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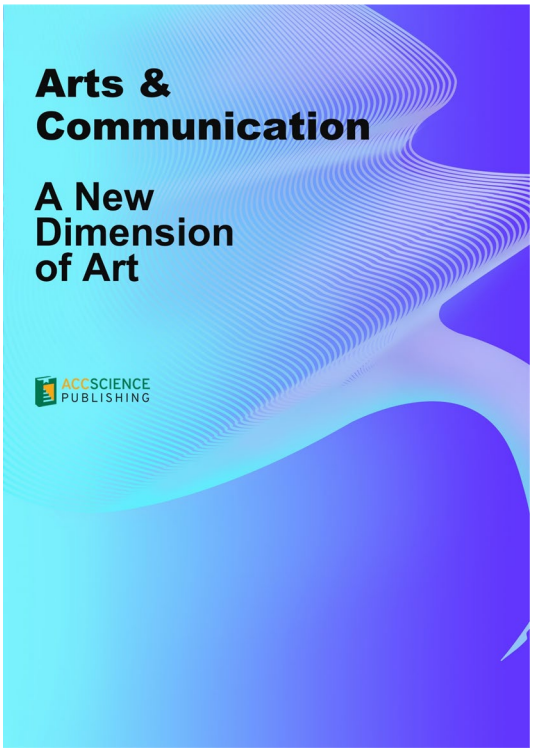

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CONTENTS

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Arts & Communication

REVIEW ARTICLE

Exploring the potential application of technology for revitalizing traditional performance arts: Costume and musical elements in Yakshagana

Shashiraj Somayaji*, Narahari N, Shivashankar R. Srivatsa, and Sangamesh C. Godi

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Abstract

The artistic heritage of a country plays a vital role in ensuring its enduring legacy. Thus, dance-drama performance arts, such as Yakshagana, serve as symbols of India's rich cultural heritage. However, despite significant technological advancements, traditional art forms have often been overlooked. At present, many traditional Indian art forms are facing numerous difficulties and challenges, while artists and organizers continue to rely on traditional designs and manufacturing techniques, raising concerns about productivity and efficiency. To preserve and nurture these art forms for future generations, research and development on the technological needs of artists and other stakeholders is essential. This study, therefore, first examined the technological requirements of the Yakshagana community. Based on the findings, demands for significant improvements in costume and musical elements were identified, which are particularly relevant for researchers in materials science and engineering. Specifically, these demands are discussed in terms of their varieties, materials, and manufacturing methods. Next, this study explores the potential application of scientific technology and research opportunities in the field of materials engineering to enhance Yakshagana as an art form. This includes experimentation, testing, modeling, analysis, reverse engineering, the use of composite material technology, additive manufacturing, vibroacoustic analysis, and advanced manufacturing technology, among others. It is hoped that the results of this study will not only expand the scope of technical research and contribute to the performance arts community but also inspire future research on similar challenges across various art disciplines.

Keywords: Technological revitalization; Research opportunities; Materials engineering; Costume elements; Musical elements; Artistic heritage; Yakshagana

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1. Introduction

The performing arts in India have contributed to the cultural, emotional, ethical, and societal development of people, including artists. Comprising aspects such as music, dance, body language, dialogues, stage techniques, makeup, and costumes, performing

art forms also serve as highly effective mediums of entertainment, communication, and education. The previous research has indicated that engagement with performing arts offers significant physical and mental health benefits to both practitioners and viewers. For example, art therapy utilizes various artistic approaches for therapeutic purposes. n addition, learning and performing art forms represent valuable extracurricular activities for youth, fostering their holistic development. Traditional art forms, further, contribute to the festive spirit at various celebrations such as festivals, weddings, and other communal gatherings. Among diverse dance forms, Yakshagana stands out as a distinctive dance-drama form originating from Karnataka, a southern state of India. Specifically, Yakshagana encompasses unique elements, including music, dance, costume, vocal styles, and theatrical presentation.[1]

Overall, two distinctive styles of Yakshagana are prevalent: Badaguthittu, or the northern style of the Uttara Kannada and Udupi districts (Figure 1A), and Thenkuthittu, or the southern style of the Dakshina Kannada district (Figure 1B). Despite numerous similarities between these two forms, the instruments, vocal styles, and dance patterns are significantly distinct. However, all the aspects of the theater are present in both.[2] In the 1960s, Indian polymath Dr. Shivarama Karanth's pioneering research contributions on Yakshagana made this art form gain renown within India and abroad.[3] His work also contributed to several widely held beliefs about Yakshagana and its development. Since then, many scholars have documented the values and traditions of this art form.[4,5]

A notable scientific and engineering-based exploration of Yakshagana was undertaken by Gopalkrishna Hegde and Gautam Hegde,[6] who delved into its mathematical parameters to understand its performance execution and artistic potential. Specifically, they developed empirical mathematical models to estimate performance indices and quality. In addition, their research focused on the synchronization of the primary components of Yakshagana for high-quality presentations, underscoring the integration of art as a cohesive performance, and paved the way for future scientific inquiries into the extended performances of traditional Indian art forms.

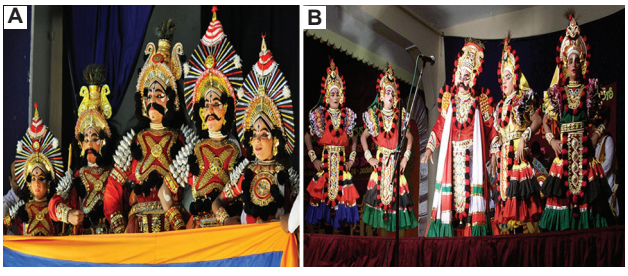

Figure 1. Two distinctive styles of Yakshagana: (A) Badaguthittu (the northern style) and (B) Thenkuthittu (the southern style)

In Yakshagana performances, the songs are performed by the *Bhagavata*, a member of the background music team (*himmela*). This collective group of musicians consists of the Bhagavata, a maddale player, and a chande player.[6] The Bhagavata's singing is synchronized with the shruti svara (a pitch set using a tuning box or harmonium), ensuring harmony with the maddale and chande players. In this regard, as the Bhagavata raises the pitch (shruti) at regular intervals during the performance, the maddale and chande are tuned to meet the pitch. The coordination among these musicians is crucial, and any disharmony or off-pitch beats can affect the Bhagavatam's tone.

In scientific studies, researchers have analyzed the vocal characteristics of Yakshagana singers, comparing them with non-singers of similar age.[7] In addition, investigations into vocal health have been conducted among Yakshagana singers, contrasting those who have reported voice issues to those without such problems.[8] These studies have shed light on the physiological aspects of Yakshagana singing and its impact on vocal well-being.

Meanwhile, music and musical instruments are integral parts of any performing art form. However, among the limited technical research on the musical instruments in traditional Indian art forms, two studies have focused on the mridangam, an important percussion instrument in the Indian musical family. In one study, a new membrane model based on extensive measurements was developed.[9] In this case, the pseudo-spectral and finite element methods were employed to solve a vibration problem. In a different study, an analytical model was created for the wooden shell of the mridangam, with a smaller centrally loaded membrane in the right and a larger membrane on the left.[10] Natural frequencies and mode shapes were also calculated and validated using a 3D finite element model. Moderate changes to the instrument's geometry resulted in a slight shift for the first mode and essentially no noticeable change in the higher modes. However, the cavity response to boundary excitations for various forms indicated a potential impact on vibroacoustic performance.

As for other Indian musical instruments, one study used physics-based simulations of the sound generated by mallet percussion instruments in the time domain through a 3D-coupled vibroacoustic model using the finite element method.[11] Another study considered material replacement and conducted acoustic testing for creating an Indian bamboo flute for commercial production. In this case, polyvinyl chloride was chosen as an alternate material, since it can provide high returns at low input cost.[12] In

related research, the fundamental and second harmonic frequencies of a bamboo angklung were analyzed. Specifically, the estimated frequencies of each rattle tube were compared with the pitch from the respective tube.[13]

In his handbook on materials for percussion instruments, Voichita Bucur described the properties of such materials for the timpani, marimba, xylophone, vibraphone, gong, cymbal, triangle, celesta, and castanets.[14] This resource mainly focused on percussion instruments used in symphony orchestras, considering centuries of musical art and history. This resource also fills the void in the technical literature by detailing the qualities of the materials. However, information on the instruments used in folk arts, such as Yakshagana, is unavailable.

A related review highlighted the evolution of musical instrument manufacturing toward innovative materials such as composite materials, 3D-printed materials, and metamaterials.[15] These alternatives were developed as a response to challenges such as scarcity of quality tone woods and environmental concerns. Materials, such as carbon fiber, graphite fiber, and ceramic polymers, offer advantages in durability, weight reduction, and customizable acoustics. Meanwhile, 3D printing technology enables precise engineering of instrument components and unprecedented customization. As for metamaterials, they provide unique structural designs for tailored vibrational characteristics, promising novel possibilities in sound production. Overall, this exploration of advanced materials and technologies in musical instruments set the stage for future innovations in instrument design and performance, especially in art forms such as Yakshagana.

In another study, the utilization of carbon fiber in musical instrument construction was examined, with focus on a carbon fiber cello that underwent sound quality assessment through Chladni experiments and Fourier analysis.[16] In this case, a criterion for musical sound based on Fourier analysis was developed, establishing the efficacy of carbon fiber as a revolutionary material for musical instrument manufacturing. The significance of this research stemmed from its technological innovation, promotion of environmental sustainability through alternative materials, and contribution to the connection of technology and art in instrument design.

As for Yakshagana, costumes, ornaments, and makeup are important components because they depict characters and bring focus to artists' expressions. The majority of the costumes and ornaments used today are hand-woven fabrics and wooden items. Common wooden ornaments are headdresses (crowns or head gears), chest ornaments, ear ornaments, armlets, necklaces, and belts. These ornaments are hand-carved and then decorated with fabric, mirrors, beads, and shiny foils. Significant time and effort are involved in the production of such ornaments. Meanwhile, skilled craftsmen who produce these ornaments face challenges such as the availability of raw materials, maintenance requirements, material wastage, inconsistency in shape or aesthetics, lead times, and inventory. All of these factors increase the costs of these ornaments.

A previous case study on Yakshagana costumes focused on the technical research of *bhujakeerthi* (shoulder ornaments), while the issues of inconsistency, cost, weight, lead time, etc., were addressed with the help of engineering design, analysis, and manufacturing techniques.[17] Specifically, the beads of bhujakeerthi, which were originally made from wood (*Gmelina arborea*), were manufactured using additive manufacturing. In this case, the weight of each bead was reduced using a hollow design, while the wall thickness of the modified bead was optimized through finite element simulations. After comparison, feasible material was selected, based on the strength and stiffness of parts with different 3D printing materials. Overall, this study demonstrated the potential for technological applications in the costume designs of art forms such as Yakshagana.

Conventionally, a Yakshagana performance spans from dusk to dawn. In many instances, thousands of spectators attend such performances (Figure 2). On average, commercial Yakshagana performances, comprising 25 full-fledged professional troupes and 200 amateur troops, generate a turnover of INR60 million (approx. USD 720,000) through approximately 5,000 shows a year. Professional troupes go on tour from November to May, presenting 160 – 180 performances in different locations of the state. Several teams occasionally perform outside the state or even abroad. Overall, there are about a thousand professional artists, with many more amateurs in this art genre. Numerous groups of Yakshagana artists and

Figure 2. Immense audience at a Yakshagana performance

professors exist throughout India, as well as in the United States, Canada, the United Arab Emirates, and Germany.

At present, many Indian art forms, including Yakshagana, are facing significant challenges due to the lack of proper tools, techniques, and systems. For art forms such as drama, song, dance, and film, technology has strengthened various aspects, including propaganda, communication, pre-production, learning, display, printing, viewing, transmission, feedback, criticism, and artist security. However, to date, advancements in materials science and manufacturing technologies have not been effectively used in performance arts.

In India, Kathakali, Kutiyattam (Kerala), Terukkuttu (Tamil Nadu), Raslila (Manipur), Chhau (West Bengal), etc., and other art forms in the world, such as Kabuki (Japan) and Bian Lian (China), use traditional costumes and percussion instruments.[18,19] Although there are many studies on the literature and sociocultural values of these art forms, limited research has focused on their costumes and instruments, which have strong international relevance. Furthermore, since this domain is not a mainstream commercial segment, no noteworthy technical research has been undertaken in regard to costumes and percussion instruments. The absence of a connection between technical experts and performers is another reason for this gap.

However, as people become increasingly aware of the value and benefits of the performing arts, the primary challenge is to sustain and spread traditional art forms in the face of modernization and globalization. In this regard, effective use of technology is vital for preserving, growing, and passing along these magnificent art forms to future generations.

1.1. Understanding the needs through a survey

Understanding the need for technology in any domain is crucial while determining whether the stakeholders are satisfied with current technological developments is another important aspect. To address these aspects and to establish a connection between the stakeholders of Yakshagana and technical researchers, a survey was conducted. The key objectives were to determine whether there are any needs that call for immediate attention and whether the stakeholders are desperately seeking certain technological developments.

A total of 526 participants, including audience members, professional and amateur artists, supporters, researchers, learners, organizers, and costume experts, participated in the survey. When asked which areas of Yakshagana should see technological improvements, the majority of the participants mentioned advertising and broadcasting as the top priority, followed by lighting, choreography, and costume materials. Literature research and musical instrument innovations were also identified as significant areas for advancement (Figure 3A).

Specifically, the survey revealed overwhelming support (96%) for exploring technical research possibilities within Yakshagana. Notably, 91% of the participants expressed a desire to reduce the time required for costume changes, while 92% emphasized the need for lighter, yet durable costumes (Figures 3C and D). More than 90% of participants believed that technology could address the production and manufacturing challenges associated with Yakshagana costumes (Figure 3E). Moreover, the participants emphasized the need to expand research beyond traditional areas, such as literature and artist studies, to encompass costume and musical instrument design and production (Figure 3F). This underscores the vast potential for technical research and development in Yakshagana (Figure 3B).

Among the numerous aspects of Yakshagana open to technical research, the areas of literature, broadcasting, lighting, and choreography are less critical for engineering studies. Instead, two key areas stand out for materials engineering research: the design and development of costume elements and musical instruments. Thus, this study explores specific research possibilities related to ornaments and percussion instruments used in Badaguthittu Yakshagana, highlighting avenues for future innovation and exploration.

2. Major ornaments of Yakshagana

Ornaments used in Badaguthittu slightly differ in their design and construction from Thenkuthittu. However, all of these ornaments are unique and attract attention, since they are made of light wood, canvas, and fabric. Specifically, these ornaments are hand-carved on wood covered with gold/aluminum foils, and inlaid with colored mirrors, stones, and beetle wings. Major ornaments worn by common characters in Badaguthittu Yakshagana are shown in Figure 4. They include the *pagade* (main structure of a headdress), the *karnapathra* (ornament that covers the ears), wrist and shoulder ornaments, belts, chest ornaments, hanging girdles, bracelets, anklets, and so on. Figure 5 presents various armlets, shoulder ornaments, chest ornaments, belts, and other wooden jewels. Overall, these headdresses and other ornaments are examples of beautiful artistic work.

Figure 6A-C depicts a variety of headdresses, each consisting of different components. For example, the crown (locally called *Kirita*) type of headgear in Figure 6A is typically made from a tubular hollow design of wood and inlaid with glass, mirror, and attractive artificial stones.

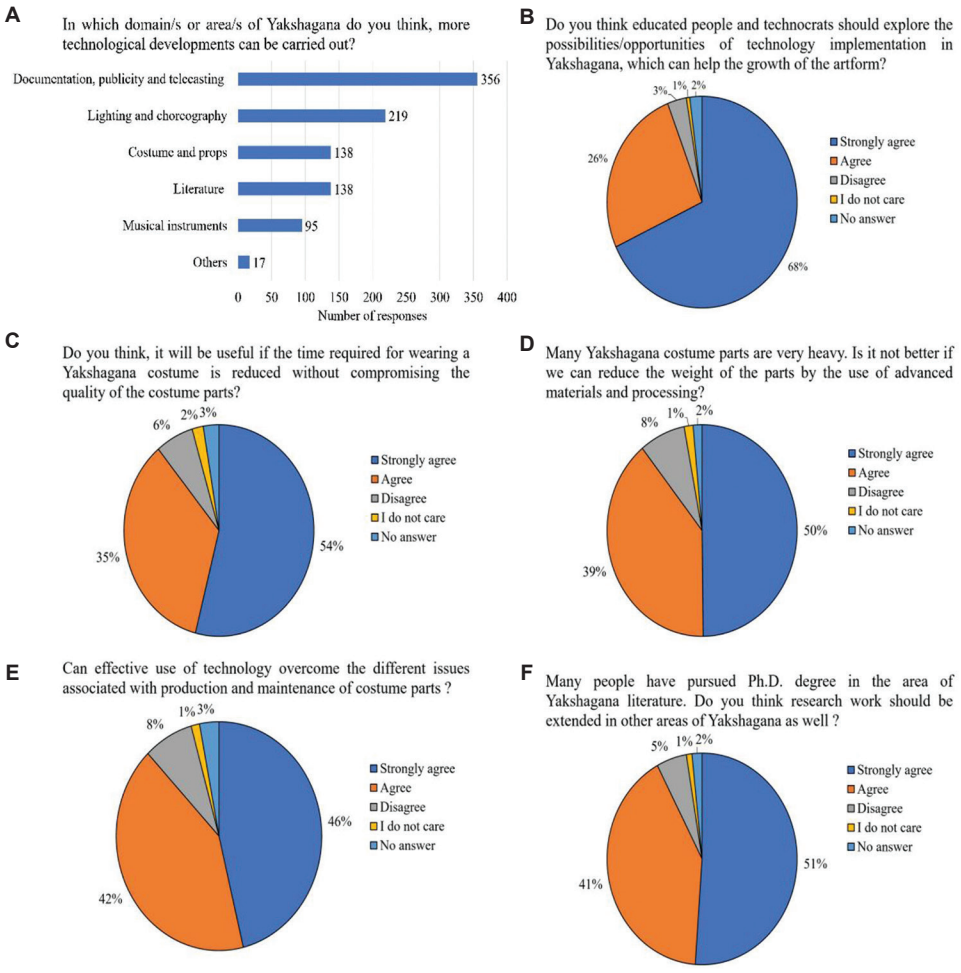

Figure 3. Survey responses from the Yakshagana community

A peacock hovering on top and a pair of wings on the side make a stunning combination. Moreover, these headdresses vary in size, color, and shape. Previously, there was a highly skilled class of artisans creating these ornaments. However, currently, the number of skilled workers is very limited. The shortage of resources, reduced profits, and lack of incentives are causing ornament production to become expensive and complicated.

Likewise, many of the other ornaments are handcrafted from wood, which requires skill. Meanwhile, the golden foil cover (silver- or gold-colored aluminum foil) of these ornaments frequently peels off after regular use. Other key considerations include the availability of materials (wood), the quality in terms of shape and size, waste, weight, cost, and durability. These components are also subject to severe temperatures and humidity conditions. In this regard, the ambient temperature generally ranges from 15°C to 40°C, with relative humidity ranging from 40% to 95%.

3. Musical instruments of Yakshagana

The music during a Yakshagana performance is entirely improvised. In Badaguthittu Yakshagana, three musicians perform using their musical instruments, with a vocalist singing the poems while holding the tuning box (shruti) and playing finger cymbals (locally called *thaala*) (Figure 7A). These finger cymbals are typically constructed of bronze, with 78% copper and 22% tin by mass. Meanwhile, maddale and chande artists support the vocalist on their percussion instruments. The maddale (similar to the mridangam) (Figure 7B) is played barehanded and is a double-sided instrument whose body is usually made from a hollow tubular piece of wood (drum). The two circular openings of the drum are covered with thick, seasoned leather membranes, which are laced together with leather straps along the length of the drum to create high tension. The chande (Figure 7C) is also made from a piece of hollow cylindrical wood with pre-tensioned membranes at the ends. However, it is held vertically and played using two

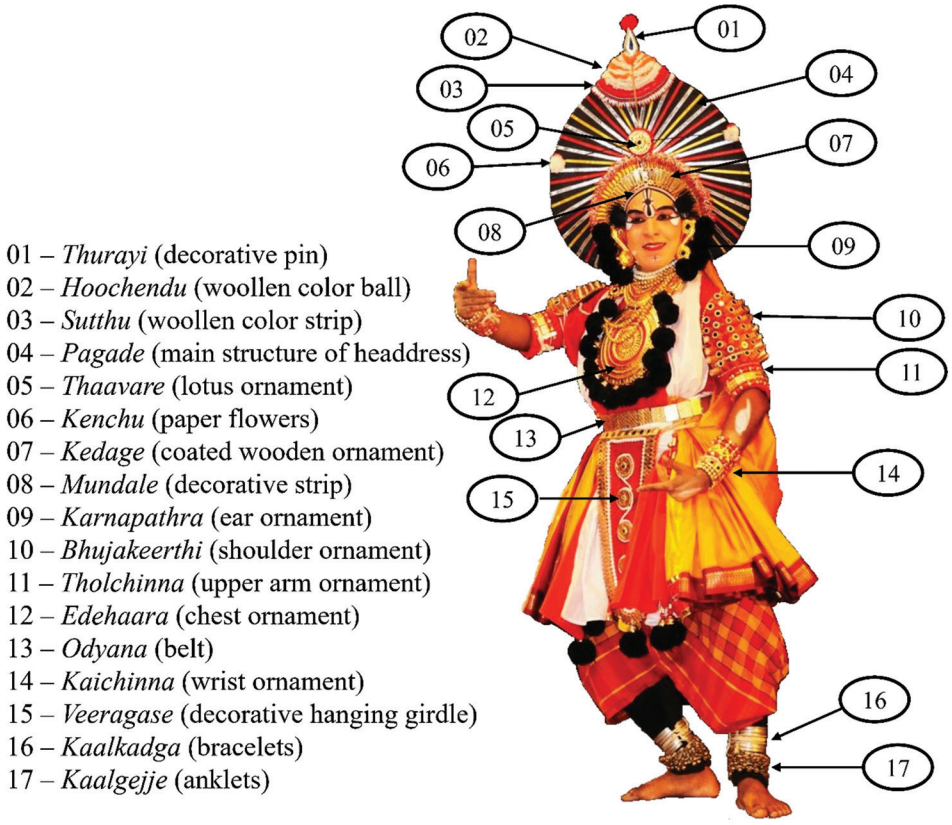

Figure 4. Major ornaments (Badaguthittu Yakshagana)

Figure 5. Variety of ornaments (Badaguthittu Yakshagana)

sticks. A common aspect of the maddale and mridangam instruments is the presence of an applied mass (shown in black in Figure 7B) on the membrane to change its density distribution, whereas in the chande, no such mass is used.

