In this examination, architecture from the Ancient Egyptian era has been selected as a focal point. Various scholars, including Ragai (1986), Kuehni (1980), and Dodd et al. (2009), have explored the symbolic significance of colors in ancient Egypt through an analysis of ancient Egyptian texts. A smaller body of literature has delved into Egyptian clothing customs (Shin, 2001), jewelry design inspired by Egyptian motifs (Ramadan & Wu, 2021), and geometric patterns found in Egyptian architecture and interior design (Mahmoud, 2017). Concerning the digitization of Egyptian cultural heritage, Mandelli et al. (2019) utilized methods such as structured light scanners, photogrammetry, and micro-mapping to generate a digital 3D model of the scribe Butehamon's coffin. ElNashar et al. (2016) converted the textile designs found in Egyptian decorations into digital form. Nonetheless, the exploration of digital animation and interactive design of Egyptian theological totems has been scarce (Zeng et al., 2023). Thus, additional research is warranted regarding the digitization of Egyptian architectural legacy.

Accessing interior visuals of ancient architectural structures through artificial intelligence primarily relies on the utilization of text-to-image generation technologies. These technologies are capable of producing realistic images based on textual descriptions. For instance, a user can provide a text input describing the interior of an ancient temple, and artificial intelligence can analyze this text to comprehend the temple's interior and generate a realistic image based on this understanding. This process is carried out using specialized artificial intelligence models trained with deep learning and large datasets. Due to their ability to perceive complex patterns and details, these models are highly effective in accurately representing the interiors of ancient architectural structures. Consequently, researchers and historians can leverage the power of artificial intelligence to visualize and understand the interiors of ancient architectural structures.

In this context, the methodology of this study involves the creation of key architectural terms of the Ancient Egyptian Period by using text-to-image technology to produce images of unknown interior spaces in the period's architecture. The aim is for this study, which is still in its infancy, to be developed in subsequent studies and used as a method for reconstructing architectural history. This study underscores the significance and potential of employing a novel research method. It highlights the potential contribution of text-to-image technology in visualizing the unknown interior spaces of architectural structures and enhancing the comprehension of these structures. Such a method could provide a more comprehensive understanding in architectural history research and aid in the reconstruction of past structures. Therefore, the development and utilization of such methods enable a deeper examination of architectural history.

2. Materials and methods

"...the history of architecture is the history of the struggle for light."

(Le Corbusier, 1931)

2.1. Ancient Egypt and space-light relationship

Egyptian civilization, one of the four ancient civilizations with a five-thousand-year history, not only held a prominent position in ancient world history but also significantly influenced the surrounding Mediterranean regions. The ancient Egyptians left behind an abundant legacy for humanity, comprising both tangible and intangible culture (Liu, 2008). Particularly within the realm of ancient Egyptian civilization, religion and theology were at the core, influencing architecture, art, music, ritual practices, astronomy, and various other aspects (Zeng et al., 2023).

The ancient Egyptians had a tendency to perceive all phenomena, especially the natural forces that greatly influenced their lives, as objects. This was largely because the reasons behind the natural order and its forces were perceived as mysterious by the people. Additionally, as their lives were closely intertwined with these forces, they had little control over them. To bring greater understanding to the world around them, they interpreted these natural forces as the gods of their environment (Foroughi & Javadi, 2017). The Pharaohs, Kings of Egypt, were seen as semi-gods, priests and builders. Amongst other things, they prac-ticed religious rites and stimulated the arts (Fletcher, 1961).