4. Research opportunities

The survival of the Yakshagana art form requires technical remedies to mitigate the difficulties experienced by the

Figure 6. Variety of headdresses in Badaguthittu Yakshagana: (A) Crown (*kireeta*) type; (B) kedagemundale type; (C) mundasu type; and (D) bannada kireeta type

Figure 7. Musical instruments used in Yakshagana: (A) thaala (cymbals); (B) maddale; and (C) chande

artists when staging the productions. Improvements in the development of Yakshagana costume materials and musical instruments are of significant importance. Although the literature review revealed limited research on materials engineering for the performing arts in general, there are numerous unexplored possibilities for the requirements of art forms, such as Yakshagana, including reverse engineering, bio-inspired design, parametric design principles, materials engineering, engineering analysis, sophisticated production methods, etc. In this regard, materials engineering, design, production, processing, and reverse engineering are some of the key areas of the mechanical engineering discipline whereby engineers and researchers can contribute.

4.1. Finding suitable material alternatives

The main requirements for the ornaments in this art form are cost effectiveness, reduction in weight, shorter production lead times, and increased quality and durability. At present, the majority of the ornaments are made from solid wooden parts, while leather is used for the membranes and straps of the musical instruments. Replacing traditional wooden and leather materials with modern materials can be one solution to these problems. Meanwhile, the difficulties in replacing the color foils can be addressed by researching customized paints, appropriate adhesives, suitable coating techniques, and related processes. Variations in ambient temperature and humidity should also be considered.

In the domain of musical instruments, the scarcity of appropriate wooden raw materials and the complexity in processing leather membranes and tuning them to the required tension levels during production are major problems. In fact, artists frequently struggle to tune the instruments to the required pitch during performance, and these instruments are prone to atmospheric conditions such as temperature and humidity. To address these issues, a material replacement for wood and leather must be researched. This process of re-designing the instruments with alternative materials also requires a comprehensive study of mechanical design and vibroacoustics.

In India, there have been few attempts to create musical instruments using synthetic materials. However, these efforts have been mainly experimental and not supported by systematic technical research, resulting in the limited success of these endeavors. Furthermore, the musical instruments utilized in Yakshagana must include distinct functions and characteristics, which require a systematic scientific study.

4.2. Re-design and optimization

At present, the geometry and shapes of the majority of the costume parts are inconsistent. Thus, the parts of different varieties and sizes must be standardized. In this regard, the geometries of the ornaments can be internally altered to optimize the material distribution and reduce the weight of the parts. Any inconsistencies in the shape or quality of the parts due to hand carving can be addressed using reverse engineering techniques such as 3D scanning.

As for the weapons (locally called *ayudhas*) carried by the actors[20] (Figure 8) during the performance, they are typically crafted from steel or wood, presenting considerable weight challenges. The bulkiness of these weapons, particularly the long and heavy ones, also poses difficulties for transportation. Hence, there is a need to explore new material designs that can address these issues such as investigating collapsible, foldable, or detachable weapon designs. To package and preserve the parts and equipment, interactive approaches, such as reverse

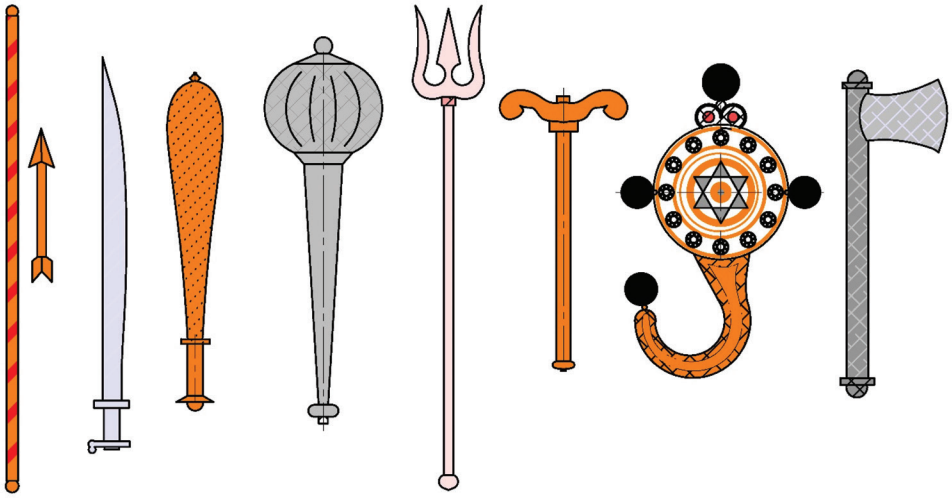

Figure 8. Weapons (*ayudhas*) used in Badaguthittu Yakshagana

engineering, finite element analysis, and rapid prototyping, can be employed.[21]

4.3. Reinforcement of manufacturing/fabrication methods

In general, the strength and stiffness in the costume parts differ from the mechanical parts in, for example, the automotive, aerospace, or other similar sectors. This provides a scope for research in the area of composite materials as a replacement for wood and leather. For instance, advanced manufacturing techniques, such as injection molding, can be adopted for the mass production of certain parts. The possibility of employing additive manufacturing techniques to produce complex shapes of the parts can also be explored.

Regarding the wearing of costume parts, it can be tedious and time-consuming. For example, there is the traditional method of building a pagade using *atte* (Figure 9). In this process, the artists must build the headdresses on their own before every performance. However, this can be simplified to reduce time and effort. In recent years, artists have found a more straightforward approach using a pre-made thermocol (made from polystyrene) headdress. Nevertheless, various concerns have emerged regarding its fit, size, and shape, with potential flaws (Figure 10) such as durability. Hence, a primary focal area is the design and development of the headdresses (Figure 6). Specifically, investigations in this area can help standardize the shape, size, design, parametric modeling, structural analysis, and standard production techniques for the headdress assembly, significantly contributing to the art form in particular, and benefiting the Yakshagana community in general. The findings can also serve as a model for future research into similar challenges in other creative genres.

4.4. Experimentation and testing

Since costume parts are mainly for decoration and normally subjected to less intense operating loads, the components can be designed according to stiffness requirements, instead of extreme structural, fatigue, or thermal conditions. However, to understand the operating loads of these components, it is essential to closely examine their usage. It is also necessary to study the different modes of failure and the distribution of structural loads or load paths. In this regard, extensive measurements and experimentation during the performance are required. For example, shape distortion and tip deformation are common issues (Figure 10) with pagade-type headdresses, based on the artists' experiences. Specifically, the tip of the pagade can easily be broken or bent with regular use, while permanent edge deformation can occur on each side where the thread of the *thaavare* (lotus decoration) passes through. Thus, visual identification of the damaged pieces is required to validate all of the features and the possibility of other failure mechanisms. In addition, photographs and video clips can be used to document the relevant information, while measurements should be taken to determine the dimensions, weight, size variant details, operational loads, and other characteristics of the parts. Structural simulations under extreme loading conditions can also provide a more detailed explanation for such breakdowns. Finally, holding frequent discussions with artists and conducting field experiments can help comprehend the practical challenges and requirements of the newly produced parts or ornaments.

4.5. Sustainable/green solutions

Recycling and reusing materials as well as using biodegradable materials can lead to sustainable solutions

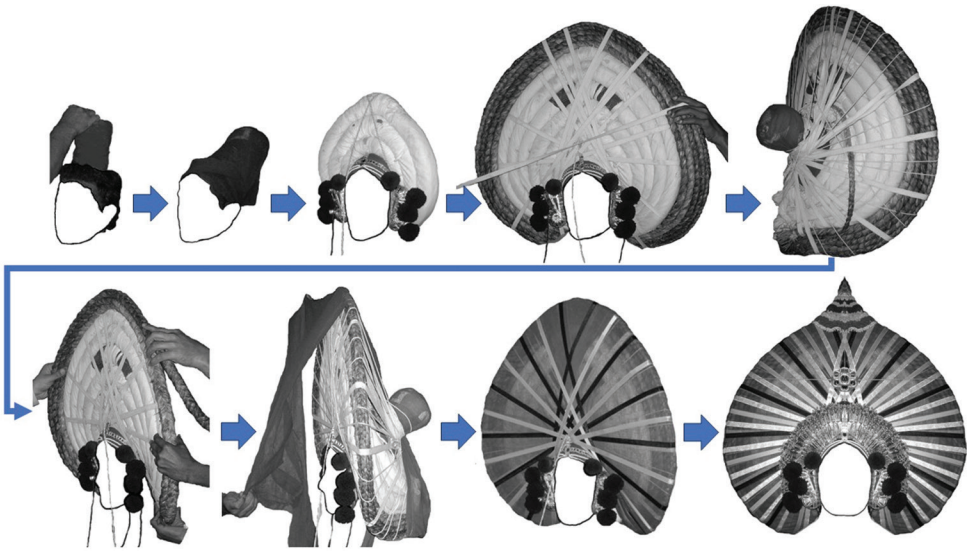

Figure 9. Traditional process of building the *pagade* headdress using *atte*

Figure 10. Common defects of the ready-to-use *pagade* component of the headdress

and reduce the cost of components. In this regard, technologies to recycle paper and plastic materials, and manufacture the appropriate components should be developed. Accessories should also be made from biodegradable and environmentally friendly materials.

In the realm of Yakshagana, the significance of sustainable and green solutions for its ornaments and musical instruments cannot be overstated. Yakshagana, deeply rooted in local traditions and customs, heavily relies on intricate ornaments and finely crafted musical instruments to bring its narratives to life. Embracing sustainable practices in the creation of these artifacts not only respects the environment but also safeguards the traditions for future generations. By employing eco-friendly materials, renewable energy sources, and environmentally conscious manufacturing processes, artisans and craftsmen can mitigate the environmental impact associated with their creations. Moreover, prioritizing sustainability fosters a sense of responsibility toward preserving natural resources and ecosystems, aligning with the ethos of Yakshagana as a cultural expression that is deeply intertwined with the natural world. Ultimately, integrating sustainable and green solutions into the production of Yakshagana ornaments and musical instruments not only upholds the integrity of the art form but also contributes to the broader movement toward environmental stewardship and conservation.

Similarly, all of the aforementioned research possibilities can be related to Thenkuthittu Yakshagana. Many other

similar art forms make use of a variety of headdresses and ornaments and employ musical instruments. However, because noteworthy research has not been conducted on any of these aspects, future research on Yakshagana can stimulate ideas and approaches that are relevant to other traditional art forms.

5. Conclusion

Pioneering researchers must be mindful of the importance, necessity, and scope of a newly developing field of research. Artists and researchers are often unaware that many of the challenges in the field of art forms are within the scope of technical research. In this study, the survey conducted among the stakeholders of Yakshagana clearly showed that many technological needs must be addressed. In addition, it revealed various issues regarding costumes and musical instruments of Yakshagana in relation to the discipline of materials engineering. In this case, wood is the primary material used for ornaments and musical instruments, while leather is used for the membranes and straps of musical instruments. However, a critical need is to identify suitable replacements for wood and leather, which requires experimentation and testing, modeling, analysis, reverse engineering, use of composite material technology, additive manufacturing, vibration and acoustic analysis, and advanced manufacturing technology. Since there are so many other art forms with comparable requirements, research and development linked to one of them can be extended to the others. Thus, this study's findings will be valuable both for the development of Yakshagana, in particular and traditional art forms, in general.

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Conflict of interest

The authors declare that they have no competing interests.

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Ethics approval and consent to participate

Not applicable.

Consent for publication

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Availability of data

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ARTICLE

Plus Ultra: Female body in public sphere at 8th Biennial Sea Salon

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Abstract

Oriana Duarte's compelling piece, "Plus Ultra," unveiled at the 8th Biennial Sea Salon (Vitória-Espírito Santo, Brazil), intricately weaves personal narratives that accentuate the interplay between movement, landscape, and the human form. This artwork serves as a profound exploration of subjectivity, inviting the audience to immerse themselves in a realm that is both geographical and virtual. Duarte's creation prompts a series of pivotal inquiries, unraveling the layers of experience within the urban landscape of Espírito Santo. The first query delves into the intricate dynamics of encountering the artwork and its inherent esthetic and political ties within this specific locale. The second interrogates the role of the female body in "Plus Ultra," shedding light on how it becomes a central element in the narrative. Ultimately, the third question scrutinizes the evaluation of female artists' participation within the broader context of the 8th Biennial Sea Salon. The findings from this exploration resonate profoundly, emphasizing the critical relevance of interconnected themes such as art, body, subjectivity, gender, and space in contemporary artistic discourse. Duarte's work not only underscores the symbiosis between these elements but also unveils the transformative potential of corporeality in reshaping the urban landscape. By decoding the intricate relationships within "Plus Ultra," this study contributes to a deeper understanding of how contemporary art serves as a catalyst for redefining not only physical spaces but also societal perceptions, especially when viewed through the lens of female artistic expression.

Keywords: Contemporary art; Oriana Duarte; Body; Gender; Public art; Subjectivity

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1. Introduction

This paper presents an excerpt regarding research conducted at the Postgraduate Program in Arts at the Federal University of Espírito Santo, Brazil (PPGA-UFES), and the Laboratory of Extension and Research in Arts (LEENA-UFES), focusing on the representation of women in public art in the state of Espírito Santo. The overall objective is to deepen the studies on artistic expressions in the context of Espírito Santo, a terrain that is still relatively invisible when compared to other states in the southeastern region.

To delve into the art scene of Espírito Santo, it is imperative to examine key facets of the state's historical, political, and social formation. This exploration aims to scrutinize the entrenched hegemony of major cultural centers, contrasting them with regions often deemed "peripheral." It involves questioning the persistence of a colonial narrative that, rather than acknowledging and nurturing diverse artistic landscapes, tends to neglect and

dismantle them. This process occurs in favor of upholding the dominant discourse of a cultural metropolis, to which we may be perceived as subservient.

While it is not suitable to present a comprehensive social, political, or economic history of the state in this context, it is pertinent to underscore specific traits that have positioned Espírito Santo on the fringes of development, despite its coastal location and role as a conduit for abundant natural resources. The state's isolation and the consequent deficiency in advanced knowledge and skills can be traced back to diverse factors, including colonization by a grantee with limited financial means and political clout. This isolation endured through the brutal eradication of native populations in violent conflicts and the suppression of local cultural practices. Furthermore, it arises from the settlement and colonization by ethnic groups that adhere to cultural practices emphasizing seclusion.

While historiographical accounts of Espírito Santo suggest the emergence of a reserved and distrustful society, one seemingly detached from the ongoing process of shaping and engaging with contemporary national culture, there was a notable shift in the 1990s. During this period, there was a greater openness to incentives specifically directed at supporting local art production. Against this backdrop, the Municipal Government of Vitória (PMV), in collaboration with the Capitania dos Portos through the Secretary of Culture (SEMC), launched the 1st edition of the Sea Salon in 1999. The initiative aimed to invest in the cultural development of the region, with the sea serving as the central theme for artistic projects participating ever since.

Initially limited to artists from the states of Espírito Santo and Minas Gerais, within the jurisdiction of the Capitania dos Portos, the salon underwent a pivotal change starting from the seventh edition in 2006. Recognizing the relevance of broadening the event's scope, the organizers decided to make it a national platform, intending to enhance visibility and prominence. Simultaneously, the venue was relocated to the warehouses of the Port of Vitória, Espírito Santo.[1] In the eighth edition, the exhibition solidified its connection with the urban landscape, fully exploring the city's boundaries and definitively departing from the "White Cube."[2]

The 8th Biennial Sea Salon, titled "Waves, Bridges, and Navigable Interventions," unfolded from December 20, 2008, to February 5, 2009. This dynamic event showcased 12 ephemeral artistic proposals and one permanent installation, transforming the area delineated between the Historic Center of Vitória and Beira Mar Avenue into an artistic canvas. The chosen route sought to rekindle the city of Espírito Santo's expansion movement spanning from the 1960s to the 1990s.

The driving forces behind the exhibited works were the interplay of sea, city, and art. These central elements were meticulously selected through a public call, with artists contributing their unique perspectives. Notably, one exceptional piece diverged from this process – the work of the French artist and urban planner Jean–Blaise Picheral which was commissioned by SEMC (the only permanent work among the participants).

The highlight of the 8th Biennial Sea Salon was through urban interventions, showcasing artworks outdoors and redefining specific locations in the city. This process established a strong connection between passersby, the urban landscape, and the public sphere. The SEMC received 110 submissions from 13 states, with the majority being from Espírito Santo.[3] This contributed to a higher presence of local artists in the final selection.

The following artworks were part of the exhibition: "Do pó ao pó" (Laerte Ramos), "grandePEQUENAcatraia" (Marcelo Gandini), "Liquidas Fronteiras" (Lucimar Bello), "Flutuante: Ego trip Pré-sal" (João Wesley and Sandro Novaes), "ATENÇÃO: ARTE" (Jo Name), "Folhetim sereia" (Herbert Bastos), "O retorno de Araribóia" (Coletivo Maruipe), "Marí[n]timo" (Melina Almada), "nós vemos a cidade como a cidade nos vê" (Heraldo Borges), "Caminho das águas" (Piatan Lube), "Você vê" (Jean Picheral), "O silêncio do martelo" (Fabricio Carvalho), and "Projeto Plus Ultra" (Oriana Duarte) – some of those artworks and their creative process can be seen at https://www.flickr.com/photos/bienal2/with/3269284983 [last accessed: March 26, 2023].

Among these works, Oriana Duarte's project, "Plus Ultra," stands out as a captivating exploration saturated with personal connections, illuminating the intricacies of subjectivity within the interplay of movement, landscape, and the human body. This project unfolds as a nuanced and intricate exploration, intertwining various layers of actions that delve into the artist's profound experiences with rowing. It encompasses the sharing of not only the physical aspects of rowing but also the emotional and societal dimensions that are inherent to the sport. This includes delving into the challenges, pains, unexpected accidents, and instances of misogyny that the artist has encountered throughout her engagement with rowing. By sharing these personal experiences, the project goes beyond the physical act of rowing, offering a comprehensive insight into the complexities and nuances that shape the artist's relationship with this sport. What sets "Plus Ultra" apart is its intricate dance of esthetic enjoyment, seamlessly harmonizing with the technical finesse of photography and video, skillfully capturing fleeting moments in time. The project also navigates the evolving landscapes encountered

across different bodies of water, adding a dynamic layer to the narrative. Integral to the essence of "Plus Ultra" is the deliberate use of the artist's own body as a unique and expressive instrument, further enhancing the depth and resonance of this artistic endeavor.

2. Plus Ultra: Esthetic-political connections, body, and subjectivity

Oriana Duarte, a native of Campina Grande, Paraíba, has been a presence in the art scene since the 1990s. Her artworks incorporate subjects such as the body, landscape, subjectivity, and experimental elements. The practice of self-expression and the exploration of corporeal limits serve as pivotal aspects in comprehending her artistic trajectory. Her journey is characterized by contemplative reflections that aim to forge connections between life, art, and the urban environment.

Her poetics are laden with a constant exchange between her body and the public sphere. Installations, drawings, video, photography, and performance are part of Oriana's artistic repertoire, and her works engage in a strong dialog with each other. If we quickly look back at previous works, such as "Playground" (1995), "*A coisa em si*" (1997, available at https://enciclopedia.itaucultural.org.br/pessoa27038/oriana-duarte [last accessed at: March 26, 2024]), and "*Dos Heteróclitos: enquanto campo de ação*" (2002, available at: https://eba.ufmg.br/colecaolivrodeartista/?p=4990 [last accessed at: March 26, 2024]), we will witness how potent the fusion of her body with the geographical space is. This fusion narrates possibilities of reconsidering the exchange between interior and exterior, high and low, proportional and disproportional, as well as a return to origins.

In "Plus Ultra," these facets come to the forefront, especially when contemplating the intricate interplay of the body, oar, and city in the crafting of an expressiveness tethered to philosophical themes drawn from Michel Foucault's works, notably "Ethics, Sexuality, and Politics" (2006). This piece delves into the historical narrative of Western sexuality in relation to ethics and the formation of subjects. The Latin phrase "Plus Ultra," signifying "further beyond," initially conceived as a performance involving rowing along the Capibaribe River, coursing through the city of Recife, was meticulously documented in videos and unfolded into a tapestry of drawings, photos, and texts. According to the artist, the intention was to "provoke the emergence of inspiring metaphors of the body-environment relationship".[4,p.353] Subsequently, the project gained dimension and was continued in different waters of Brazil, including those of Vitória Bay. In this context, the work translated into a set of artistic operations that proposed the immersion of the observer in a geovirtual experience[5] (Figure 1).

A camera records aspects of Oriana's rowing that escape her direct vision, such as the back of her head with its hair, the strained muscles of her back, and the motion of her arms as she handles the oars. This repetitive exercise takes on a fixed, almost silent form, except when disrupted by the contrasting elements of changing landscape and body. Over time, the evolving relationship between landscape and body shifts the observer's perspective: now, she becomes both the boat and the rower, focused on the present moment without clear sight of the future, persistently moving forward.

In documenting the constant flow of rowing in urban waters through video, its trajectory gradually forms and shares new landscapes of Vitória Bay. This action is complemented by footage of the performance conducted in Recife, as well as various photographs emphasizing the proximity of the performer's body to the environment. The editing process allowed the audience to reconfigure the scenery, including through the perception of varying angles and daylight conditions. It represents an accumulative operation, where past waters will intertwine with the new, in a process of continuous permanence of the artwork. As the artist suggests, from this proposition emerged the idea of visually connecting distant territories.[6] Oriana also underscores the significance of the location for the actions, particularly because it requires specific infrastructure from rowing clubs for its realization. In the setting of Espírito Santo, the performance took place at the Saldanha da Gama Rowing Club (Figure 2), and the video was launched on December 19, 2008, at the Rowing Garage.

Oriana Duarte, by proposing to the audience a visual narrative that involves interaction with different bodies of water, achieved using collages and overlays, encourages them to imagine themselves in her position. The primary

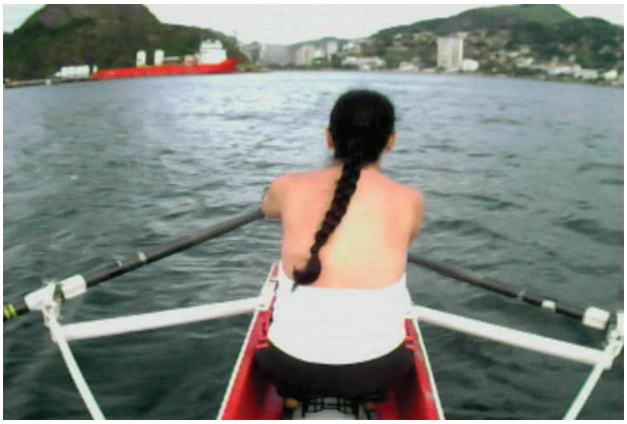

Figure 1. Oriana Duarte, Plus Ultra, Vitória Bay, 2008

Figure 2. Oriana Duarte, Plus Ultra Vitória Bay, 2008. Screenshot

activity of Plus Ultra involves video capture during the artist's rowing sessions, employing four cameras: one to capture the main image (showing the artist's back and the surrounding landscape), two micro-cameras to capture footage of the boat, and one camera to document the behind-the-scenes process. By sharing the subjective experience through an angle that positions the audience as fellow rowers, a stronger connection between the artist and the viewer is established, transforming the viewer into an active participant in the journey. The experience of rowing, captured in this way, transcends mere observation; it becomes an act of revealing, through accurately recorded images on video.

In this aspect, Plus Ultra can be understood within the esthetic-political framework proposed by Félix Guattari, wherein it is seen as a crucial element in shaping individual human experiences.[7] This framework views art as inseparable from the political, social, and esthetic realms, emphasizing the importance of creating new pathways and modes of expression that foster unique forms of subjectivity and realities. This involves a commitment to continuous movement and creative flow.[8] Oriana Duarte's suggestion of sharing the immersive experience of the boat-oar-landscape fusion in Vitória Bay offers the audience access to alternative perspectives and ways of experiencing the world through art. Selected for the 8th Biennial Sea Salon, Plus Ultra aligns with the event's theme of "waves, bridges, and navigable interventions," contributing to the activation of collective memories within the urban landscape.

As we are discussing corporeality in the artist's project, it is relevant to make some remarks about the situation of the body in the context of contemporary art. Since the mid-20th century, the body has been widely used as a central object in art. Not that it was not a consistent subject before. The organic form, the envelope of matter, or the delineation of human physical consistency has always been the focus of artistic interest. In Renaissance works, for example, all the details and unfolding of the skin over the musculature, veins and arteries, anatomical exercises, appeared carefully and cautiously in paintings, engravings, and sculptures, as Vasari suggested when analyzing artists like Antonio Pollaiolo (1429 – 1498).[9] However, it is only in the 1960s, especially in the North American and European artistic scene (though not disregarding the Japanese and Latin), that the artist's body comes to be elevated to the status of a work of art.

As art historian Amelia Jones suggests, this is the moment when artists start to negotiate with the personal and the public sphere.[10] In this way, identity aspects come into play, partly subjective, partly collective, and the body then seems to be the perfect means to express current questions. According to researchers Pam Meecham and Julie Sheldon, the assertion that the body from the 1960s onward becomes politically and socially inscribed in the public sphere is justified by the reconfigurations about corporeality arising from cultural and philosophical discourses of the time.[11]

In the 20th century, we see the profusion of discourses that treat the body as a cultural object, as something organic, agentive, subjective, material envelope of conscious forms, and unconscious drives.[12] From the 1960s, with counterculture and feminism, this is even more evident with a plurality of artists offering models of corporeality that functions as resistance and critiques of values and meanings. It is in this context that Oriana Duarte develops her artistic strategy around her female body.

In this sense, it is important to highlight that the tradition in the history of art reveals that women have long been seen as objects of male contemplation, and their bodies have often been translated as sexual apparatuses. Filipa Vicente (2012) addresses this issue masterfully in "A arte sem história: mulheres e cultura artística (séculos XVI–XX)" ("Art Without History: Women and Artistic Culture [16th – 20th Centuries]").[13] The art historian, who focuses on feminist currents in her studies, asserts that women, as objects of male observation and creation, are one of the most persistent typologies of artistic representation throughout the history of Western painting. She discusses the continuation of female sexualization in contemporary art. The representation of the female body (nude) predominates in works from the Renaissance to Modernism. In contemporary times, women continue to have to undress to enter museums. By considering those aspects and the context of the rowing clubs, it is possible to recognize in Oriana's project a strategy to confront various instances of misogyny through her body. Throughout her visits to different clubs, the prevalent male dominance is unmistakable (Figures 3 and 4), and her narrative serves to underscore this reality even further: "It marked the first occasion where I openly recognized the impact of gender differentiation, the presence of sexism, as an unavoidable influence shaping the dynamics of a particular environment

Figure 3. Oriana Duarte, Saldanha Rowing Club, Plus Ultra, Vitória Bay, 2008

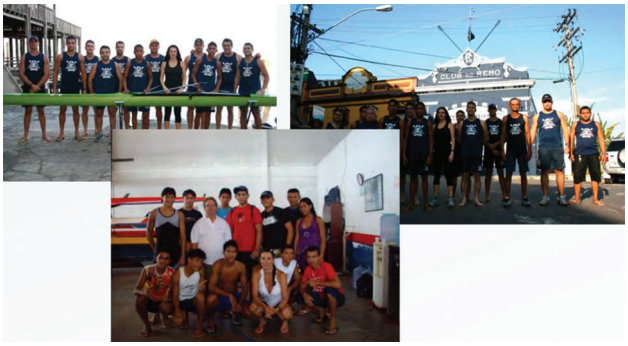

Figure 4. Oriana Duarte, Belém Rowing Club and Manauara Athletic Association

– a space I found myself in. It felt as if I had landed on another planet and the thought of giving up crossed my mind. Every night, before drifting off to sleep, I found myself pondering: How could I possibly continue working in such an explicitly misogynistic setting? Nevertheless, my pursuit of an enriched esthetic experience, encapsulated by the notion of "plus ultra," anchored me there – amidst the murky waters of a river [alluding to the Capibaribe River], a rowing garage, and amidst unfamiliar faces".[14,p.258]

The artist's initial exposure to rowing occurred at the Capibaribe Club, where she found herself as the sole woman among approximately 30 participants. Throughout the entire duration of the project, spanning various clubs, she encountered challenging and uncomfortable situations. In response, she asserted her autonomy by engaging in a process akin to that of Dr. Frankenstein: selecting, piecing together, and attempting to integrate disparate elements from the scene – a process she found both gratifying and draining.[15] This method served as her way of navigating the dynamic between self and others, offering insight into her stance amidst varied corporealities (Figures 5 and 6).

Figure 5. Oriana Duarte, Plus Ultra experiments, 2012

During her rowing journeys, Oriana Duarte encountered other women who empowered her to overcome prejudice in the sport. She reflected on this, saying, "I confess that, upon returning to the club's garage, I felt immense pleasure upon seeing astonished men with our courage; I realized that they had accepted my calling card".[16] Plus Ultra opens avenues to challenge the societal construction of the female body in the public sphere as passive. By exploring both corporeality and mentality through journeys across various waters and delving into the backstage of rowing garages, the project suggests the potential to produce subjectivity that stands in opposition to socially imposed modes of subjection.

Duarte's body serves as a site of resistance, embodying a woman artist who asserts control over her own visibility. She navigates her creative process through the fluctuations of desire and transforms her body, whether by directly challenging societal expectations imposed on the female form or by evading them altogether. In adopting a stylistic approach to existence, shaped by techniques of self-expression, her art takes on an added layer of significance – a form of situated and politically charged expression.[17]

This refers to a body that defies the conventional norms of art history, which often portrays the female body either as an object of desire or as silenced and confined. In this context, art historian Lynda Nead suggests that the female body, celebrated as the epitome of esthetic beauty, has been historically "framed" to represent the transformation of raw material or nature into refined cultural and spiritual ideals. Nead argues that within dominant cultural discourses, the female body – perceived as impure or improper – is "controlled" through artistic nudity, typically depicted by male artists adhering to established esthetic norms. This not only dictates how the female body is portrayed but also influences how it is perceived.[18] In this context, the act of a female artist representing herself disrupts this tradition. Thus, by directing both her own body and the public's gaze upon it, Duarte assumes a political stance that emphasizes autonomy while simultaneously blending into the urban landscape, undergoing a transformation while rowing through unfamiliar waters.

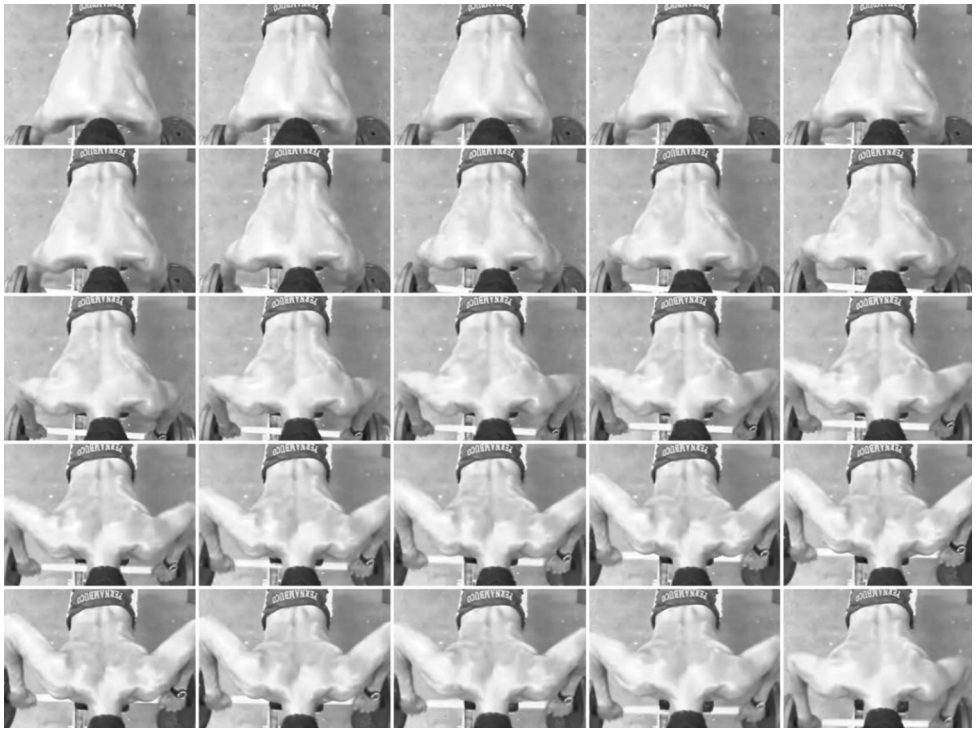

Figure 6. Oriana Duarte, a visual exploration of the young male athletic body through repetition, highlighting the dynamic interplay of form and movement, Plus Ultra, 2012

In conclusion, revisiting the 8th Sea Salon prompts a brief but necessary evaluation of the participation of female artists, shedding light on both their roles and exclusions within the public sphere dialog. Aside from Oriana Duarte's project, only those of Melina Almada and the Maruípe Collective (which includes artists Elaine Pinheiro and Meng Guimarães among its five members) were selected. Consequently, out of the 12 urban interventions showcased, only two were exclusively executed by women – a significant departure from the previous edition of the Sea Salon, which boasted 27 artists, including 12 women: Patrícia Osses, Camila Sposati, Branca, Cristine de Bem e Canto, Carla Zaccagnini, Maria Lúcia Cattani, Isadora Bonder, Raquel Baelles, Ana Gastelois, Luciana Ohira, Beatriz Pimenta, and Dayse Resende. This discrepancy underscores the ongoing challenges and disparities faced by female artists within the realm of public art exhibitions.

While it may appear incidental, the organization asserts justifications for the criteria it applied in selecting works for the 8th Salon, citing unpredictability and the interplay between city, art, and community. However, there is an unmistakable gender asymmetry within the salon's participants that warrant careful consideration. This discrepancy echoes broader patterns observed in art collections worldwide, underscoring that gender equality within the artistic realm remains a distant goal. The stark contrast with the previous salon compels us to approach these issues with a critical eye, devoid of naivety, and neutrality.

3. Conclusion

Oriana Duarte's Plus Ultra truly went "beyond" at the 8th Biennial Sea Salon, playing on the pun that the Latin root of the artwork's title allows. Her journey transcended borders, prejudices, and waters propelled by the intense energy of being and existing in the world, forming a poetic link between art and life. Her project resonated with the themes of other urban interventions, fostering a continuous exchange between landscape, city, body, and subjectivity. In addition, the sharing of her experience through audiovisual mediums expanded the scope of the work, inviting viewers to imagine themselves in her place, to shift from observer to participant in the scenery, the moment, the rhythm of breathing, the flow, and the rowing of the waters.

The artist's "body-boat" took on an intersubjective dimension, involving athletes, the public, passersby, and visitors. This allowed for a re-evaluation of Vitória Bay's waters, which are often disregarded amidst the constant

flow of citizens enjoying the view. Landscape and body are mutually transformed, linking body and oar in an exploration of the unknown, as the artist continuously performs in new waters.

While not explicitly highlighted in Oriana Duarte's discourse on the artwork or in the intervention itself, her identity as a female artist remains present. Her body, wielded autonomously as an instrument, assumes a prominent role in the public sphere, guiding the audience's gaze toward an exploration of the creation of new modes of subjectivity.

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Conflict of interest

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Ethics approval and consent to participate

Not applicable.

Consent for publication

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ARTICLE

The Panhellenic student competition "Hack the Art: Yanoulis Halepas": Extending art experience, communication, and learning through multimodal digital applications

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Abstract

This paper presents the case of an innovative national digital student competition for school groups of secondary education, entitled: "Hack the Art: Yanoulis Halepas." Conducted remotely in Greece during the 2022 – 2023 school year, the competition was organized by the Onassis Foundation and the Onassis Library in partnership with the Teloglion Fine Arts Foundation, the National Gallery of Greece–Alexandros Soutsos Museum, the Cultural Foundation of Tinos, and the Cultural Center of Panormos-Municipality of Tinos. Accredited by the Hellenic Ministry for Education and Religious Affairs, it was realized under the aegis of the General Secretariat for Greeks Abroad and Public Diplomacy. This competition was the fourth iteration of this digital format since 2020. This time, we invited student teams from Greek high schools, both in Greece and abroad, led by at least one educator, to learn about the life and work of the great Greek sculptor Yanoulis Halepas and to communicate art by creating projects of augmented reality, virtual reality, digital storytelling, and 3D video games for PC and android devices. This innovative educational project enhanced students' experience and conceptual understanding of art, motivating them to interact with cultural heritage and experiment with multimodal digital tools. Furthermore, it offered an alternative educational paradigm for teaching history, literature, visual arts, and technology by applying object-based learning, game-based learning, and project-based learning methodologies. According to the assessment results, this learning approach successfully integrated significant artworks into the school curriculum, extending their lifespan and visibility through digital transformations and reinterpretations.

Keywords: History of art; Virtual reality and augmented reality; 3D video game; Digital storytelling; Yanoulis Halepas; New educational model; Art communication

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1. Introduction

The Onassis Library is a special library that houses collections of rare books and archives from the 15th to the 20th centuries, as well as a collection of great works of art that welcome and escort visitors, evoking a sense of a bygone era. Traversing a wide spectrum of artistic movements and historical periods, the artworks hosted inside the library space are in constant dialogue with all the exhibits, each sharing a story with every gaze that encounters them (Figure 1). Among this cultural wealth, the sculptures of Yanoulis Halepas stand out in their beauty and unique historical value.

Since the history of art is not part of the school curriculum in Greece, students are barely aware of Yanoulis Halepas as one of the most prominent sculptors of the Neohellenic period. To address this gap, we designed an educational program to communicate art and highlight the life and work of this important artist. The program ran remotely during the 2022 – 2023 school year and invited secondary education school groups (students aged 13 – 17) to get inspired by the remarkable drawings, casts, masterpiece sculptures, personal items, accounting documents, and rare archival materials to create digital projects and compete in four categories: virtual reality (VR), augmented reality (AR), digital storytelling, and 3D video games.

The school teams that took part in the competition were given the chance to use object-based learning (OBL), game-based learning (GBL), and project-based learning (PBL) approaches to creatively combine different scientific fields. Furthermore, the students undertook a series of historical research procedures, became acquainted with significant artifacts of Greek cultural heritage, examined the life and oeuvre of a pre-eminent Greek sculptor, engaged in remote learning, and acquired a range of functional, structural, and strategic competencies that could prove advantageous in their future professional endeavors.[1] The educational program "Hack the Art: Yanoulis Halepas" was a good example of digital literacy, successfully enhancing the creative connection of information and communication technologies with other subjects in the school curriculum and applying online synchronous and asynchronous education. Finally, it developed into a breeding ground for preparing the next generation to cultivate the necessary soft skills, which will transform each learner into an independent thinker and active citizen of the 21st century.[2,3]

Figure 1. The Onassis Library: Main library room and central hall

2. Theoretical frame

2.1. OBL

OBL is an educational method that engages students in the active utilization of authentic or replicated material objects. Described as a student-centered learning approach that actively incorporates objects into the learning environment,[4] this method encourages analysis and critical reflection.[5] Objects are instrumental in fostering communication, teamwork, lateral thinking, and observational and drawing skills.[6] Extensive research on OBL highlights that objects possess the capacity to inspire, inform, captivate, and motivate students at every stage of their educational journey, thereby creating a productive learning environment.

Based on this theoretical background, we decided to organize a student competition to highlight the life and the work of Yanoulis Halepas, giving the next generation an opportunity to engage with and reinterpret important artworks of the past. These significant objects can inspire and convey information, enthusiasm, and knowledge in a creative way through interaction and observation, thus enhancing memory and knowledge retention. It has been observed that the use of objects in education improves the learning process and makes it more effective, leading to a long-lasting impact on memory and understanding.[7]

OBL also enhances collaboration among students, serving as a catalyst for stimulating their imagination and creativity. This effect is further amplified and becomes a unique experience when combined with GBL and PBL, motivating participants to acquire knowledge and skills in subjects that are often considered "difficult," tedious, or even boring.[8]

2.2. PBL

PBL is an instructional approach wherein students engage in an extended exploration of authentic, challenging questions, problems, or challenges. This method cultivates a proactive learning approach, enabling students to effectively address uncertainties and opportunities. PBL aims to foster critical thinking, collaborative skills, innovative problem-solving, and a genuine enthusiasm for learning.