The ideology and allegory embodied in ancient Egyptian designs profoundly influenced the global community. This was particularly evident in the formal language employed in ancient Egyptian temples, which led to the resurgence of the ancient Egyptian artistic style. The ancient Egyptians were greatly influenced by the natural world and correlated every aspect of their lives with the phenomena of the universe and nature surrounding them (Abdoh, 2020). Sunrise and sunset were two of the most significant occurrences that impacted the religion of the ancient Egyptians, inspiring them with the notion of immortality: the belief that humans do not perish but will be reborn after death. The architectural features and symbols of ancient Egyptian designs carried a profound religious philosophy, which was closely tied to their beliefs in resurrection. For instance, a representation of an ancient Egyptian deity, like the winged sun disk, symbolizing the ancient god Horus Behdety (Abdoh, 2020). According to ancient Egyptians, when the sun's rays touched the earth, they solidified and transformed into a granite pillar – a monument to eternity. This is how the ancient Egyptians referred to their sacred constructions: pyramids, temples, obelisks, steles, and statues (Pavlov, 2019).

The core philosophy behind the architectural design of ancient Egyptian temples was to create a microcosm. The temple's façade was shaped in the form of the term

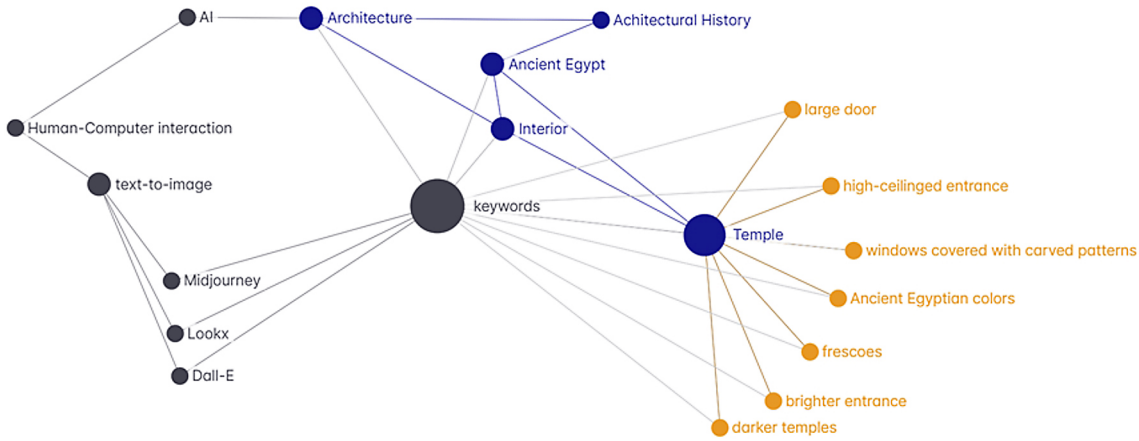

Figure 1. Network diagram of study

"Akhet," meaning "Horizon," representing the sunrise appearing between two mountaintops or hills. This imagery symbolized the creative power of the god Ra, who is reborn each day and ascends to the horizon. At the entrances of Egyptian temples, the winged sun disk, with sacred cobras, is prominently displayed, representing the deity Horus the Behdetite "Hr Bhd.ty." Horus Behdetite symbolizes the fusion of Horus, the god of the sky, with Ra, the sun god, to signify the rebirth of kings who serve as guardians of the boundary between the mortal world outside the temple and the divine realm within (Shonkwiler, 2014; Abdoh, 2020).

The architectural arrangement of ancient Egyptian temples was founded on the concept of gradual dimming, which initiates upon entering the temple's gate. The dimness steadily engulfs the temple, with the ceiling progressively descending, culminating at the darkest point in the sanctuary–an embodiment of the eternal mound, where the creator god first emerged (Chepchumba, 2013; Shonkwiler, 2014). The sizes of openings were determined by the capacity of stone spans, with most featuring square heads and covered by robust lintels. Clerestories, which enabled deeper layouts, also enhanced the interior's natural light. Thick walls were employed to soften and scatter sunlight through multiple reflections. Additional openings included roof slits, petite window apertures, and entrance portals (Moore, 1991). In ancient Egypt, the walls and ceilings of interior spaces were painted with bright colors that were reflected in the spaces. This would help create atmosphere by reflecting more light into the interior spaces. Frescoes and colors would contribute to the spread of natural light and create a more beautiful environment in the interior (Hosny, 2020).

The architecture of ancient Egypt exhibits distinct features concerning the relationship between space and light, although finding direct documentation and sources on this matter may be challenging. Ancient Egyptian architecture is commonly associated with monumental structures such as religious temples, pyramids, and tombs. While these constructions often include interior spaces, there are also open spaces that directly benefit from natural sunlight. Within interior spaces, light sources are typically limited to natural light from outside, which can significantly influence the relationship between space and light. For instance, in temples or burial chambers, light is often scarce, impacting the atmosphere and perceived dimensions of the interior. Some ancient Egyptian temples feature specially designed openings or windows to manipulate light. These elements provide limited amounts of light to the interior spaces, creating a particular ambiance during rituals or ceremonies. However, gaining further insights into ancient Egyptian architecture may require additional research through archaeological and historical sources. This study, however, is motivated by the pursuit of obtaining interior visuals not present in archaeological records using artificial intelligence tools.

As a result of these literature reviews, a keyword pool has been obtained for Ancient Period Architecture. At the same time, the human-computer interaction architecture relationship has been associated in this diagram (Figure 1) as the method of the study. The study has been developed in the context of this word network.

2.2. Human-Computer Interaction

The rapidly advancing digital technologies, computer environment, and new art themes in today's world are significant sources that can open new horizons in architectural concepts, allowing their logic to be reflected in architectural design inputs and products. "Human-Computer Interaction" (HCI) is a discipline that studies how people interact with computers and explores user experiences. Essentially, it investigates how people interact with computers and other digital technologies. The goal of HCI is to understand user needs and expectations, provide them with effective experiences, and establish a scientific foundation for this process (Webster et al., 1993; Guan et al., 2015).

The utilization of digital technologies, which have transformed the boundaries of life, by art and consequently architecture, along with the ability to be produced through digital tools, creates a conceptual space for discussion and experimentation that is open to development and transformation (Yin et al., 2023; Çelik, 2023a). In this context, it is essential to highlight how the use of digital tools transforms the traditional boundaries of art and architecture, and how this opens up new possibilities in the field. This is because it can lead to the conclusion that progress and innovative applications should be encouraged in the fields of art and architecture.

One of today's technologies, GANs, or Generative Adversarial Networks, are a model that operates within a framework where two networks engage in adversarial competition (Tan et al., 2023). On one side, a network called the "generator" creates images from text, while on the other side, a network called the "discriminator" attempts to distinguish the generated images from real ones. In this process, the generator progressively strives to produce more realistic images, while the discriminator endeavors to differentiate these images from real ones (Wang et al., 2020). Transfer learning is employed to generate images from text. This involves a pre-trained model understanding a general concept and then customizing it based on a specific text description (Efimova & Filchenkov, 2022).

The technology of text-to-image generation is a branch of artificial intelligence that focuses on producing visual content from text-based descriptions. This technology is typically implemented using deep learning models (Talasila & Narasingarao, 2022). The fundamental working principles of text-to-image generation technology are:

- Dataset and Training: Text-to-image generation models are typically trained on extensive visual and textual datasets. The training dataset includes textual descriptions and corresponding visual data (Talasila & Narasingarao, 2022).
- Embedding: Text data is typically passed through an embedding layer, allowing each word or token to be represented in a vector space. This provides a numerical representation that encapsulates the meaning of the word (Talasila & Narasingarao, 2022).
- Encoding: Text data is then processed through an encoding mechanism, such as a recurrent neural network (RNN) or attention mechanism. This helps understand temporal and sequential connections in text descriptions (Talasila & Narasingarao, 2022).
- Generation of the Generative Model: The generative model is designed to produce realistic visual content from text descriptions. Models like Generative Adversarial Networks (GANs) are commonly used. GANs consist of two main components: the generator and the discriminator (Talasila & Narasingarao, 2022).
- Generator: Takes in text data and attempts to generate a suitable visual output from that text (Talasila & Narasingarao, 2022).
- Discriminator: Attempts to determine whether the generated images are real or synthetic. This provides an incentive for the generator to produce more realistic images (Talasila & Narasingarao, 2022).
- Training and Optimization: The generative model tries to generate visual content based on text descriptions from the training dataset. Throughout the training process, a balance is sought between the generator and the discriminator. As the generator learns to create more realistic images, the discriminator learns to more effectively distinguish between real and generated images (Talasila & Narasingarao, 2022).
- Result Generation: After training is complete, a generative model can be used to produce new visual content based on text descriptions. This allows users to obtain desired visual elements based on specific text descriptions (Talasila & Narasingarao, 2022).