The significance of PBL has historical roots, from Piaget's social constructivism to Vygotsky's sociocultural

learning theory, and contemporary perspectives like Jenkins *et al.*'s[9] theory of collective intelligence. In current competence development models,[10] collaboration plays a key role. Kuhn[11] further argues that collaboration, as a process, leads to favorable outcomes, including successful problem-solving and enhanced intellectual development.

In the context of PBL, students showcase their knowledge and skills by tackling real-world problems and presenting their solutions to their peers. This approach results in the development of profound content knowledge and the enhancement of critical thinking, interplay, creativity, and communication skills.

Given the above considerations, our project placed a primary focus on inter subjectivity and cooperation among people with different interests and talents through participation in the competition. This emphasis extends beyond being a cognitive catalyst; it is a deliberate strategy to drive psychological resilience in the school environment while preparing youngsters for the challenges they will encounter in their careers.

2.3. GBL

The rise of GBL gained significant traction in 2001 when Prensky[12] introduced the concept, marking a pivotal moment that profoundly influenced the establishment of GBL standards and requirements in educational settings. This development has shaped the trajectory of the academic world, with GBL being an educational approach rooted in the use of computer games or software applications integrating games for learning and education.[13]

The integration of games into education has elicited diverse reactions from scholars, educators, and researchers, leading to varied perspectives on the efficacy and appropriateness of incorporating games into educational settings. The conflicting viewpoints presented by Moula,[14] Mitchell and Saville-Smith,[15] and Anderson and Dill[16] reflect the multifaceted nature of the ongoing debate in the field, covering issues such as engagement, skill development, equity, and concerns about distraction, lack of clear learning outcomes, and potential overreliance on technology. The effectiveness of integrating games into education is likely contingent on factors such as game design, context of use, and alignment with educational goals.

Gamification, as defined by Kapp,[17] involves employing game-based mechanics, esthetics, and game thinking to engage individuals, motivate action, facilitate learning, and address problems. Its overarching purpose is to enhance activities, making them more enjoyable and engaging, particularly in non-game contexts. The ultimate goal is to modify user behavior, concurrently fostering increased participation and commitment.[18]

In the realm of gamification, creative thinking is encouraged, failure is destigmatized, and players are empowered with a sense of control over the process. These elements imbue the content with game-like qualities without transforming it into a game. The primary objective is to motivate learners to complete tasks or study course content more pleasantly.

Considering the theoretical frameworks mentioned earlier, we have opted to integrate OBL, PBL, and GBL methodologies, incorporating 2D and 3D technological tools as well as synchronous and asynchronous distance learning. We presented this pioneer combination in the innovative digital student competition "Hack the Art: Yanoulis Halepas."

3. The competition theme

Yianoulis Halepas is a significant figure in modern Greek art. Born in 1851 in Pyrgos of Tinos and passing away in 1938 in Athens, Halepas came from a family with a tradition in marble carving; his father, Ioannis Halepas, maintained marble workshops in Greece and Europe. Although his family initially intended for him to pursue a career in trade, he was drawn to the arts, particularly sculpture. Consequently, he enrolled at the School of Arts in Athens, where he studied under Professor Leonidas Drosis (1836 – 1882) until 1872. Subsequently, he continued his studies in Munich with a scholarship from the Foundation of the Evangelist of Tinos, attending the Academy of Fine Arts under Professor Max von Widnmann (1812 – 1895). He excelled and received numerous awards. However, in 1875, his scholarship was discontinued, and he returned to Athens. In 1878, he began showing symptoms of mental illness. By 1888, he was admitted to the Psychiatric Hospital of Corfu, where he stayed for 14 years. In 1902, his mother made the decision to take him out of the psychiatric hospital, and he lived in Tinos until 1930 when he moved back to Athens (Figure 2).

Halepas's art is conventionally divided into three periods. The first, lasting from 1873 to 1916, is classified as Classicism. Representative works from this period include *Philostorgia*, *Satyros and Eros*, and the renowned *Sleeping Beauty*, which also incorporates aspects of Romanticism and is located in the First Cemetery of Athens.[19] The second period, spanning from 1918 to 1930, marks a gradual shift from the rules of Classicism to a more abstract style. While the subject matter remains similar, the style differs significantly. Characteristic works from this period include *Medea*, *Naked Woman with a Mirror*, *Satyr, and Eros V*. This period is often referred to as the "metalogical" period in the literature. The third and final period, from 1930 to

Figure 2. Yanoulis Halepas (middle) and two of his masterpieces: *Satyr Playing with Eros* (left) and *Satyr's Head* (Right)

1938, is a prolongation of the previous ones but features greater realism in volumes and forms. Indicative works from this period include *The Great Reposed*, *The Girl with a Rose*, and *The Satyr and Eros XII*. Halepas's art throughout these periods was permeated with pictorial elements of the currents of the time. Classicism, Romanticism, and the avant-garde currents of early 20th-century Europe, such as Cubism, as well as popular artistic tradition and ancient Greek cultural heritage, all influenced his art.[20-22]

The Dounai Kai Lavein exhibition took place at the Teloglion Foundation of Art in Thessaloniki from February 18 to July 17, 2022, in partnership with the Onassis Foundation, which owns over 80 works of Yianoulis Halepas[23] This exhibition was the reason for the formation of the student competition "Hack the Art: Yanoulis Halepas," which took place between January and May 2023. The choice of this particular artist was made for several reasons. First, the wide range of his art and the particular way in which his art evolved are fascinating. Through his work, students come into contact with both the technical and interpretative aspects of art analysis, becoming accustomed to marble sculpture, preforms, sculpting techniques, and tools. They also unravel various aspects of art history, learning about Greek and European artists, art currents such as Classicism, and interpretive dimensions, such as the role of myth and symbols in his art. This approach leads to deeper and more meaningful understanding. Therefore, given Halepas's diverse body of work, he is an ideal subject for educational purposes and acquaintance with art. Through technological means and interactive methods, students can engage more deeply with and conduct further research on his art.

Another main reason Halepas is worth mentioning as an option for the competition is the issue of mental illness. During his era, social stigma heavily influenced perceptions and attitudes toward people suffering from mental illness.[24] In our time, it is our duty to eliminate these outdated perceptions and contribute to the non-stigmatization of mental illness, thereby promoting the essential freedom of people's identities. As a result, the case of Halepas is ideal for raising awareness about mental illness. In the past, cinematic and literary portrayals of "madness" often "demonized" the sufferer as a "lunatic" stalking the "sane," shaping the collective unconscious in harmful ways. Yianoulis Halepas provides a chance to deconstruct these negative dimensions and highlight a more human and realistic perspective. Furthermore, it is of great interest to observe the coexistence and co-formation of mental illness and art.

Aside from these reasons, Halepas' body of work and life narrative remains largely unfamiliar to the general public. His contributions are also infrequently encountered by students at various educational levels and within applied curricula. This competition offers a chance to reassess the content of secondary education courses in visual art and art history. It does so by introducing new material, exploring diverse methods and technologies, and engaging students with the life stories of artists whose contributions have been overlooked or sidelined.

4. The educational aim of the competition

The national student competition "Hack the Art: Yanoulis Halepas" was announced in September 2022 and ran from January to May 2023. The main goal of the competition was to motivate secondary school groups to:

(i) Utilize advanced technology applications to create digital projects that highlight the life and work of the great Greek sculptor Yanoulis Halepas

(ii) Creatively combine lessons from language, literature, history (ancient and art history), visual arts, museology, technology, and computer science through the study of art projects and historical testimonies
(iii) Engage in historical research and interact with primary sources and records
(iv) Communicate effectively and collaborate in groups to combine their diverse interests and talents in realizing an original digital project
(v) Familiarize themselves with innovative digital tools and open-source software, acquiring digital skills while expanding their knowledge
(vi) Become creators, not just consumers, of technology
(vii) Learn about sculptural art, including historical and contemporary trends, materials used, techniques, and important artists from different periods
(viii) Visualize an idea and share it with the school community using new digital applications and effective communication practices
(ix) Communicate art, reuse, and reinterpret artifacts in a modern way.

5. Software and digital tools

To implement their digital projects, school groups had to explore available digital resources in online databases, digital libraries, museums, and archives. They were encouraged to utilize software that is either freely accessible, open-source, or available with an educational license. To assist the teams, scientific collaborators of the competition prepared tailored supporting materials aligned with the competition's theme. In addition, they supplied a suggestive, non-binding list of software options and produced demo videos illustrating the installation and functionality of selected digital tools.

The recommended software by category includes:
(i) 3D design: Tinkercad (free), SketchUp (free), Blender 3D (free), Autodesk 3ds Max (educational license)
(ii) 3D game engines: Unity 3D (free), Unreal Engine (free)
(iii) 2D graphics and video editing: PhotoPea (free), OpenShot (free), Gimp (free)
(iv) Audio processing: Audacity (free).

Students were also invited to experiment with other software, such as:
- AR Educational Platform AR Tutor
- AR Vuforia Engine
- AR creation portal Blippar
- 2D editing software Inkscape and Synfig studio
- Google Poly online platform
- Roblox online game creation platform
- OpenSimulator online platform
- Unity Asset store for free assets
- Miro.com platform
- Canva design portal
- 3D creation software MeshLab
- Roblox 3D Game platform
- Twine platform
- Artsteps VR platform
- Photogrammetry software Meshroom
- Kden live video editing platform
- Deep Nostalgia facial animation tool
- qStopMotion and Heron Animation video creation programs
- Storymap multimedia map creation tool
- Marble virtual 3D map software
- Book Creator software used for multimedia book creations
- Geni-al.ly motion graphics and escape game creation software
- Google Earth Pro planet visualization software
- Scaniverse application
- Educational version of the Camtasia video editing software
- MuseScore and Bandlab music composition software
- Climpchamp platform
- Scribble Maps online mapping application
- Painting software Krita and Pixlr
- Video capture software OBS Studio
- Development environment Microsoft Visual Studio
- Enhanced text editor Notepad++
- Phoca Maps plugin for the Joomla! platform
- ChatGPT open AI platform

6. Methodology

The design of the national student competition "Hack the Art: Yanoulis Halepas" was divided into two stages: the preparation stage and the implementation stage.

6.1. The preparatory stage

During the preparatory stage, the organizers designed the basic scheme of the competition to be conducted entirely online for high schools in Greece and abroad during the 2022 – 23 school year. After analyzing the results and feedback from previous competitions, they presented their updated educational proposal to researchers and collaborators from the Departments of Educational Programs and Digital Development at the Onassis Foundation. Following amendments and improvements, they received approval to submit the draft announcement of the competition to the Institute of Educational Policy and the Ministry of Education for official authorization. In parallel, they devised a communication strategy to promote

this educational initiative. After receiving feedback and permission to implement the action, they finalized all the relative competition documents and published them publicly through press releases, newsletters, and posts on all Onassis Foundation's websites, platforms, and social media networks. Participation in the competition was free of charge.

6.1.1. Supporting materials

In the context of the educational program, the scientific collaborators and partners of the competition were committed to collecting all the supporting material related to the competition theme (video recordings, notes, optional scenarios, bibliography, digital exhibitions, editions, documentaries, references, and examples). They also produced six Moodle lessons, offering rich theoretical sources and helpful case studies for further development by the school teams. The challenge for the scientific collaborators in choosing the subject matters and preparing the supporting material was to select interesting topics and concepts for youngsters and transform or present them in attractive ways. The six lessons created on Yanoulis Halepas are as follows:

a) Yanoulis Halepas and his time

In this lesson, the artistic range of Yianoulis Halepas was examined in reference to the art currents of his time in Greece and Europe. The broader historical context of sculpture during his time was exposed. Through art history, we understand the intersections and influences between his art and European art of the late 19th and early 20- centuries. The transition from the Classicism of the Munich School to works with aspects of cubist and primitivist art is remarkable. The art of Halepas reflects influences from Antonio Canova (1757 – 1822), Leonidas Drosis (1836 – 1882), and Alexander Porfyrovych Archipenko (1887 – 1964), showcasing a wide spectrum of pictorial references. Renowned works of Yianoulis Halepas are mentioned, such as *Sleeping Beauty, Satyros and Eros, and Oedipus and Antigone*. The technique of transferring plaster casts to marble, a procedure not done by the artist himself, is briefly analyzed in the context of *Sleeping Beauty*. This explains the mystery of Halepas' later signature, chiseled on *Sleeping Beauty* in 1913. In addition, other artists, such as Vincent van Gogh (1853 – 1890), who were affected by mental illness were presented. The main reason for choosing this particular subject was the great interest in the evolution of his art, viewed through a historical perspective.

b) The life and work of Yanoulis Halepas

The life and work of Yanoulis Halepas were presented in a straightforward and comprehensible manner in this lesson, highlighting the artist's relationship with his family, historical context, and broader developments in the field of sculpture during his lifetime.[25-27] Halepas' life journey – from his birthplace in Tinos to his studies in Munich, his return to Athens, the unfulfilled love with Marigo, health challenges, confinement in a psychiatric hospital, return to Tinos, impoverishment, and recognition of his work before the end of his life – resembles a cinematic narrative of a tragic hero undergoing catharsis.

Tranquil and serene, Halepas left behind a collection of over 150 works, including sculptures and drawings, along with the enduring myth of a man who, overcoming illness, the stigma of mental instability, and the pain of lost time, managed to "resurrect" artistically. He was celebrated by the artistic community and, most importantly, reconciled his small and large self, expressing everything that circulated in his mind and heart in what he was born to do – art.

The above presentation aimed to familiarize the students' teams with the renowned sculptor and inspire them to create their own narrative based on his life and work.

c) The three phases of Yanoulis Halepas' art

In this lesson, school teams had the opportunity to explore the three periods that characterize Halepas' work, as identified by most scholars. These periods are marked by crucial turning points in his life and stylistic differences in his creations. The first period, spanning from 1870 to 1878, encompasses his youth in the schools of Athens and Munich, as well as his creative phase on returning to Athens in his father's workshop. This period extends until the onset of his illness. The second period, from 1918 to 1930, covers the years he lived and worked on the island of Tinos after his return from the psychiatric hospital in Corfu. Finally, the third period, from 1930 to 1938, includes the years he spent in Athens until his death.

d) The impact of fairytale and myth in the artwork of Yanoulis Halepas

The supplementary materials regarding the incorporation of myth and fairy tale elements in the works of Yanoulis Halepas were designed to assist participants by furnishing comprehensive content. They elucidated the distinctions between myth and fairy tale, offering examples from Greek mythology, and European and Greek oral and written storytelling traditions. In addition, the materials presented various depictions spanning from ceramics to the 19th century.

Halepas, drawing inspiration from diverse myths, crafted an artistic body of work centered around them. While art schools in 19th-century Europe often focused

on myths, Halepas' connection with them was profoundly experiential. Through the narratives and chosen heroes in his creations, the artist sought to unravel the meaning of his life's purpose, gain a deeper understanding of his relationships with his immediate environment and family, and explore his identity.[28,29]

e) The use of symbols in the artwork of Yanoulis Halepas

This supporting material defines the significance of both symbols and the term "allegory." Symbols are found in almost all cultures and religions, and their role is vital in visual arts. A symbol is an object, an animate being, or a conventional representation which, in a specific context, is associated with an abstract concept or idea.[30]

An allegory is an attempt to illustrate an abstract concept via personification. In the arts, allegories usually appear as humans embodying various concepts, such as justice. Halepas uses both symbols and allegories in his artistic production to facilitate his narration, express deep emotions, and navigate through the darkest periods of his life.

f) Yanoulis Halepas' art as a source of inspiration

In this lesson, a presentation of selected works by Yanoulis Halepas was conducted with the aim of encouraging student teams to delve deeper into Halepas' work, using his sculptures and drawings as a source of inspiration. The focus was on learning about the influences he had and the feelings he wanted to express. Thus, an analysis with interpretative commentary was conducted on the following works: *Satyr Playing with Eros* (1877), *Sleeping Beauty* (1877), *Satyr's Head* (1878), *Medea* (1918, 1931, 1933), *Fairy Tale of Sleeping Beauty II* (1918), *Alexander the Great Alive and Dead* (circa 1922), *Oedipus and Antigone* (1930), and *Reclining Female Figure* (1931). This approach provided students with the necessary documentation and motivated them to create their own stories utilizing these supporting materials.

Furthermore, the scientific collaborators created example scenarios for digital applications and games to showcase how teams should work, transfer knowledge, and inspire them.

g) AR application scenario

Participants who chose to create an AR application were able to familiarize themselves with the integration of digital information into the users' actual environment in real-time, experiencing a real-world space combined with generated perceptual characteristics. At the same time, students received information about Halepas' sculptures, including significant details regarding each art piece, such as the title, date of creation, materials used, dimensions, current location, descriptions, and extensive bibliographical resources.[31-33]

After studying the supplementary material, students who opted to create an AR application were required not only to present their choices of Halepas' sculptures through a three-dimensional presentation but also to accompany their project with proper research, descriptions, and analysis. As a result, participants became acquainted with both the technological tools used in the AR creation process and adopted the roles of virtual tour guides, and art historians, curating and designing their exhibition space.

h) VR application scenario

The proposed VR application scenario aimed to provide students with an in-depth examination of the life and work of Yanoulis Halepas, based on well-researched primary materials covering the three periods of his life. Through this brief review of his significant personal and professional moments, students gained insights into the factors that influenced his work and creativity. Within this context, his creations were organized in chronological order, showcasing Halepa's life journey. His sketch production was particularly intriguing, allowing viewers to trace not only Halepa's dedication to perfecting his skills both technically and thematically but also offering a glimpse into his state of mind and creative evolution.

Armed with this theoretical background, students were asked to create their virtual exhibition featuring the works of the renowned sculptor. To complete their task, they had to make several important choices while engaging in a team-building process to overcome creative blockages and differences. The goal of these choices was to trigger the students' critical thinking, urging them to immerse themselves in Halepa's life and work, conduct proper bibliographical research, and alter their learning motivation by helping them visualize the outcome.

i) 3D video game scenario

Another category in the student competition was the development of a 3D video game. For this purpose, a video game scenario was created and proposed to the participants as an example. In this instructive scenario, Yanoulis Halepas was the central hero, and the video game was structured into three levels/stages. In each level, the hero was required to complete a series of tasks and correctly answer a specific number of questions related to the life of the sculptor to advance to the next level.

The first level of the game took place in Tinos, specifically in the house where Yanoulis Halepas was born, in Pyrgos village. The next level was set in Munich, where he studied and created his first artworks. Finally, the third

level featured the hero in his old age, in Athens, where he spent the past 8 years of his life. The script was based on the life of the great Greek sculptor, who managed to overcome societal and familial obstacles, surpass his mental illness, and free himself from the ghosts of his past to pursue his passion for art. The application of GBL techniques ensures high levels of motivation, boosts creativity and encourages students to use their logic to complete tasks, manage their time, and compartmentalize to achieve a common goal.

j) Digital storytelling scenario

Another category of the competition "Hack the Art: Yanoulis Halepas" was the creation of digital narratives (video or animated video up to 5 min) based on selected key stories related to the sculptor's life and work. Participants were briefed on the rules and steps for creating digital stories and supplied with several storylines originating from Halepa's turbulent life to use as a source of inspiration. Digital storytelling leverages children's imagination, encouraging them to express themselves freely while activating their memory by combining knowledge and skills they obtained from other courses, maximizing intersubjectivity.[34]

Children would study the stories, enrich them by adding their findings, and make new connections derived from Yanoulis' life while interlocking their own unique experiences in life. Through this process, students can develop their esthetic criteria, learn from their mistakes, reinforce their leadership skills, and exercise empathy during the intensive collaboration and creative process. Guiding questions were provided alongside the proposed storylines to support the children in articulating the rationale behind their chosen storyline, elucidating the specific means through which they intend to convey it, tapping into their emotional reservoirs, and embracing the challenge of reshaping their reality through the transformative lens of digital narration.[35,36]

6.1.2. The digital educational platform – Classroom

All the supporting material created was organized and posted on Classroom,[37] the open-access digital educational platform of the Onassis Foundation, to promote involvement and visibility. This easy-to-use asynchronous educational repository encouraged interested school groups to engage in the student competition. This web tool was developed to adequately support each of the new competition's required processes: general information, registration, application submission, contact form, frequently asked questions, announcements, new content additions, evaluation, and a digital projects gallery. All this useful content remained on the platform after the competition ended and is freely available to all.

6.1.3. Online event

The competition was launched with a 1-day online event (December 18, 2022), prefaced by presentations of two university professors who made an introduction to the new competition theme. Following this, the five awarded school teams from the previous competition took the digital floor to present their projects and share their experiences and skills gained. This opportunity allowed professors and students to promote their digital projects and exchange views, experiences, and expertise. They also offered consultancy to newcomers and encouraged them to study the rich educational material uploaded on the Classroom platform, register, and take part in the new competition.

Following these preliminary actions, the implementation stage commenced.

6.2. The implementation stage

The implementation stage can be analyzed in two phases. During the first phase, which lasted about 2.5 months, interested school groups (consisting of more than three students and at least one leader professor) had to submit an idea or proposal describing the development of a digital project using historical material and data from available online institutional or open-access repositories in Greece and abroad. The interest in participation was significant, with 17 valid proposals and one non-valid proposal submitted, involving more than 200 students and 60 professors. The participants came from Greek schools in Athens, Thessaloniki, Corfu Island, Crete Island, Giannitsa, Kastoria, Kalamata, Evros, and Karditsa. Five proposals were from private schools, and 13 were from public ones. Among them, one proposal came from a special gymnasium-lyceum, and one from a private school that participated out of the competition (non-valid) due to late proposal submission.

Regarding the categories of digital works, the submissions were as follows:

(i) VR = one proposal (out-–of-competition-late proposal submission)
(ii) AR = one proposal
(iii) Digital storytelling = 12 proposals
(iv) 3D video game = four proposals.

After an initial evaluation process by a predetermined evaluation committee, 17 proposals qualified to proceed to the next level to implement their digital project. The results of the first phase of the competition were posted on the Classroom platform.

During the second phase, which also lasted about 2.5 months, the school teams had to prepare the deliverables of their digital projects (executable files, source

files, video capture, explanatory text) and submit them in a timely manner through the Classroom platform, using a Microsoft SharePoint integration.

In the context of this final stage, to optimally implement their challenging proposal and upgrade their digital skills, the school teams were motivated to participate in live virtual tours inside the Onassis Library and a series of five open online workshops (https://classroom.onassis.org/course/view.php?id=112). These workshops featured presentations and demonstrations of software, applications, and techniques by experienced educators, specialized researchers, and scientists (via Zoom and WebEx platforms). The series was open to the public, inviting anyone interested in learning about pioneering computer applications and techniques for the creation of digital works. Through this advanced digital experience, students and their professors had the opportunity to improve their knowledge of the basic principles of 2D and 3D graphic design, video game and application creation, animation, level and gameplay design, basic programming concepts, video creation, editing, and digital material processing.

The training topics were selected based on the four categories of the competition (VR, AR, digital storytelling, 3D video game) and are as follows:

- Creation and implementation of scripts for digital games and applications

In this webinar, we focused on writing and realizing basic scenarios for applications and video games. We addressed the problems of choosing a subject, timeframe, and narrative features, carefully and consistently weaving all elements of our digital work together. This included analyzing character development (backstories, psychological makeup) and outlining the action with a view to creating a powerful plot that will help players hold their interest to the end. This work was implemented on the Twine platform, with which we can create simple or complex narrative games without the need for any advanced programming knowledge.

- Create a virtual (VR) exhibition with the Artsteps platform

This webinar began by preparing and processing the digital materials used to create a VR exhibition (color profile use, proportions, and dimensions of works, preparation of texts about and details of each work). It followed with the design of an exhibition space, either on paper or using a free design program, to meet the needs of presenting these works. The final step was an introduction to the ArtSteps platform, presenting all its possibilities and options. Once all stages were completed, the digital exhibition was published online, and possible ways of sharing it were considered.

- AR in education: The use of BlippAR software

This webinar introduced participants to the practice of using AR in educational settings. It also offered a demonstration of Blippar, used to create illustrative examples in conjunction with other digital applications and AI features.

- 3D video game creation with the Unity platform

This webinar guided the participants step-by-step through the creation of a game on the basis of a specific scenario. Various libraries were presented, where participants could search for free assets to incorporate into their digital works. There was also a demonstration of the process involved in presenting a scenario idea in diagrammatic form (using the miro.com platform) and creating a game design document, essential tools for the realization of any game or application.

- Stop Motion: Create animated images with your imagination and your smartphone!

This webinar presented traditional animation techniques using an application to create an animated video using a smartphone. The final file could be stored on a computer and presented or shared as video material.

These webinars were specially designed by expert professionals digital technology sector and concluded with a problem-solving or question and answer session. In addition, to assist and inspire the school teams, the competition's technical instructors prepared custom video presentations aligned with the competition's categories (VR, AR, digital storytelling, 3D video game). They also demonstrated original digital projects implemented using easy-to-use digital applications such as ezgif, giphy, PIXLR, and PIXLR II (The GIF projects produced by external collaborators to inspire the school teams to participate in the competition "Hack the Art: Yanoulis Halepas" are available in the Supplementary GIF File).

All the recorded videos were uploaded on the Classroom platform and are available to everyone.

7. Results

After the completion of the second phase of the competition, 10 school teams successfully implemented and submitted their digital project. All the projects were remarkable, distinguished by their quality, cognitive depth, and pedagogical value, highlighting the great effort,

perseverance, and interest of students and professors to work methodically and cooperatively to deliver an excellent project.

The evaluation committee received the submitted works and recommended awards totaling 6,000 euros, judging with predefined evaluation criteria published in the competition announcement:

(i) Creativity and originality of the script
(ii) Relevance to the theme of the competition
(iii) Documentation and presentation of the central idea
(iv) Use of open technologies
(v) Functionality, usability/simplicity, compatibility with various devices
(vi) Quality of the application
(vii) Pedagogical value of the digital project
(viii) Pleasant experience for the user.

The assessment system employed was identical to the one utilized by the Onassis Foundation for scholarships, enabling each member of the evaluation committee to conduct an impartial and independent evaluation. The award was shared by the winning school groups and delivered in the form of gift cards for acquiring technological equipment. The final results of the competition were announced on June 19, 2023, and posted on the classroom platform (https://classroom.onassis.org/course/view.php?id=126) together with all the capture (promotional) videos of the digital projects created by the school teams.

The school teams awarded are as follows:

- Three-dimensional video game digital projects (3D video game): The first prize (1,500 euros) was awarded to the 1st Vocational High School of Kamatero (Attica) and the school team, The Rubins, for the digital project *Talk to Art*[1].

Game description: In this 3D video game, the "player" is located in the Marble Crafts Museum of Pyrgos, a village on the island of Tinos, which is the birthplace of Chalepas. The museum is empty of artworks, and a young student is trapped in the museum's toilet, locked in by class bullies during a school trip. Overwhelmed by anxiety, the student has blocked the door. The player hears the child's pleas for help and tries to rescue him by unlocking the door. How? They must answer a series of questions related to the art of marble in Tinos initially, and subsequent questions primarily related to the life and work of Yanoulis Halepas (Figure 3).

- Digital storytelling category: The first prize (1500 euros) was awarded to the 2nd Vocational High School of Giannitsa (Central Macedonia) and the school team, The Wonderful 15, for the digital project *Yanoulis Smokes Calmly in the Hall*[2].

Project description: The school team created a short film animation inspired by the life and artwork of Yanoulis Halepas using the stop-motion technique. The result was an impressive contraction of three-dimensional models and sets, along with digital image processing and video-capturing techniques (Figure 4).

- VR digital project category: There were no nominations in this category. The corresponding award for this category was equally shared as the second prize among the schools that gathered the second-highest scores in the 3D video game and digital storytelling categories.
- Three-dimensional video game digital projects (3D video game) category: The second prize (750 euros) was awarded to the Doukas Schools (Athens) and the school team, Fractal, for the digital project *In the Mind of Yannoulis Halepas*[3].

Game description: The school team developed a digital game using the Unity 3D platform set on the island of Tinos, the birthplace of Halepas. The protagonist in the game is the artist in his youth. At the initial level, players aim to respond to questions related to Halepas' life and

[1] Watch the capture video of the digital project here: https://classroom.onassis.org/mod/page/view.php?id=1661

[2] Watch the capture video of the digital project here: https://classroom.onassis.org/mod/page/view.php?id=1662

[3] Watch the capture video of the digital project here: https://classroom.onassis.org/mod/page/view.php?id=1664

Figure 3. Screenshot from the digital project *Talk to Art*

gather sculpting tools (3D models), which are then included in an item list (2D inventory). After successfully completing the first level, players unlock access to the second level, symbolizing the sculptor's darker years, marked by madness and rejection. Players are tasked with gathering information and applying it in the subsequent challenges (Figure 5).

- Digital storytelling category: The second prize (750 euros) was awarded to the College of Athens and the school team, Art Explorers – Engravers in Training, for the digital project *Singing to the Monumental Beauty with Chisel and Pen*[4].

Project description: This school team drew inspiration from the life story of Yanoulis Halepas, weaving together poetry, art, and history. They delved into the exploration of beauty, encompassing its various forms – physical, moral, and mental – seeking to comprehend how art has the capacity to imbue a timeless and incorruptible essence. The goal was to transmute the transient journey of an individual into an enduring and memorable legacy (Figure 6).

[4] Watch the capture video of the digital project here: https://classroom.onassis.org/mod/page/view.php?id=1665

Figure 4. Screenshot from the digital project *Yanoulis Smokes Calmly in the Hall*

Figure 5. Screenshot from the digital project *In the Mind of Yannoulis Halepas*

- AR digital projects category: The evaluation committee decided not to give an award in this category. Therefore, the award for this category will be equally shared as the third prize among the schools that received the third-highest scores in the 3D video game and digital storytelling categories.
- Three-dimensional video game digital projects (3D video game) category: The third prize was awarded to the Music School of Thessaloniki and the school team, Universal Tomatoes, for the digital project *Escape the Sculptrix – A Yiannoulis Chalepas Tribute*[5].

Game description: This is a three-dimensional digital knowledge game that mentally and actively immerses the user in the world of sculpture, guided and taught by Yanoulis Halepas. Leveraging digital technology, the game encourages users to explore and discover the fundamental principles of sculpture, define its place in the world of arts, and, more specifically, get to know the life and works of Halepas. At the same time, users have the opportunity to test their sculpting skills in a virtual workshop by recreating Halepas' works digitally in three dimensions (Figure 7).

- Digital storytelling category: The third prize was awarded equally to two schools:
  (i) The Experimental Vocational High School of Neapoli Lasithiou (Crete) and the school team, Art Hackers, for the project *True Unreasonable*[6].

Project description: The digital storytelling project *True Unreasonable* is an autobiographical narrative inspired by Yannoulis Halepas, referring to the long period during which the artist struggled with mental illness, diagnosed during the era of "insanity." The narrative is an attempt to capture Halepas' emotions connected to events and milestones in his life, including the insidious and gradual onset of the disease, romantic disappointment, confinement in the psychiatric hospital, the psychiatric approach to his illness, the death of his

[5] Watch the capture video of the digital project here: https://classroom.onassis.org/mod/page/view.php?id=1666

[6] Watch the capture video of the digital project here: https://classroom.onassis.org/mod/page/view.php?id=1668

Figure 6. Screenshot from the digital project *Singing to the Monumental Beauty with Chisel and Pen*

Figure 7. Screenshot from the digital project *Escape the Sculptrix – A Yiannoulis Chalepas Tribute*

father, the return to Tinos, and his eventual redemption (Figure 8).

(ii) The Gymnasium of Amphipagiton "Andreas Kalvos" (Corfu) and the school team, The Sleeping team... of A2, for the digital project *The Statues Speak*[7].

Project description: In this project, students have the opportunity to get to know the artist himself, follow his tumultuous life, and approach his feelings through his own works. Subsequently, they will be called on to embody the artist and convey his thoughts and emotions through an original and imaginative first-person narrative. The same process is carried out for the artist's works, which "come to life" and narrate their own stories, always through the imagination and personal perspective of the students themselves (Figure 9).

Figure 8. Screenshots from the digital project *True unreasonable*

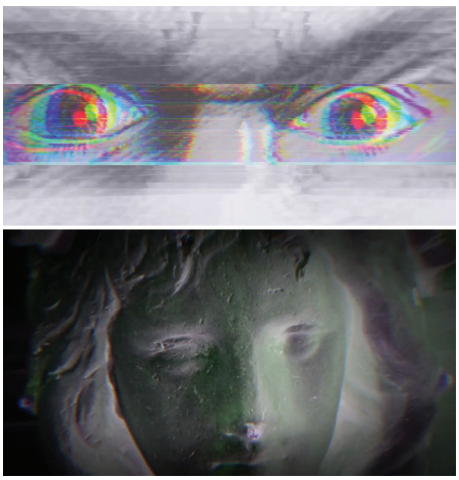


Figure 9. Screenshot from the digital project *The Statues Speak*

8. Assessment

Feedback collected through a mixed-methods approach, including anonymous questionnaires[8], an online award ceremony[9], presentations, surveys, interviews, and in-class observations, revealed positive comments from all participants, including students, teachers, scientific collaborators, and partners, in the evaluation of the student competition. The synthetic approach of the competition was noted by all, being deemed unique, inventive, and multidisciplinary. The method was considered effective and novel, supported by Classroom, an organized, useful, and user-friendly educational digital platform that greatly facilitated remote communication and interaction between participants and organizers without interfering with the program's objectivity and transparency. The competition's topic, which revolved around one personality despite being specialized, kept the majority of participants engaged, underscoring the significance of the life and work of Yanoulis Halepas and its extensive research potential.

Furthermore, it became evident that combining new technologies with computer science, history, literature, and the arts is especially beneficial for the educational process. This approach enhances participants' digital literacy and increases the younger generation's familiarity with Greek cultural heritage. Initially, most students were unaware of the technological solutions available for implementing their digital projects. However, they demonstrated an openness to the concept and swiftly

[7] Watch the capture video of the digital project here: https://classroom.onassis.org/mod/page/view.php?id=1667

[8] You can see here the feedback questionnaire: https://eu.jotform.com/203411977981362

[9] See here the award ceremony and the online presentations of the winning school projects: https://classroom.onassis.org/mod/page/view.php?id=1963

adapted to utilizing them. Finally, students and educators expressed a desire for and suggested new training in digital tools, applications, and platforms in the future (Blender 3D, Unreal Engine, 3D Modeling tutorials, Roblox 3D game platform, etc.).

The qualitative and quantitative analysis of 248 questionnaires submitted by educators and students can be found below (Figures 10-17).

In open-ended questions, participants responded that what they liked most about the program was the originality, innovation, creativity, cooperation among students and teachers, collaboration across different specialties and talents, interdisciplinarity, engagement, exposure to new technologies, and approaching art in alternative and more attractive ways. In addition, they mentioned that the greatest challenges they faced were the limited time available to implement their digital projects, the high level of difficulty in the competition, and the technical constraints of managing and transferring large volumes of files to meet the deadlines for their deliverables.

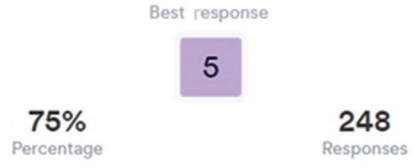
The online award ceremony, organized on December 16, 2023, provided participants with the chance to reflect on their educational experience from a temporal distance and articulate the impact it has had on their creativity and their approach to art moving forward. In this context,

Data	Response	%
5	191	77%
4	48	19%
3	7	3%
2	2	1%
1	0	0%

Figure 10. Feedback to the questionnaire "The digital educational platform was user-friendly"

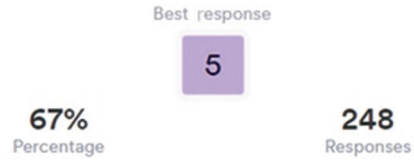
Data	Response	%
5	176	71%
4	61	25%
3	10	4%
1	1	0%
2	0	0%

Figure 11. Feedback to the questionnaire "The educational program was well structured"



Data	Response	%
5	186	75%
4	52	21%
3	9	4%
2	1	0%
1	0	0%

Figure 12. Feedback to the questionnaire "The content of the educational program was innovative"



Data	Response	%
5	165	67%
4	61	25%
3	19	8%
2	3	1%
1	0	0%

Figure 13. Feedback to the questionnaire "The educational program generated new ideas"

Data	Response	%
5	173	70%
4	58	23%
3	15	6%
2	2	1%
1	0	0%

Figure 14. Feedback to the questionnaire "The educational program gave me useful information"

Data	Response	%
5	202	81%
4	38	15%
3	6	2%
1	1	0%
2	1	0%

Figure 15. Feedback to the questionnaire "The instructors were adequately prepared for the subject matter they presented"

Data	Response	%
5	195	79%
4	40	16%
3	11	4%
2	2	1%
1	0	0%

Figure 16. Feedback to the questionnaire "The instructors were engaging"

Data	Response	%
5	191	77%
4	41	17%
3	15	6%
1	1	0%
2	0	0%

Figure 17. Feedback to the questionnaire "The instructors were open to the dialogue"

seven schools presented their digital projects to the public, describing the impact of this initiative on their views of art, digital and communicational skills, and personal development.

Most participants in their presentations reported that in the context of this educational journey, they traveled to the magical world of a great artist, learned a lot from his artworks, were moved by his tumultuous life, and equipped themselves with the courage, patience, and perseverance to create their own digital projects. Taking inspiration from Halepas' attitude toward challenges and obstacles, the competition proved to be a pleasant and creative process that changed participants' perspectives on demanding lessons and art. This valuable educational experience encouraged them to express their feelings, face daily life with greater optimism, and not give up at the first sign of difficulty.

Simultaneously, the digital competition sharpened their creative spirit, unleashed their emotional richness, encouraged experimentation, and improved their communication with each other. Students and educators successfully collaborated, achieving outstanding results in fields that were previously unknown to them. They successfully dealt with inhibiting factors such as time constraints, high difficulty levels, distance learning, and the demanding specifications of the competition deliverables.

During the award ceremony, students and educators seized the chance to connect with other teams, gaining insights into their collaborative approaches that led to success. In addition, they discovered that two schools,

which took part in the previous digital competitions (2021 and 2022) showcased their digital projects at an international conference[10,11] at the University of Twente in Enschede, Netherlands, reaching a wider audience and setting a good example for future participants.

9. Conclusion

The Panhellenic student competition "Hack the Art: Yanoulis Halepas" integrated multiple subjects, including computer technology, literature, history of arts, visual arts, and museology. Beyond subject matter, it fostered innovation and experimentation among participants and their professors, transforming them from ordinary technology users into creators.

The competition facilitated a flipped educational model, allowing both instructors and students to express their creativity and enhance collaboration, efficiency, and communication. Participating school teams demonstrated a high level of interest and commitment, engaging in historical research and utilizing primary materials and archives. Interactions with drawings, sculptures, and historical records prompted them to visualize concepts, stimulate imagination, and apply knowledge across various fields to cooperate, navigate diverse situations, and solve problems.

Through the Panhellenic student competition "Hack the Art: Yanoulis Halepas" and the Onassis Foundation's Classroom educational platform, students acquired digital skills and soft skills like comprehension, critical thinking, empathy, and communication, which are valuable for their future careers. The challenging nature of the project, rooted in PBL, brought together individuals with diverse interests, experiences, perspectives, talents, and needs, leading to psychological resilience in the school environment. Interactive tools and educational resources from partner institutions and the Onassis Library allowed students with varying learning styles to connect with artwork from different eras and trends, comprehend new information, and develop their potential. Creating digital works enhanced their self-esteem, promoted equality and fulfillment, and fostered a community of learners and a positive classroom environment between students and teachers.

The competition exemplified how OBL, GBL, and PBL approaches can integrate historical documents and artifacts into the educational process, communicating art in playful and enjoyable ways. This approach engaged the younger generation, inspired new creations, and allowed for multifaceted interpretations across various scientific and art fields. The creative teaching methods used successfully merged the digital realm with the humanities, laying the groundwork for a more inclusive educational model, prompting a paradigm shift, and serving as an example of opening cultural heritage to the public and educational community. Consequently, educators should embrace the integration of multimodal digital solutions into the creative process, modifying teaching methods to prepare students for a future where digital technology plays an increasingly pivotal role in diverse learning domains.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: Vasiliki Gerontopoulou
Formal analysis: Vasiliki Gerontopoulou
Investigation: All authors
Methodology: Vasiliki Gerontopoulou
Writing – original draft: All authors
Writing – review & editing: All authors

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

[10] See the paper: Mavroudaki, G. *et al*, History and Cartography meet youth through Digital Technology, Vol. 17 No. 1 (2023): Proceedings of the 17th European Conference on Games Based Learning, https://papers.academic-conferences.org/index.php/ecgbl/article/view/1713

[11] Korasidi, A., Merkouri, A., Rigas' Charta: Design and Development of a Complex Digital Game on the Unity 3D Platform by High School Students, Presentation at the 17th European Conference on Games Based Learning by the school team of Doukas School that awarded the first prize at the Hack the Map: Rigas' Charta digital competition in the 3D Video Game category.