The increasing public recognition of artificial intelligence-generated content, attributed to recent advancements in high-fidelity text-paired image synthesis research (Gu et al., 2022). It highlights how models trained on large-scale datasets have showcased remarkable capabilities in generating novel images from text descriptions that encompass unseen combinations of visual concepts. From the inception of DALL-E onwards, various methodologies have been proposed to elevate the state-of-the-art in text-to-image generation, focusing on enhancing both the quality of generation and its efficiency (Ramesh et al., 2021; Zhou et al., 2023). For instance, the Latent Diffusion Model diverges by training a diffusion model within the latent space of an auto-encoder instead of directly in pixel space, resulting in improved generation efficiency. GLIDE adopts a hierarchical architecture, employing diffusion models at different resolutions, a design approach that has proven effective and has been widely adopted (Nichol et al., 2021; Zhou et al., 2023). Additionally, DALL-E2 introduces an additional image embedding input, which not only enhances model performance in text-to-image generation but also enables broader applications such as image-to-image generation and generation under multi-modal conditions. Furthermore, leveraging a rich pre-trained text encoder demonstrates its utility in aiding text-to-image generation models in grasping the semantics of text descriptions (Zhou et al., 2023). Lastly, the successful scale-up of generative models, incorporating transformer structures, has significantly enhanced text-to-image consistency (Raffel et al., 2020). This study aims to highlight the potential in the field of text-to-image generation. Additionally, it explains the importance of utilizing rich pre-trained text encoders and elaborates on the scalability effect of generative models incorporating transformer architectures. These findings may play a significant role in shaping future research and applications in the text-to-image generation domain.

3. Results

Recent studies in the realm of Human-Computer Interaction (HCI) emphasize text prompting as a skill that involves a learning curve. Typically, longer prompts tend to yield

higher quality outcomes (Paananen et al., 2024). Chang et al. (2023) characterize prompt writing as an art form, highlighting that "artists" – in this context, designers – also derive advantages from possessing advanced proficiency in natural language (Chang et al., 2023; Paananen et al., 2024). Moreover, when employing artificial intelligence for design purposes, Kulkarni et al. (2023) elegantly convey the notion that "A Word is Worth a Thousand Pictures," as articulated in the title of their study (Kulkarni et al., 2023).

Text-guided diffusion models have gained traction as a widely used approach for generating new digital images based on textual prompts written in natural language. This utilization of generative artificial intelligence is progressively expanding both in academic research and industrial applications. In this study, the generative artificial intelligence interfaces including Midjourney, Lookx, and Dall-E2 artificial intelligence bots have been selected as the tools for the research.

The first results were obtained from the Midjourney artificial intelligence bot. Midjourney's artificial intelligence working logic is based on solving complex problems, predicting unpredictable events and analyzing data using data-based algorithms. This system is designed to automate decision-making processes based on large amounts of data and make them more efficient (Çelik, 2023b). Midjourney epitomizes the cutting-edge capabilities in text-to-image generation available to the public. This tool has gained immense popularity for its user-friendly interface, enabling effortless creation of images based on textual prompts.

In order to obtain visuals from the text, the keywords in the network diagram prepared in the study were used and the visuals in Figure 2 were experienced.

The second artificial intelligence interface selected in the study is Lookx. Lookx is an architecture-specific artificial intelligence platform. LookX AI represents an innovative artificial intelligence assistant tailored for both artificial intelligence enthusiasts and architects alike. Aligned with its predefined goals, its primary mission is to streamline the integration of artificial intelligence technology into architectural practices. It achieves this by harnessing the specialized technical knowledge, profound comprehension of the architectural domain, and comprehensive studies in human-computer interaction of architectural professionals. This study particularly emphasizes the utilization of this interface due to its nature as an artificial intelligence technology tailored for the discipline of architecture. Within the study, obscure interiors from various historical architectural periods have been transformed into a vocabulary pool through literature review, with an attempt made to attain visual outcomes through artificial intelligence. Hence, the development of an artificial intelligence bot specifically for architecture is deemed significant.

The prompts written in Lookx provide autonomous and multi-alternative visual results. First, only the "A temple interior in ancient Egypt" prompt was entered into the artificial intelligence interface (Figure 3).

Later, the prompt written to Lookx was detailed.: "The interior of an ancient Egyptian temple with a large door, a high-ceilinged entrance, windows covered with carved patterns, walls covered with ancient Egyptian colors and frescoes, a brighter entrance and darker temples" (Figure 4).

Initially, the purpose of solely describing the interior of an ancient Egyptian temple was to test whether the artificial intelligence recognizes the era. Subsequently, information was meticulously delineated according to the architectural historical literature. Even if it does not recognize the era, the artificial intelligence will be able to generate visuals from the text. In the second attempt, although the details were more pronounced, it can be inferred that the artificial intelligence recognizes the ancient Egyptian era. This stage of the study delineates a research process focused on artificial intelligence's capability to recognize ancient Egyptian architecture. Testing whether artificial intelligence can identify the era is crucial for understanding its ability to recognize architecture from a specific time period. The research employs a rigorous methodology to

Figure 2. Unknown interiors of ancient Egypt (source: Midjourney, 2024)

Figure 3. A temple interior in ancient Egypt (source: Lookx, 2024)

Figure 4. The interior of an ancient Egyptian temple with a large door, a high-ceilinged entrance, windows covered with carved patterns, walls covered with ancient Egyptian colors and frescoes, a brighter entrance and darker temples (source: Lookx, 2024)

Figure 5. A temple interior in ancient Egypt (source: Dall-E, 2024)

Figure 6. The interior of an ancient Egyptian temple with a large door, a high-ceilinged entrance, windows covered with carved patterns, walls covered with ancient Egyptian colors and frescoes, a brighter entrance and darker temples (source: Dall-E, 2024)

evaluate artificial intelligence's capacity to perceive details related to ancient architectural structures. In this context, the study is significant for comprehending how artificial intelligence technology can be utilized in architectural history research.

Finally, the same prompts were experienced in the Dall-E artificial intelligence interface (Figures 5, 6). DALL-E is made available as web-based services through OpenAI. Given text associated with visual concepts, DALL-E2 can visually generate those concepts. DALL-E2 can work visually creatively and flexibly. This model can produce creative images using a wide range of visual data and concepts associated with text (Çelik, 2023c).

In this artificial intelligence bot, initially, only the interior of an ancient Egyptian temple was described to observe the outcomes. Upon examining the results, it is evident that DALL-E2 indeed recognizes ancient Egypt. However, the results did not address the context of space-light in terms of period architecture. While the wall colors and frescoes are accurate, the spatial lighting effects are not discernible from the results. Therefore, the descriptive text written for LookX was also provided as a prompt to DALL-E2. This time, the results yielded visually faithful representations of the period architecture, with high-fidelity, depicting light entering the space in a beam-like manner, alongside accurate color frescoes.