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ARTICLE

Integrating art and culture into modern architectural buildings in Nigeria: The cases of Akure, Benin, and Ibadan

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Abstract

Modernism in architecture has witnessed the erosion of traditions, art, culture, and beliefs of Indigenous southwestern Nigerians in recent architectural developments. This phenomenon has stripped most modern buildings, especially in southwestern Nigeria, of their cultural values. This study delves into the historical context of Nigerian art and architecture, highlighting the need for a paradigm shift toward a more culturally inclusive approach. It investigates various strategies and presents examples of successful integration, including the utilization of traditional materials, incorporation of indigenous motifs, and collaboration with local artists and craftsmen. This research examines three cultural center buildings where the architects have endeavored to integrate the art and culture of the people of southwestern Nigeria into contemporary architecture. The case study method of inquiry was adopted for this research, combined with detailed observation and analysis of digital photographs of these buildings. The study highlights the relevance of art and culture in recent architectural developments in three southwestern Nigerian cities: Akure, Benin, and Ibadan. These cities were selected because of their historical backgrounds and rich cultural affiliations that reflect the art and lifestyle of their localities. The cases studied were cultural center buildings because these building types are purposely built to reflect the culture of the people. Findings from the study reveal that some modern buildings still imbibe the art and culture of the people, while others incorporate these elements in more subtle ways, such as mural paintings and relief sculptures on walls. These features connote cultural expressions and representations of Nigeria's heritage, which should not be forgotten but preserved for future generations.

Keywords: Akure; Architectural styles; Art and culture; Benin; Historical buildings; Ibadan; Modernity; Tradition

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1. Introduction

Nigeria has recently witnessed a tremendous evolution in its architectural landscape, with significant efforts toward integrating art and culture into contemporary buildings. The fusion of art and culture in architecture reflects the dynamic nature of Nigerian traditional architecture, highlighting the country's rich heritage. Idoko[1] argues that

balancing modern and traditional styles in Nigerian architecture can enhance tourism, boost the economy, and create opportunities for local artisans to harness their construction skills. This balance preserves cultural identity while promoting development, potentially leading to international recognition and economic growth.[1]

Within the context of this study, tradition refers to the cultural practices and values that have transcended from one generation to another. These include but are not limited to the use of traditional styles, materials, and construction methods (which preserves cultural identity), as well as the incorporation of indigenous motifs and symbols and eco-friendly and sustainable design practices. Al Suwaidi[2] further explains that cultural identity influences art by helping artists create works of art that represents the experiences and traditions of their people, showcasing a community's traditional heritage. Allu-Kangkum[3] posits that architecture is an embodiment of the cultural disposition of a society's customs and beliefs. This embodiment extends beyond the construction practices that have existed in Nigeria for ages and have been impacted by the culture, religion, and environment where they are practiced. It encompasses the design and construction practices adopted in Nigeria for centuries, which have been influenced by various elements, including the environment, culture, and religion. Nigerian traditional architecture is known for its simplicity, practicality, and functionality, and is often decorated with intricate patterns and designs that reflect the culture, religion, and beliefs of the people. In this study, modern design refers to new developments in architecture and art that are simple, functional, and devoid of decorations. Idoko[1] emphasizes that modern buildings disregard traditional architectural developments, resulting in a loss of cultural identity. Allu-Kangkum[3] reiterates that external influences from foreign cultural practices have affected Nigerian traditional architecture, eroding its architectural value and the identity of traditional societies.

In another study, Idoko[4] observed that recently, a significant change has been noticed in how Nigerian architecture has transformed into modern buildings while retaining traditional styles, resulting in a unique design. Nigerian architecture has also witnessed a paradigm shift toward sustainable architecture through the integration of traditional elements into modern styles. This integration has resulted in highly functional, esthetic, and sustainable designs. However, Al-Thahab[5] suggests that maintaining the cultural identity of architecture is uttermost and requires reducing the negative effects that contemporary styles have had on the value of traditional architecture. According to Baydar,[6] value retention ensures that the contextual value of various Nigerian architectural identities is maintained at different levels, thereby creating architectural spaces for sustainable living. While Bilyaminu[7] asserts that modern architecture erodes traditional principles, he also notes that it provides a platform for criticism and differentiation between vernacular architecture and other forms of architecture. Al Suwaidi[2] advocates for a fusion strategy that begets creativity, reiterating that in today's globalized world, cultural identity is crucial in producing art. He reiterates that artists are increasingly inspired by various cultural influences when they create works that showcase a blend of different cultural affiliations.

Architecture has the power to shape our experiences and reflect the values and identity of a society. In Nigeria, a country known for its diverse cultural heritage, there is a growing recognition of the need to integrate art and culture into modern architectural buildings. By incorporating elements such as traditional motifs, materials, and design principles, architects can create spaces that not only serve functional purposes but also celebrate and preserve Nigeria's rich cultural legacy. The aim of this study is to highlight the use of art and culture in modern architectural buildings within southwestern Nigeria, with the goal of reawakening the lost culture of traditional art symbols, motifs, and patterns in contemporary cultural buildings.

2. Literature review

2.1. Historical context of Nigerian art and architecture

Nigeria, a country rich in cultural heritage, has a long and vibrant history of art and architecture. Before the arrival of European colonial powers, Nigeria was home to various indigenous civilizations, each with its distinct artistic traditions. These civilizations, such as the Nok, Ife, and Benin, produced intricate sculptures, masks, and architectural structures. The old Benin people, in particular, had an influential sculptural tradition that was significant and remarkable in Nigeria's ancient art traditions Chukueggu.[8] Their art often reflected religious beliefs, social hierarchy, and cultural practices. The art and architecture of this era were characterized by a high level of craftsmanship, attention to detail, and a connection to spirituality.

The colonial period brought significant changes to Nigerian art and architecture. European influences, particularly from Britain, began to shape the artistic landscape. European architectural styles, such as Neo-Classical and Victorian, were introduced, leading to the construction of government buildings, churches, and other structures that reflected colonial power and authority. Prucnal-Ogunsote[9] emphasized that some of the most significant impacts on traditional Nigerian

architecture were the Islamization of northern Nigeria, the expatriation of former slaves to Nigeria from the Americas, and colonization. However, Nigerian artists also started to incorporate European techniques and materials into their work, creating a fusion of indigenous and Western artistic expressions. After Nigeria gained independence in 1960, there was a renewed appreciation for indigenous art and architecture. This period witnessed a resurgence of interest in traditional art forms and a rejection of colonial influences. Nigerian artists and architects sought to reclaim their cultural identity by embracing local materials, techniques, and motifs. For example, the Ife bronze casting tradition saw a revival as artists aimed to preserve and promote Nigeria's ancient artistic heritage.

In recent decades, Nigerian art and architecture have continued to evolve, embracing modernity while maintaining a connection to cultural roots. Contemporary Nigerian artists have gained international recognition for their innovative and thought-provoking works and address various social, political, and environmental issues.

2.2. Cultural significance of Nigerian art and architecture

Architecturally, Nigerian art and architecture serve as potent forms of cultural expression, embodying the beliefs, values, and experiences of its people. Traditional art forms, such as sculpture, painting, and textile design, are imbued with symbolism and meaning, often drawing inspiration from mythology, spirituality, and everyday life. For example, the iconic bronze sculptures of the ancient city of Ife are not merely esthetic objects but embodiments of royal power, craftsmanship, and spiritual reverence. Similarly, Nigerian architecture reflects the country's cultural diversity and historical narratives. Indigenous architectural styles, such as the mud-brick structures of the Hausa-Fulani or the compound houses of the Yoruba, are manifestations of community values, social organization, and environmental adaptation. These architectural forms often incorporate decorative motifs and symbolic elements that convey spiritual beliefs, social hierarchies, and communal identity as seen in the ancient Yoruba dwelling in Figure 1.

Nigerian art and architecture play pivotal roles in fostering community cohesion and social relationships. Traditional art forms, such as oral poetry, beadwork, and pottery, serve as repositories of historical knowledge, occasions for collective celebration, storytelling, and cultural transmission. Through these artistic expressions, communities reaffirm their shared values, histories, and identities, forging bonds of solidarity and belonging. Likewise, architectural spaces serve as hubs for social interaction, communal gatherings, and ritual activities. Village squares, marketplaces, and religious sites are not only functional spaces but also cultural landscapes that facilitate interpersonal relationships, exchange, and collective experiences. The design and layout of these spaces often reflect social norms, hierarchies, and values, reinforcing a sense of belonging and collective identity. Most established and lasting places before Africa were colonized grew because of their concentrated rites, performances, and economic activities. Oliver[10] refers to such cities before industrialization as symbols of power and influence.

Nigerian art and architecture play crucial roles in preserving and transmitting cultural heritage across generations. Traditional art forms, such as oral poetry, beadwork, and pottery, serve as repositories of historical knowledge, ancestral wisdom, and cultural practices. Through artistic production and performance, artisans and storytellers ensure the continuity of cultural traditions and the preservation of collective memory. Similarly, architectural landmarks and sacred sites serve as tangible reminders of Nigeria's rich cultural heritage and historical legacies. From the ancient city walls of Kano to the UNESCO World Heritage sites of Osun-Osogbo Grove and the Sukur Cultural Landscape, Nigerian architecture bears witness to centuries of human creativity, ingenuity, and resilience. For the Hausas, Daura was the spiritual haven more established among the old kingdoms; the same was the case of Ile-Ife for the Yorubas. From the 15th century, the mosque became one of the most recognized and popular buildings in Hausa settlements Prucnal-Ogunsote.[9] Figure 2 shows an example of a traditional Hausa building. By safeguarding these architectural treasures, communities reaffirm their

Figure 1. An ancient Yoruba dwelling at Ile-Ife Source: A history of Yoruba people. Source: https://es.advisor.travel/poi/Bosque-sagrado-de-Osun-Osogbo-12410#window-photo

Figure 2. A typical example of a well-adorned wall in a traditional Hausa community. Source: https://mir-s3-cdn-cf.behance.net/project_modules/disp/b5e09d178182653.64e3c3b3ba8e4.jpg

connections to the past and commit to preserving their cultural legacy for future generations.

2.3. Need for cultural inclusion in contemporary architecture

Contemporary architecture operates within a globalized context where cultural diversity is celebrated and valued. However, the architectural profession has historically struggled with issues of cultural exclusion, where certain cultural narratives, identities, and traditions have been marginalized or overlooked.

The history of architecture is replete with examples of cultural exclusion, where dominant narratives and esthetic paradigms have marginalized alternative viewpoints and traditions. Colonialism, globalization, and Western-centric architectural discourse have often perpetuated a homogenized architectural landscape that neglects the rich diversity of cultural expressions and identities worldwide. This legacy of exclusion has contributed to a built environment that fails to reflect the complex tapestry of human experience and heritage. When old communities were evolving, certain factors greatly influenced the construction styles, the internal arrangement of the rooms, and the form of most buildings.[9] Cultural inclusion in architecture is essential for honoring the diverse identities, histories, and aspirations of communities around the world. Adeyemi[11] asserts that these traditional built forms became a reference point to the cultural settings in Nigeria and the basis of what evolved as vernacular architecture in Nigeria. Architecture is not merely a functional necessity but a reflection of cultural values, beliefs, and aspirations. By embracing diverse cultural perspectives, architects can create spaces that resonate with the lived experiences and cultural identities of their users, fostering a sense of belonging, pride, and cultural continuity.

Moreover, cultural inclusion in architecture contributes to the preservation and revitalization of indigenous architectural traditions and vernacular building practices. By integrating local materials, construction techniques, and design motifs into contemporary architectural projects, architects can pay homage to cultural heritage while promoting sustainability, resilience, and community empowerment.[1] Inclusive architecture has the power to foster social cohesion, equity, and empowerment within diverse communities. By engaging stakeholders in the design process and prioritizing their needs, architects can create inclusive spaces that promote social interaction, accessibility, and inclusivity. Public buildings, such as libraries, schools, and community centers, serve as hubs for social exchange and collective engagement, where diverse voices and perspectives are valued and respected.

Furthermore, inclusive architecture can address issues of social justice and urban inequality by prioritizing the needs of marginalized communities and underserved populations. By designing affordable housing, public parks, and infrastructure projects that are responsive to local contexts and cultural preferences, architects can contribute to the creation of more equitable and inclusive cities. Cultural inclusion is imperative in contemporary architecture for honoring diversity, promoting social cohesion, and fostering equity and empowerment. Okwumabua[12] observed that the innovative residential designs in the Ibo culture resulted from the impact of colonization. By embracing diverse cultural perspectives, architects can create spaces that reflect the richness and complexity of human experience, while also contributing to the preservation and revitalization of indigenous architectural traditions. Moving forward, efforts to promote cultural inclusion in architecture must be prioritized to create built environments that are inclusive, equitable, and reflective of the diverse societies they serve. Denyer[13] opines that the European styles of architecture and planning policies are still being practiced in Africa today, resulting in a less developed African traditional design style. As a result, many contemporary architectural landscapes lack cultural diversity and authenticity, perpetuating a one-size-fits-all approach to design

2.4. Impact and benefits of integrating art and culture in architecture

Integrating art and culture in architecture elevates the esthetic appeal of built environments, creating visually stimulating and emotionally resonant spaces. Recently, certain architects in Africa have created unique architectural

forms that showcase the lifestyles of specific African cultures and aim to enhance and preserve the cultures and environment of their people Hughes.[14] Artistic elements, such as murals, sculptures, and installations, serve as focal points that capture the imagination and evoke a range of emotions. Whether through vibrant street art in urban neighborhoods or intricately carved facades in historic buildings, art imbues architecture with a sense of vitality, creativity, and cultural richness. Moreover, cultural motifs, symbols, and patterns infuse architectural designs with layers of meaning and symbolism, enhancing their visual impact and resonance. From the geometric patterns of Islamic tile work to the organic forms of indigenous textiles, cultural esthetics contribute to the unique character and identity of architectural spaces, fostering a sense of place and belonging for users and visitors alike (Okwumabua, 2007).

These integrations of art and culture in architecture stimulate innovation and experimentation in design, leading to the creation of more dynamic and responsive built environments. Artists and architects collaborate to explore new materials, technologies, and spatial configurations that blur the boundaries between art and architecture. From interactive installations that invite user participation to kinetic sculptures that respond to environmental stimuli, art-driven interventions push the boundaries of conventional design paradigms, offering new possibilities for spatial expression and engagement Carrol.[15] Furthermore, cultural considerations inform architectural solutions that are responsive to the needs, values, and aspirations of diverse communities. By incorporating local building traditions, social practices, and environmental knowledge into design processes, architects create spaces that resonate with the cultural identity and lived experiences of their users. This approach promotes inclusivity, sustainability, and resilience, fostering environments that are adaptable, accessible, and responsive to changing social and environmental contexts.

Integrating art and culture in architecture offers numerous benefits, including fostering social cohesion, cultural exchange, and community empowerment. Public art initiatives, such as murals, installations, and performances, activate urban spaces and bring people together, fostering a sense of collective ownership and pride in the built environment. Cultural events, festivals, and exhibitions hosted in architectural venues serve as platforms for cross-cultural dialogue, exchange, and collaboration, enriching public discourse and promoting intercultural understanding. Moreover, art-driven interventions in public spaces can address social issues, stimulate economic development, and revitalize communities. By transforming neglected areas into vibrant cultural hubs, architects and artists contribute to the revitalization of urban neighborhoods, fostering economic opportunities and improving the quality of life for residents. This holistic approach to place-making promotes social inclusion, civic engagement, and cultural diversity, cultivating more resilient and vibrant communities.

3. The present study

This study employed qualitative methods of inquiry involving the analysis of case studies of existing buildings within the Southwestern region of Nigeria. Given that the subject of this study is the integration of art and culture in buildings, we selected indigenous cultural center buildings within three southwestern states in Nigeria, comprising: Ondo State, Edo State, and Oyo State. The major cultural center buildings of each of these states were used as cases for the case study approach, to ascertain the level of integration of art and culture in the physical and visual structure of the selected buildings. The buildings adopted in the study are:

i. Oba Akenzua Cultural Center, Benin
ii. Oyo State Cultural Center, Mokola, Ibadan
iii. Ondo State Cultural Center, Adegbemile, Akure.

The analyses focused on the materials used for the building, the facade architecture, and their resemblance to traditional Nigerian architecture in the areas they represent. Due to limitations during the fieldwork, the internal space configurations of the case studies were not captured, meaning that only the facades of the buildings were analyzed. Below is a map of Nigeria showing the locations of Oyo state, Ondo state, and Edo state and their proximity to each other in Figure 3.

3.1. Case studies

3.1.1. Introduction

A case study is an inquiry that typically lays emphasis on describing, understanding, and predicting a process, organization, or group Woodside.[16] For the purpose of this study, three cultural centers from Oyo State (Oyo Cultural Center in Mokola, Ibadan), Ondo State (Ondo Cultural Center in Adegbemile, Akure), and Edo State (Oba Akenzua Cultural Center in Benin) in southwestern Nigeria were used as case studies. These three case studies were selected due to the close relationship the states share in terms of geographical proximity, cultural similarities, and traditional beliefs. They also share physical boundaries, and major federal roads connect them, influencing commerce and developments within these states.

3.2. Oba Akenzua cultural center in Benin

The Oba Akenzua Cultural Center in Benin was designed by Architect Demas Nwoko. The building showcases

Figure 3. Part of the map of Nigeria showing Ondo State (gray color), flanked by Edo State (yellow color) and Oyo State (light brown color). Source: https://www.worldatlas.com

tenets of indigenous art through its structural and esthetic elements, as seen in Figures 4 and 5. The building was conceived to serve two important functions: first, to house cultural activities in Benin and Edo State at large and second, to educate individuals about the art and culture of the Benin people. The building's close proximity to the Oba's palace and the Benin museum marks it as one of the major cultural buildings in Benin.

There are two main auditoriums at the center: The royal hall and the main auditorium. The royal hall has been leased out as a cinema to revive the cinema culture in the community, which started to erode gradually since the 1970s. The main auditorium, a masterpiece for theaters, is situated such that its length aligns with the road connecting to the airport, and its end is accentuated by a significant landmark in Benin, the "Ring Road."

The organization of spaces in the complex conforms to a premeditated plan, characteristic of a purpose-built building. This planning is evident in how certain spaces are designed. For instance, in the auditoriums, natural lighting is intentionally minimized by creating small fenestrations, which create an ambient atmosphere inside the hall, enhancing the theatrical experience in the space. Certain offices are attached behind the stage to serve administrative functions for activities carried out in the hall. The building also provides facilities for exhibitions, including gallery space and an exhibition room.

The materials used in the building are readily available and locally sourced. Besides the sandcrete blocks used for the walls, the building also uses materials such as laterite bricks, treated wood, ceramic tiles, and iron for various millworks and handrails.

On the building façade, clay materials are beautifully used in diverse forms (Figure 6) to accentuate and characterize the entire form of the building. In certain

Figure 4. Exterior of the Oba Akenzua Cultural Center (during construction). Source: Authors' fieldwork in 2019

Figure 5. Exterior of the Oba Akenzua Cultural Center (after its completion). Source: https://www.asabametro.com/dont-convert-oba-akenzua-ii-cultural-centre-to-market

places, fired clay materials are used for cladding, while in others, clay bricks are used for facing. Materials like the new improvements in adobe blocks, invented by Architect Demas Nwoko by mixing proportions of cement and laterite, exemplify the modified materials that help the buildings conform better to a modern style while still portraying the tenets of the indigenous culture of the place.

Common to many of Demas Nwoko's works, Nigerian art and various crafts are well represented. Many times, Demas uses sculptural forms that carry allegorical meanings depicting certain cultural ideals Nwoko.[17] The designer incorporates local art through local craftsmanship. To showcase his African architectural style, Demas invited local craftsmen to partake in the planning process, allowing them to express their skills and knowledge using different media. His contributions are evident in the elements that are used within the building, such as the intricate carvings on columns and doors within the building. Demas showcased his African style and techniques in the ways mentioned above.

As a cultural center, the building extensively reveals and celebrates the Indigenous lifestyle. Architectural elements like courtyards are adopted from indigenous architecture, showcasing the traditional style of the area. Moreover, the artwork on display provides insights into the lives of the local people, highlighting the varied crafts and skill levels of the Benin community. Particularly, at the entrance of the building, numerous mural wall paintings can be seen above the entrance slab, with a Benin mother head (a symbol of FESTAC 77) strategically placed at the center of the murals. This prominent feature cannot be missed by the visitors while entering the building. The Benin mother head is a symbolic art bronze casting typical of the Benin people and represents the cultural and historic art style of the Ancient Benin Kingdom and its people. In addition, the curvature visible on the façade walls of the building (to the right and left wings of the building in Figure 4) represents the shape of the staff of the Oba of Benin (Figure 5). This remarkable architectural style by Demas integrates the art and culture of the Benin people into their buildings. This approach is commendable as it integrates the art and culture of the old Benin tradition into new buildings within its vicinity.

Figure 6. Use of natural materials on the façade of the Oba Akenzua cultural center. Source: Authors' fieldwork in 2019

3.3. Oyo State Cultural Center in Mokola Ibadan, Nigeria

Completed in 1977, the Oyo state cultural center was intended by Chief Obafemi Awolowo, the premier of the old western region at the time, to commemorate the festival of art and culture for that year (FESTAC '77). The aim was to create a totem of the art and culture of western Nigeria. As an emblem of culture, the center became iconic to Oyo state and its people in certain periods. Since then, the center has hosted numerous events in various capacities, ranging from state-organized programs to various privately organized events.