4. Discussion

When the results obtained are examined, it is seen that different artificial intelligence bots give visual outputs in the context of their different abilities and limits. However, artificial intelligence results still yielded results parallel to ancient Egyptian architecture. Murals and frescoes are featured in all results, with the use of color most evident in Dall-E. However, the Egyptian columns, the high entrance, and the "divine light" filtering through the entrance gate were experienced as autonomous and original visual results. In this context, different artificial intelligence models possess capabilities and limitations in reflecting ancient Egyptian architecture. While the results may exhibit some common features, they underscore specific attributes uniquely interpreted and visualized by each artificial intelligence model. Furthermore, even when each prompt is inputted into the same artificial intelligence interface, the resulting visual outputs vary each time. This highly diversified situation offers architecture a rich array of alternatives. This autonomously rapid and diversified process is exciting for architecture. The findings of this study provide significant insights into how artificial intelligence technology interprets and visualizes complex and historically rich architectural structures.

The utilization of artificial intelligence bots that engage in text-to-image generation as a source of inspiration in architectural design has been extensively explored in various studies. However, this study delves into whether artificial intelligence can spatially contextualize the unknown interior visuals of ancient architectural structures while adhering to the literature. By addressing this inquiry, the study not only serves as a pilot investigation but also sheds light on subsequent research endeavors. Moreover, it is poised to expand the realm of architectural historical studies by leveraging contemporary technologies. Artificial intelligence is emerging as a new research frontier not only in architectural design but also in architectural history. Artificial intelligence techniques such as big data analysis, image recognition, and deep learning can contribute to the analysis and understanding of past structures in architectural history studies. While this study focuses on visualizing interior spaces for ancient periods, the same methods can be utilized to identify the characteristic features of specific architectural styles or track architectural changes over historical periods.

In the realm of architectural design, proficient brainstorming relies on the capacity to articulate concepts. Historically, sketches, images, and assorted visual aids have served as catalysts for brainstorming sessions and conveying design principles. Nonetheless, recent breakthroughs in generative artificial intelligence have enabled the production of intricate and lifelike depictions of architectural ideas, leveraging natural language prompts as a versatile interface. The visualization of unknown interior spaces in architectural history through artificial intelligence is considered a novel and groundbreaking phenomenon today. It can aid in better understanding the details, atmosphere, and design of historical interiors by bringing them to life. Artificial intelligence can play a significant role in virtually reconstructing past spaces by analyzing and interpreting architectural data. For instance, using remnants or architectural details uncovered during archaeological excavations, artificial intelligence algorithms can process this data to create realistic interior spaces in a computer environment. Such technology can support research in history and architecture, informing professionals in these fields. Additionally, it can be utilized for educational purposes, helping people to better comprehend and appreciate historical spaces. However, it is crucial for this technology to consider ethical and cultural sensitivities. Particularly, it is important for historical and culturally significant spaces to be represented accurately and evaluated carefully. At this point, it is worth noting that following the adoption of UNESCO's Convention for the Safeguarding of Intangible Cultural Heritage, the recreation, interpretation, and visual construction of spaces have become a significant area of focus (Agirbas & Yildiz, 2023). Similarly, this study seeks to create the atmosphere of a space within the context of the light-space relationship in ancient Egypt; however, it is presented solely as an exploratory experience. Moreover, expert supervision and validation may be necessary to assess the degree of realism and accuracy in the visuals generated by artificial intelligence. Therefore, architects and architectural historians will play a pivotal role in the decision-making process. However, various architectural traditions may evolve or disappear over time

due to factors such as changing lifestyles, climatic shifts, and environmental transformations (Agirbas, 2022). Therefore, examining and presenting the reasons for their disappearance is of critical importance. In this context, modeling intangible cultural heritage using new technologies is considered essential. Accordingly, this study explores this approach through an experimental application of text-to-image technology.

Ancient Egypt, famous for its monumental structures and architectural wonders, used natural lighting in a conscious and sophisticated way. The design and layout of the buildings were influenced by the availability and use of sunlight. This paper includes the act of measuring ancient Egyptian architecture as well as reflections on its meaning and function, spatializing them with today's technology. In the present digital era, human-computer interaction and virtual reality stand out as two of the most significant emerging technologies. Not only do these innovations offer engaging physical experiences for the promotion of cultural heritage, they also create an expansive virtual network space for its dissemination. Although both physical interaction design and virtual reality technology fall within the realm of interaction, they each emphasize different elements (Zeng et al., 2023). Virtual reality design is geared towards crafting a virtual environment for the visualization of cultural heritage, thus facilitating its widespread distribution via networks and focusing on the networked aspect.

In the age of digitalization, the spread of cultural heritage is transitioning from traditional, in-person interactions at heritage sites to a digitized format that transcends time and space constraints. Through the aid of modern digital technologies, elements such as visual culture, interactive concepts, virtual spatial understanding, and cultural values can be seamlessly blended, enabling cultural heritage to transcend the limitations of its physical form and offering a greater array of possibilities in a more fluid and rapid manner (Zeng et al., 2023).

5. Conclusions

The progress of human civilization reveals how the utilization of sunlight can significantly impact the evolution of global architecture. Beyond evident technical, biological, and practical considerations, the function of the sun in traditional societies when designing any structure was delineated by a conceptual backdrop grounded in the sun's natural functions within the world. Over millennia, this backdrop led to the establishment of a system of common and religious depictions of the divine and creative power of the sun. The quintessence of uncovering the implications and context behind a wide array of architectural techniques shaping the design from antiquity to modernity might lie in the archetype of the sun as the progenitor of all things within traditional societies and cultures.

Measuring archaeological remains is of course not a new process, but it is exciting to study it with new technological developments. The combination of traditional methods and technology can lead to more comprehensive understanding and increase discoveries. Of course, a lot of new, accurate and scientific information is obtained through traditional methods. However, the main thing in architectural visual results obtained with technology will not be the amount of data accumulated, but how we interpret and use the result. In this context, thinking and studying on ancient Egyptian architecture will create a new perspective for future strategies and studies and contribute to the continuity of architectural culture. This comment highlights an important point that the integration of archaeological studies and technology can provide a more comprehensive understanding and support the continuity of architectural culture. Additionally, it emphasizes that technology's significance lies not only in data accumulation but also in the interpretation and utilization of this data. Therefore, focusing on rich heritages such as ancient Egyptian architecture can constitute a valuable resource for future generations.

Employing generative artificial intelligence and procedural design techniques in architecture is not a recent phenomenon, with their roots tracing back to the 1970s. However, the emergence of text-to-image generation represents a significant shift in paradigm that could reshape the architectural design methodology. Text-to-image generation utilities stand as an exemplar of generative artificial intelligence in this context. These tools facilitate rapid conceptualization of ideas through natural language input, potentially revolutionizing how architects and designers conceive and convey their concepts. This study investigates the accessibility of interior spaces of ancient architectural structures through artificial intelligence. The utilization of text-to-image generation technologies represents a significant research domain in the field of ancient architecture, and this study is considered to contribute to the existing body of literature in this area. The findings demonstrate that specialized artificial intelligence models, trained with deep learning algorithms and extensive datasets, are effective in accurately representing the interior spaces of ancient architectural structures. These findings underscore the potential for researchers and historians to leverage artificial intelligence technology to revive and comprehend the interior spaces of ancient architectural structures. Future endeavors should aim to further expand the application of this technology and acquire deeper insights into ancient architecture.

Acknowledgements

I would like to express my gratitude to all my students, particularly Gazi Uğraş, Ali Bulut, Melih Sansarcı, and Sinem Kaymaz, who contributed to this study by actively participating in and attentively following my course, "Space and Natural Light." Their valuable contributions, insights, and feedback have also been a source of inspiration for me.

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