Perched beautifully atop the Mokola Hills, the cultural center's entrance is flanked by two elegant sculptures, as seen in Figure 7. One sculpture depicts a man carrying a traditional Yoruba drum called the gangan, while the other shows a man carrying a traditional Yoruba musical instrument called the shekere. Both figures are gorgeously dressed in traditional Yoruba attires. The building incorporates a great deal of elements that reflect Yoruba culture and indigenous art, evident in the large sculptures at the entrance of the complex. The embellishments on the walls, which include murals and sculpted patterns of various kinds (Figure 8), express ideas and concepts adapted from Yoruba history and tradition.

The main building features a blend of curvilinear and rectilinear forms. The most prominent space in the complex is the main auditorium, which includes two elevated platforms: The proscenium and the thrust. Offices are attached to the back of the stage, arranged sequentially on two floors. The complex houses three halls: The main auditorium with a gallery, the rehearsal hall, and the cinema hall.

A craft village is also located within the complex, at the northeastern end of the main entrance. Buffered from the

Figure 7. Exterior view toward the entrance of the Mokola cultural center showing sculptures of Yoruba music makers. Source: https://www.saeedahwits.com/2017/01/cultural-centre-mokola-ibadan

main building, it provides a serene environment for artists to work. The building's walls are constructed with sandcrete blocks, plastered with a mix of cement and sand (mortar), and finished with emulsion paints. Certain elements, such as the various shading devices and the dominant structures located at the entrance, were constructed using reinforced concrete to embellish the built form. Other materials used in the building include wood, granite, terrazzo, and more. The floors are finished in granite and terrazzo, while certain portions of the walls, especially the halls, are finished with tongue-and-groove polished wood. In the halls, due to the nature of activities, the ceilings are finished with materials that have good acoustic properties.

This particular building does not heavily incorporate local materials as major building elements. Except for certain interior areas where wood was used for flooring and ceilings, all other materials used in this development were not locally sourced.

Indigenous art and crafts are graciously celebrated in this building, with wall murals (Figure 9) and the sculptures at the entrance (Figure 7) being the most evident examples of local craftsmanship. The location of the art and craft village also highlights the significance of art in the area and reflects the living style of the community.

As a cultural center, the building reveals aspects of the Indigenous lifestyle. The activities carried out in the various spaces within the complex are culturally inspired. In addition, the building incorporates the courtyard system, adopted from Nigerian traditional architecture. It effectively showcases various crafts and skills of the local people, particularly the Ibadan community.

3.4. Adegbemile cultural center in Akure

Adegbemile cultural center initially operated as a private venture, intended to provide an environment for relaxation and cinema experiences. In 1970, an office complex was constructed next to the cultural center, providing spaces for the workforce in the center, especially after its sale to the state government in 1989. The Department of Art, Culture, and Tourism in Ondo State manages all activities at the center, both administrative and otherwise.

The complex comprises an office building and the cultural center on neighboring plots. The cultural center houses auditoriums, exhibition spaces, various retail outlets, an art shop, storage spaces, and a few offices. The office block serves entirely for administrative purposes for staff members of the Ondo State Ministry of Art, Culture, and Tourism.

Spaces in the cultural center are arranged around the main auditoriums. On approaching the building, as seen in Figure 10, the first point of entry leads into a hall now used for exhibitions. The main auditorium extends further into the building, ending at the far side of the complex, making it distant from the major road and ideal for serene activities. Other spaces include various exhibition halls. One particular hall, formerly a dance hall, now serves as a general hall. The complex has retail outlets, with the art shop being the most active and frequently used. Artworks

Figure 8. Façade of the Mokola cultural center. Source: https://feigningdepth.wordpress.com/2015/03/03/the-oyo-state-cultural-centre-ibadan

Figure 9. Wall murals at the Mokola cultural center. Source: https://www.saeedahwits.com/2017/01/cultural-centre-mokola-ibadan

Figure 10. Approach of the Akure cultural center. Source: Authors' fieldwork in 2019

Figure 11. Indigenous art and craft sparingly expressed in the building. (A) Wall murals at the entrance. (B) Relief sculpture on the fence and sculpture in the round exhibition space. Source: Authors' fieldwork in 2019

are exhibited and displayed to customers for sale, and customers can also retrieve contact information for artists for further business dealings.

The primary construction material used is sandcrete blocks, with no special finishes on the exterior. However, various materials are used inside the building, including wood, bamboo, ceramic finishes of various kinds, and others. The building structure was constructed using the most common materials that can be found locally. Despite this, the building does not prominently feature local materials as major building elements. Except for certain interior areas where wood is used for flooring and ceilings, all other materials were not locally sourced. Indigenous art and craft are sparingly expressed in this building, evident in the wall murals (Figure 11A) and the relief sculptures (Figure 11B) at the entrance (on the perimeter fence). The art shop at the entrance also exhibits a variety of works by local craftsmen, ranging from textile materials to sculptures and various graphical illustrations and patterns.

The activities within the building, rather than its elements, reveal the local culture. Activities that promote and enhance the art and culture of the people are displayed within the exhibition spaces within the building. The primary purpose of the building is to accommodate cultural activities organized by the state or private organizers.

4. Deductions and discussions

This study demonstrates that the art and culture of indigenous traditional lifestyles, which are gradually eroding due to modernization, can be reintegrated into contemporary buildings to preserve Nigeria's local heritage and tradition for future generations. This study examines three case studies to determine if the art and culture of Indigenous people were integrated into the cultural buildings in their localities. Findings indicate that the integration of art and culture was achieved, especially in the cultural center buildings in Benin and Ibadan. The introduction and integration of the Benin queen mother head (Iyoba) at the entrance of the Oba Akenzua Cultural Center, together with the mural and relief sculptures at the top of the entrance foyer, align with the opinions of previous studies[12,15] on the importance of decorative and symbolic patterns or motifs in African historical settings. The Oba Akenzua cultural center stands out among the three cultural centers because both the architectural edifice and the walls of the main entrance depict the traditions, cultural motifs, and patterns associated with the old Benin empire, especially the resemblance of the approach elevation of the building façade to the Oba of Benin's ceremonial staff. This edifice serves as an archetypal representation of cultural development in modern Nigerian societies. The main building is sculpted with a premonition of creating an edifice that speaks the artistic language of the place.

The entrance of the cultural center at Ibadan, Oyo State, to a great extent, showcases the attire and traditional musical instruments of the Yoruba people. This depiction is especially evident at the entrance of the building, where sculptures of music makers are placed, and on the relief sculptures on the walls of the perimeter fence of the site. These artworks depict the art and culture of the traditional lifestyles of the southwestern people integrated into modern buildings. This observation agrees with Denyer's[13] position that the colonial mentality had eroded the social and cultural lifestyles that were reflected in neighborhoods and communities. The design of the building fits well into its environment, as its structure is adapted to the site rather than the other way around. The best forms of architecture are expressed this way, creating a sense of place. They characterize the landscape by becoming a part of it rather than being imposed as rigid elements. In addition, a profound architectural feature of the cultural center in Ibadan is its use of the ancient traditional Yoruba courtyard system/style of construction. This method allows for architectural spaces to be built around a rectangular empty space, forming a central courtyard. This represents culture at its peak, and the reintegration of this traditional dimension into the cultural center in Ibadan is a prolific architectural language that depicts the cultural heritage of the people. The cultural centers at Benin and Ibadan explicitly represent the art and culture of the Indigenous people of their respective localities.

The cultural center in Akure only has murals on the walls of the perimeter fence, thereby showcasing the general features of the Yoruba people's lifestyles. While this may be acceptable due to the features incorporated on the walls, it cannot be compared to the cultural centers in Benin and Ibadan. Akure is an old town with a strong cultural background, just like Benin and Ibadan; therefore, it is expected that its cultural center should showcase much

more than it does. Pragmatic in approach, the building only minimally portrays Yoruba culture and fails to depict the indigenous art principles of Akure. Although certain elements, like the wall murals and the relief sculptures on the perimeter fence, slightly depict artistic tenets, they do not provide a general form of knowledge about the Yoruba people. Aside from the issue of representation, the building is also lacking in functionality as a cultural center, especially when considering the varied activities that occur within the premises.

If the cultural center buildings studied here are to be ranked in order of their depiction and showcasing of the art and culture of their region or locality, the ranking would be Benin first, Ibadan second, and Akure third.

5. Conclusion

This paper substantiates the essence of art and culture in architecture and its development. Undoubtedly, modern technological advancements have impacted architecture, causing a radical transformation in how architecture has metamorphosed. Incorporating indigenous art and culture does not necessarily mean returning to traditional forms of architecture; rather, a seemingly radical approach is sought to integrate art and culture into contemporary buildings. While trying to create a balance may not be an easy task, Idoko[1] suggested a potential strategy called "revivilism," where elements of both traditional and modern are fused together in a building project without compromising either. Contemporary buildings ought to incorporate societal ideals in the way modern art does, rather than with rigid alignment of forms and spaces. Built forms should interact more expressively, and spatial configurations should align allegorically with cultural and societal ideals.

Integrating art and culture in architecture has a profound impact on esthetics, functionality, and social dynamics, enriching built environments and enhancing the human experience. By blurring the boundaries between art and architecture, designers create spaces that are visually captivating, emotionally engaging, and culturally resonant. Moving forward, efforts to promote interdisciplinary collaboration, cultural exchange, and community participation will be essential in harnessing the transformative potential of art and culture in shaping the future of architecture. Nigerian art and architecture are not merely esthetic phenomena but integral components of cultural identity, community cohesion, and heritage preservation. By understanding the cultural significance of Nigerian art and architecture, we gain insights into the complexities and richness of Nigeria's cultural tapestry and the enduring resilience of its people. Summarily, this interconnection is profound in promoting Nigeria's national identity. These architectural expressions could help Nigerians herald their unique cultural heritage. In the future, new architectural developments should consider prioritizing cultural designs and injecting innovations that preserve Nigeria's cultural heritage. If this is sustained, Nigeria will continue to advance its course toward cultural diversity through art and architecture. Allu-Kangkum[3] suggests that no matter the dynamism experienced in architecture, Nigerian society should not lose its cultural value and identity, especially in a changing world. This brings to mind the quote of the great architect Philip Johnson: "The future of architecture is culture."

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The authors declare that they have no competing interests.

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Not applicable.

Consent for publication

Not applicable.

Availability of data

Most of the data within the study are in graphical images (photographs) that were either obtained from the Internet or taken by the authors using a digital camera during the field study. The websites where these images can be obtained are available in the reference section.

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ARTICLE

Restoration, preservation, and interpretation of the royal chariot from the Sinauli excavation in India: Safeguarding a remarkable discovery

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Abstract

The novel discovery of the royal chariot from the Sinauli excavation in India has sparked a global debate among archaeologists and historians regarding India's ancient history and the Aryan invasion theory. The chariot is a remarkable piece of engineering, showcasing advanced metalworking techniques that challenge previous assumptions about the technological capabilities of ancient India. Its design closely resembles chariots depicted in ancient Indian texts and art, underscoring its cultural significance. The royal chariot is a fascinating combination of materials and craftsmanship. Its construction features a wooden frame adorned with intricate copper-inlay decorative work. After millennia underground, the wooden structure had transformed into mud, leaving behind only the fragile, corroded copper elements. This necessitated the restoration and preservation of the royal chariot for future research, with the aim of arresting or slowing down the rate of further deterioration, using the appropriate methodology as required. This article describes the restoration and preservation of the royal chariot.

Keywords: Royal chariot; Inlay copper work; Corrosion; Restoration; Preservation

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1. Introduction

In the heart of India, at the historic site of Sinauli, an extraordinary and unprecedented discovery has sparked a global debate among archaeologists and historians. The find – a royal chariot unlike any other – has the potential to rewrite India's ancient history and reignite discussions surrounding the Aryan invasion theory.[1,2] This chariot is a remarkable piece of engineering, showcasing advanced metalworking techniques that challenge previously held beliefs about the technological capabilities of ancient India. Its design closely resembles chariots depicted in ancient Indian texts and art, providing further evidence of their cultural significance in India.[3]

Beyond its craftsmanship, the discovery of the royal chariot has sparked heated discussions among scholars regarding the Aryan invasion theory. This theory, proposed in the 19th and early 20th centuries, suggested that the migration of Indo-European

Aryans from Central Asia into the Indian subcontinent around 1500 BCE played a pivotal role in shaping India's early civilization.[4] The existence of the royal chariot raises questions about the timeline and origins of advanced civilizations in India. The dating of the Sinauli burials to around 1900 BCE[5] has led some historians and archaeologists to argue that the sophistication of the chariot indicates a well-established indigenous culture, challenging the notion that ancient Indian civilizations were primarily shaped by external migrations. They propose that instead of an invasion, cultural exchanges and internal developments within the Indian subcontinent contributed to the growth of these early societies. However, proponents of the Aryan invasion theory point to linguistic and textual evidence indicating interactions between Indo-Aryans and other indigenous cultures.[4,6] They argue that the chariot's design could result from cultural exchanges between different groups, which could still fit within the broader framework of the Aryan invasion theory.

As the scientific community grapples with these intriguing discoveries, it is essential to maintain a balanced, evidence-based approach to interpreting the past.[7] The royal chariot from Sinauli has provided a wealth of new information, offering fresh insights into India's ancient history. However, it is crucial to remember that a single artifact cannot definitively resolve debates that have persisted for centuries. Ongoing excavations and research at Sinauli are expected to reveal more about the ancient societies that once thrived there, potentially shedding further light on the Aryan invasion theory and the broader history of India. Until then, scholars will continue to exchange ideas and theories, gradually moving toward a more comprehensive understanding of India's remarkable and diverse past.

Renowned Indian archaeologist Dr. S. K. Manjul of the Archaeological Survey of India and his team began extensive excavations at Sinauli. Among their findings, the royal chariot stood out for its fascinating combination of materials and artistic craftsmanship. The chariot features a wooden frame, which serves as its structural foundation, providing the necessary strength and durability for transportation. This frame is complemented by intricate copper-inlay decorative work that enhances its exquisite beauty (Figure 1).

The skilled artisans of ancient India crafted this wooden framework, showcasing their expertise in working with woodworking and their ability to create both functional and elegant designs.[8-10] The full-sized, two-wheeled chariot measured 135 cm in length and featured a fixed axle supporting a semi-circular wooden platform covered with thick copper plates. The platform, with inner dimensions of 60 cm × 52 cm, was framed with copper pipes that attached

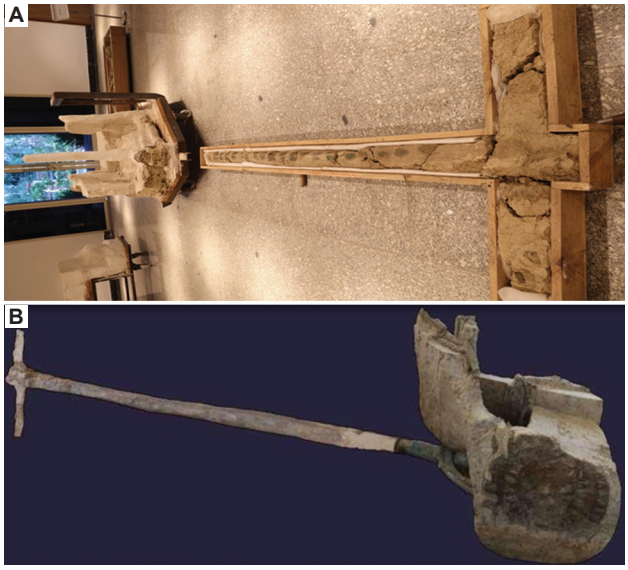

Figure 1. Preservation and visualization of the royal chariot. (A) The royal chariot excavated from Sinauli kept in a safe house at the Pt. Deendayal Upadhyaya Institute of Archaeology, Greater Noida. (B) The actual visualization of the royal chariot. Source: Archaeological Survey of India

the side panels, which stood approximately 100 cm high from the base of the chariot. A single pipe supported a canopy positioned 100 cm from the chariot's end. The solid wheels were adorned on both sides with triangular copper sheets arranged in three rows, radiating from the central hub to the outer rim. These sheets were affixed with 2-cm long copper nails. Similarly, triangular decorations adorned the 230-cm long pole and the 95-cm long yoke (Figure 2).

The first challenge faced by the excavation team was moving the royal chariot to a secure location for further research and conservation. The copper inlay on the chariot's wooden structure suggests that it was a luxurious and opulent piece, likely associated with a person of significant power and influence in ancient Indian society. The motifs and patterns created with the copper inlay may offer valuable insights into the cultural and aesthetic preferences of the time. Archaeologists and historians will meticulously study this copper inlay work to discern its symbolism, style, and possible connections to other artifacts or historical records from the same era. Such an analysis could provide a deeper understanding of the cultural and societal context in which the chariot was crafted and used. The combination of wood and copper inlay showcases the fusion of artistic expression and functional design characteristic of ancient Indian craftsmanship. As researchers continue their analysis, the royal chariot of Sinauli is poised to reveal new chapters in the rich tapestry of India's ancient history and contribute further to the ongoing debates surrounding the Aryan invasion theory.[4,11]

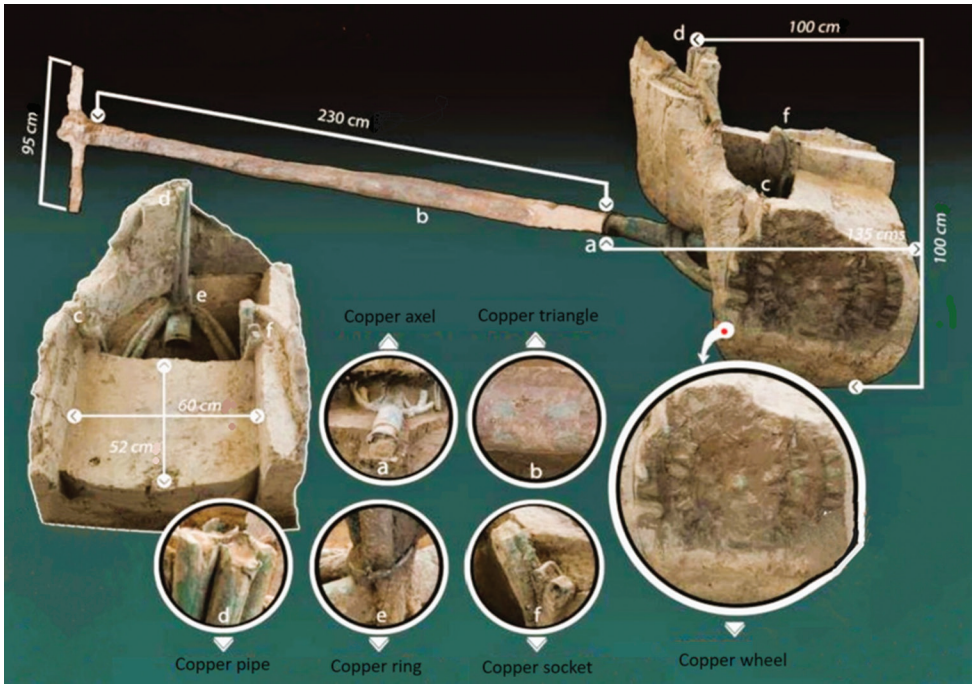

Figure 2. Detailed documentation of the royal chariot. Source: Archaeological Survey of India

It was a significant challenge for the science branch of the Archaeological Survey of India to restore and preserve the royal chariot, with the aim of arresting and slowing its deterioration. A team of archaeological chemists, led by Dr. M.K. Bhatnagar, played a crucial role in the conservation and restoration efforts. The first step was to shift the royal chariot to a secure location to facilitate the next phase of research and conservation.

2. Materials and methods

2.1. Instruments and reagents

A cutter kit, assorted surgical knives and blades, and soft nylon brushes of various sizes were procured from the local market for opening and cutting the straps and slings, as well as for superficial and mechanical cleaning of the royal chariot. Most of the inorganic and organic chemicals used in this study, such as Plaster of Paris (POP), acetone, toluene, isopropanol, and benzotriazole (BTA), were supplied by Central Drug House Ltd., India. Polyvinyl acetate (PVA), with an average molecular weight of 1,00,000, as determined by gel permeation chromatography beads, was procured from Sigma-Aldrich (Switzerland). Bandages for straps and slings, as well as binder and adhesive (animal glue), were supplied by the local market. Mud bricks retrieved from the excavation site were used to repair missing parts of the royal chariot, a necessary step for its restoration.

A handheld X-ray fluorescence (XRF) from the Olympus Vanta C Series, Model VCR (Japan), was used for the elemental analysis of materials. This handheld XRF operates with a 4-watt X-ray tube optimized with a-W-40 kV anode material. It features a silicon drift detector, an 8-position auto-selected filter per beam per mode, and is powered by a removable 14.4 V Li-ion battery with hot-swap capability. The device can function within a temperature range of –10C°–50C° and humidity levels of 10 – 90% relative humidity (non-condensing).

2.2. Process of moving the royal chariot from the excavation site to the safe house

The process of lifting the royal chariot from the Sinauli excavation site to a safe house was meticulous and delicate, given its historical significance and fragile state. The Archaeological Survey of India team undertook the following steps:

2.2.1. Documentation and assessment

The condition of the chariot was thoroughly documented and assessed by a team of expert archaeologists and conservators before being lifted. Detailed drawings, photographs, and 3D scans were conducted to record every aspect of the royal chariot (Figure 2 and Supplementary Video S1).

2.2.2. Support and reinforcement

Archaeologists, conservators, and experts assessed the structural integrity of the royal chariot to identify potential weak points and areas that needed support during the lifting

process. Temporary, reversible supports were added using POP straps and slings (bandages dipped in aqueous sludge of POP) to reinforce the chariot and prevent damage to its outer surface. The base of the royal chariot was secured to a steel frame with the help of jacks under the supervision of structural conservation experts. The attachment points were strategically chosen to evenly distribute the weight and minimize stress on the artifact.

2.2.3. Excavation and detachment

The royal chariot was carefully excavated from the surrounding soil to ensure that no part of it was damaged in the process. This required precise tools and techniques to avoid any accidental damage.

2.2.4. Lifting equipment

Specialized lifting equipment, including cranes for shifting and gantries for lifting, was brought to the site. The selection of equipment was based on the weight and dimensions of the chariot to ensure safe handling and even weight distribution, minimizing stress on the royal chariot.

2.2.5. Controlled lifting

With all safety measures in place, the lifting process was carried out gradually and under the close supervision of experts. The royal chariot was lifted inch by inch to ensure stability and avoid sudden movements. At each stage of the lift, archaeologists and other experts paused to assess the chariot's condition and adjust the rigging as necessary. This careful approach was critical to preventing accidental damage during the process.

2.2.6. Transport to the safe house

Once the royal chariot was safely lifted, it was carefully transferred to a specially designed container for transportation. The container provided adequate protection to prevent any movement that could cause damage during transit. On arrival at the safe house, the Science Branch of the Archaeological Survey of India in Greater Noida took over the stabilization and conservation of the artifact. This process included removing the straps and slings, cleaning, documenting, and repairing the chariot to ensure its long-term preservation. Details of the restoration and preservation efforts, which involve the removal of straps and slings from the royal chariot, are outlined as follows:

- Before applying POP straps and slings, the royal chariot was covered with a non-stick polythene sheet. Subsequently, straps and slings were applied to make the chariot's surface non-sticky and reversible. The removal of these straps and slings was carried out using a cutter and assorted surgical knives and blades (Figure 3).

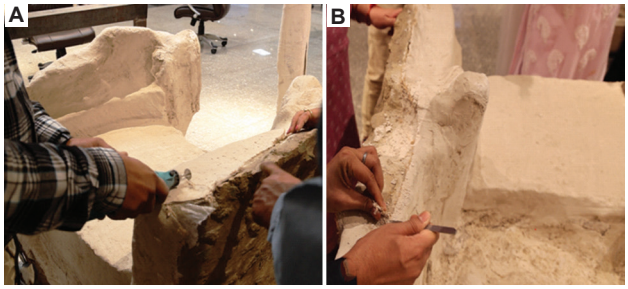

Figure 3. Removing straps and slings from the royal chariot using grinders and surgical knives and blades at the safe house. (A) Using grinder. (B) Using surgical knives and blades. Source: Archaeological Survey of India

2.2.7. Conservation state of the royal chariot

The conservation state of the royal chariot unearthed from Sinauli in 2018, dating back to the Bronze Age, presents several challenges and opportunities for restoration and preservation. The left wheel portion of the chariot, adorned with metal pieces, was consolidated with Paraloid B-72 (thermoplastic resin). The remaining sections were reinforced and coated with plaster gauze using POP. Originally crafted from wood and copper, the wooden components of the wheel have eroded over time, leaving numerous pointed triangular copper pieces embedded in the mud, along with the shaft connecting to the yoke. These copper fragments, which display green incrustations, notably form a circular motif within the wheel. The mud encasement, now robust and retaining its form, lacks any traces of wood. Although the copper plates were well preserved within the mud, the yoke segment shows faint impressions and scant remnants of copper. The shaft, which is in a fragile state with multiple breaks, is supported by a plywood case and shielded with a transparent Perspex sheet. Similar triangular copper pieces with green incrustations were also found in the long shaft portion and the copper axle linking the shaft to the chariot.

While the exposed mud wheel appears structurally sound, its core strength remains uncertain until the packaging material is fully removed. The lower base of the chariot exhibits visible lacunae, voids, and pits (Figure 4). Due to the fragile nature of the shaft and yoke, extreme caution is required during handling for restoration and preservation. Overall, the conservation state of the chariot requires careful examination and treatment to ensure its long-term preservation and display.

2.2.8. Superficial and mechanical cleaning

To remove loose dirt and dust from the surface of the chariot, archaeologists used soft-bristled brushes made of nylon hair. Brushes of various sizes and shapes were employed to reach different areas effectively. Mechanical

cleaning was carried out using wooden picks and spatulas to gently dislodge debris without scratching or damaging the surface.

Both superficial and mechanical cleaning requires the utmost care and caution. Archaeological chemists first assessed inconspicuous are as to ensure that no adverse effects would result. The goal was to enhance the royal chariot's appearance and stability without altering its original state. Before undertaking any scientific treatment, a detailed assessment and documentation of the royal chariot's condition have been conducted. This includes noting any existing coatings, varnishes or pigments, and areas of particular vulnerability, such as fragile decorations or corroded metals. It is important to emphasize that the cleaning process was carried out by experienced and trained archaeological chemists with specific expertise in handling and preserving such artifacts. The preservation of the royal chariot's integrity and historical value was paramount throughout the cleaning process.

2.2.9. Restoration and preservation of the royal chariot

The restoration and preservation of the royal chariot involved meticulous and specialized tasks aimed at stabilizing, conserving, and repairing the royal chariot to its closest original condition while preserving its historical and archaeological value (Figure 5). This process was comprehensive and multi-step, ensuring its long-term protection and its effective presentation to the public.

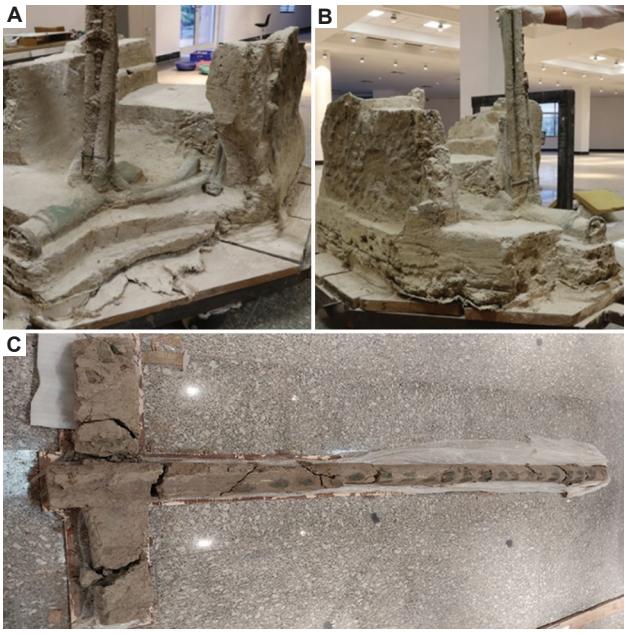

Figure 4. On opening the straps and slings from the royal chariot. (A) Left side view. (B) Right side view. (C) Yoke and shaft view. Source: Archaeological Survey of India

A detailed overview of the process is explained in the subsequent sections.

2.2.10. Removal of consolidate, adhesive, or preservative

During the excavation of the royal chariot, consolidants, adhesives, and preservatives were applied to prevent further damage to the structure. Thus, before proceeding with restoration and preservation, it was essential to remove any excess coating from the artifacts. The choice of chemicals/solvents for the removal of those coatings was based on trial methods using specially formulated chemical solutions that were safe and compatible with excavated objects. Organic solvents such as toluene 100%, toluene 60% + acetone 40%, toluene 40% + acetone 40% + isopropanol 20%, and distilled water as per requirement were used along with cotton swabs to remove old adhesive, consolidate, and preservatives (Figure 6). The protective coatings were gradually removed, and any unwanted material was cleaned from the surface.

2.2.11. Structural stabilization

The royal chariot exhibited signs of structural instability or fragility in its wooden parts and pole. Fragile or deteriorated sections were stabilized using non-invasive and appropriate methods. For example, a mixture of mud powder and animal glue in distilled water was used in a

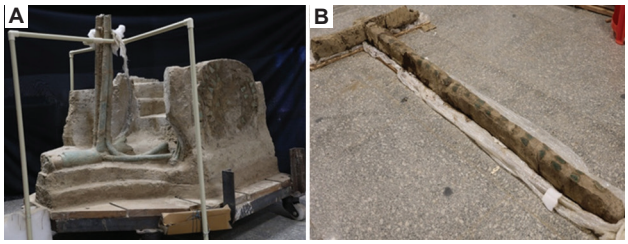

Figure 5. Restoration and preservation of royal chariot. (A) Canopy pole. (B) Yoke and shaft. Source: Archaeological Survey of India

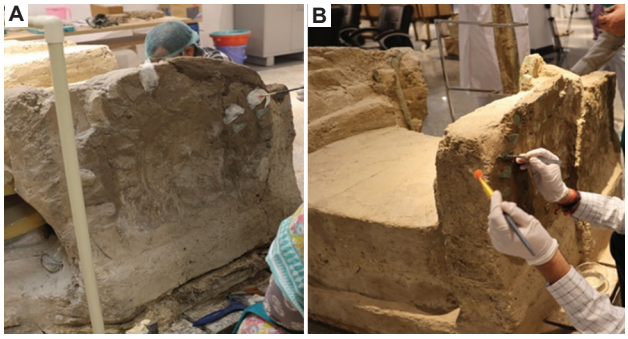

Figure 6. Removal of consolidate, adhesive, or preservative coating and hard encrustation. (A) Left wheel. (B) Right wheel. Source: Archaeological Survey of India

ratio of 3:1:1. Damaged parts of the wheel were restored to ensure its structural integrity and enhance public understanding. To strengthen and support the weak areas, stainless steel rods and adhesives were used to stabilize the wooden frame and other elements, including the pole.

2.2.12. Non-destructive XRF analysis of the royal chariot

XRF is a powerful analytical technique that was crucial in studying the royal chariot excavated from Sinauli. XRF is a non-destructive method[12-14] used to determine the elemental composition of materials through single-beam and double-beam methods. In our analysis with a hand-held XRF instrument, we examined the composition of the copper plates on the chariot, revealing a range of copper concentrations, from approximately 99% to 58%, depending on the position tested. We employed the alloying method, utilizing the single beam for 10 s (Supplementary Figures S1 and 2). These variations in composition could be attributed to the presence of surface accretions or deterioration; further investigation is needed to understand the implications of these variations in composition.

Moreover, the analysis of the wood, which had transformed into mud, revealed a silica content of approximately 20 – 28% (Figures 7 and 8). This analysis was conducted using the double-beam geochemical method. Beam-1 was directed at the sample for 20 s, while beam-2 was applied for 40 s, aiding in on-site assessments for the identification and quantification of the elemental composition (Supplementary Figures S3 and 4). These findings underscore the need for ongoing investigation to ensure accuracy and reliability. Additional research is crucial to understanding the implications and significance of the observed differences in material composition within the historical context of the chariot.

2.2.13. Scientific treatment

After removing the preservative coating and other incrustations and identifying the construction material, it was found that the full-sized two-wheeled chariot with pole and yoke was nearly intact. However, the axle, chassis, and dashboard were partially damaged. Nevertheless, it is evident that the chariot had a fixed axle supporting a semi-circular wooden platform covered with thick copper plates. The copper metallic portion of the royal chariot was brushed with alcohol to remove sand and dirt from the surface. Following the removal of incrustations and cleaning, the metal parts were rinsed with hot distilled water once they were completely dry (Figure 5).

Active corrosion areas were meticulously cleaned and treated with a corrosion inhibitor (1 – 3% BTA solution in isopropanol) using cotton swabs, applied every half hour over the course of 3 days. Any excess powdery BTA was removed using isopropanol. Loose copper chips were joined or repositioned using acrylic resin. A protective coating of a 1% PVA solution in toluene was applied to the cleaned, stabilized, and dried copper metal. In some cases, toluene-soaked swabs were used to remove any excess coating or gloss from the surface.

3. Results and discussion

The royal chariot discovered in the Sinauli excavations is a unique discovery on the entire subcontinent, dating back to the Bronze Age. The primary structural material of the ancient royal chariot was wood, supported by thick metal sheets (plates) and adorned with copper triangles. The metal components were identified using a hand-held portable energy dispersive XRF (EDXRF) (Figures 7 and S1). Over

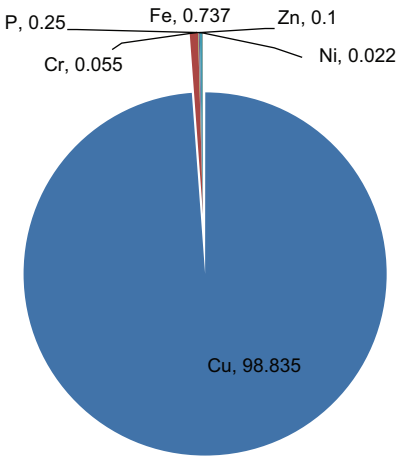

Figure 7. Handheld energy dispersive X-ray fluorescence data (%) of the copper plating and decorated copper metal on the wooden frame of the royal chariot

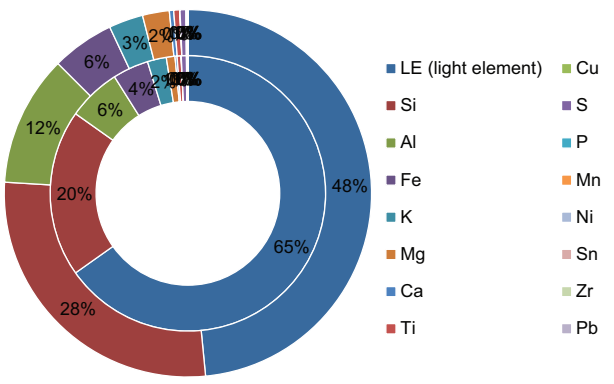

Figure 8. Handheld energy dispersive X-ray fluorescence data of the mud and wooden frame that has transformed into mud in the royal chariot

the course of several millennia, the wooden materials have completely transformed into mud. The transformation, where organic matter converts into clay minerals, is a complex process that occurs over a long period of time under specific environmental conditions. When wood is exposed to moisture, microorganisms such as fungi and bacteria begin to break down its organic components, including cellulose and lignin. This initial decay weakens the wood structure. As the decay progresses, soluble components of the wood, such as sugars and other organic molecules, leach out into the surrounding environment. This leaching can contribute to the formation of a muddy or sludgy substance around the decaying wood. In environments with high levels of clay minerals, such as certain soils or sedimentary environments, these leached organic compounds can interact with mineral particles, leading to the formation of new clay minerals. This process, known as mineralization or pedogenesis, involves complex chemical reactions that transform the organic matter into inorganic mineral structures. Over time, the muddy or sludgy substance surrounding the decaying wood becomes compacted, further enhancing the transformation into a solid, clay-rich material.[9,10,15] EDXRF analysis has also been performed on the mud portion transformed from wood as well as on the original mud bricks recovered from the Sinuali excavation (Figures 8 and S2). Investigating the variation in the composition of metals and wood transformed into mud will be a focal point of our upcoming research. We plan to employ more sophisticated techniques and compare our findings with those of similar copper objects. The analysis will also examine impurity concentrations and specific areas associated with the relevant historical period. This comprehensive approach aims to provide a nuanced understanding of the material transformation, shedding light on the broader historical and archaeological context.

The semi-circular wooden platform of the ancient royal chariot was covered with thick metal plates, approximately 99% copper (Supplementary Figures S1 and 2), as analyzed using the non-destructive hand-held EDXRF technique (Figure 7). Pure copper was commonly used for inlay work in ancient royal-class artifacts due to its malleability, conductivity, and durability.[16] The chariot was heavily decorated with copper inlays, hence its designation as the royal chariot. The platform was constructed using copper pipes to secure the side panels and a pipe to connect the canopies and inner-outer edges of both solid wheels. Triangular copper inlays, arranged in three rows extending from the central hub to the outer rim, adorned the wheel, pole, and yoke.

This chariot was discovered at a depth of about 1.5 m beneath the alluvial soil in agricultural fields. Over time, copper artifacts can develop a natural patina or corrosion product on their surface. Metals are thermodynamically unstable and release free energy to attain a stable state, resulting in surface changes as they react with various environmental agents, a process known as corrosion. Corrosion is a chemical or electrochemical process where metal is converted into its mineral form, and it is a continuous process.

The corrosion mechanism of pure copper metal under the earth involves a combination of chemical reactions with various components present in the soil or surrounding environment. The patina forms through a combination of copper oxide, copper carbonate, and other copper salts. The primary corrosion process is known as oxidation, where copper reacts with oxygen and other substances to form corrosion products. A simplified overview of the mechanism is given below:

Formation of copper oxide:

Copper + Oxygen + Water→ Copper (I) oxide+ Hydrogen ions

Formation of copper carbonate:

Copper (I) oxide + Carbon dioxide + Water→ Copper carbonate + Hydrogen ions

The copper carbonate formed in this process is typically green in color.

The problem of corrosion is severe in unearthed decorated copper inlay and thick plates of royal chariot because cuprous ions rapidly oxidize to cupric ions, influenced by various factors.[17] The symbolic mechanism is:

$Cu \rightarrow Cu^{+} + e$

$Cu^{+} \rightarrow Cu^{++} + 2e$

$O_2 + 2H_2O + 4e \rightarrow 4OH^{-}$

The unearthed copper plates and decorated inlay work of the royal chariot exhibit patina or encrustation of chlorides, oxides, and copper carbonates on the surface. The copper metal from the excavated royal chariot underwent scientific treatment, involving both mechanical and chemical methods. This treatment, guided by the expertise of archaeological chemists, aimed to remove the corrosion products and hazardous compounds present within the corrosion crust.

To prevent potential issues in the future, comprehensive documentation of every step was carried out. After the removal of straps and slings from the royal chariot, it was delicately brushed to eliminate dust and dirt, and detailed photographs of its surface were taken. A surface

investigation was conducted before any scientific treatment to assess the extent of corrosion, abnormal corrosion characteristics, mineral deposits, etc. A detailed condition report for the ancient royal chariot was also generated for future reference.

To control reactions during chemical treatment and avoid complications, mechanical treatment was prioritized for the royal chariot. Different levels of corrosion removal were employed, with minimal cleaning for less corroded copper metal parts and careful cleaning for parts with heavy calcareous deposits and encrustations. Fine tools such as paint brushes, fiber brushes, points, needles, dental picks, metal scalpels, surgical blades, and wooden or stick tools were utilized.

The patina on the metal surface serves as a natural preservative, helping to reduce further deterioration of the metal. Therefore, it is crucial to minimize the loss of patina during scientific treatment.

Active corrosion areas on the clean and dry metal surfaces were treated separately and with care for stabilization. A 1 – 3% solution of BTA in isopropanol was applied to these clean and dry areas of active corrosion to prevent further deterioration. The mechanism of action of BTA with copper metal for corrosion inhibition is as follows:

The initial step involves the adsorption of BTA molecules onto the copper surface. This process relies on weak chemical interactions, including van der Waals forces, π-π interactions, and electrostatic interactions between the BTA molecules and the copper surface. Once adsorbed, BTA molecules tend to form a monolayer on the copper surface, with their aromatic rings aligning parallel to the metal surface. The nitrogen atoms in the BTA molecules, which have lone pairs of electrons, coordinate with copper ions on the surface, acting as a chelating agent and forming coordination bonds with copper atoms (Figure 9). This coordination inhibits the dissolution of copper ions, thereby slowing down the corrosion process. The adsorbed BTA molecules create a protective barrier on the copper surface, limiting the access of aggressive species such as oxygen and water. This restriction reduces the corrosion rate. Notably, BTA exhibits a remarkable self-healing property as a corrosion inhibitor. If the protective layer is damaged or removed in certain areas, the remaining adsorbed BTA molecules can diffuse to these sites, re-establishing the protective barrier and ensuring continuous corrosion protection.[18,19]

PVA is a widely used polymer in adhesives, coatings, and surface treatments. When applied as a protective coating to copper surfaces, PVA provides several beneficial properties. It forms a continuous, impermeable barrier on copper surfaces, preventing direct contact with moisture, oxygen, and other corrosive substances. This barrier helps to slow down the corrosion process and protects the underlying copper from degradation. PVA exhibits strong adhesion, ensuring that the protective coating remains intact over time without peeling or delaminating. It is hydrophobic nature repels water, which is useful in preventing moisture-induced corrosion, as water is one

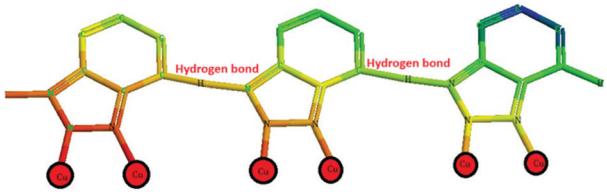

Figure 9. Benzotriazole acting as a chelating agent with copper atoms. Image created using ChemDraw

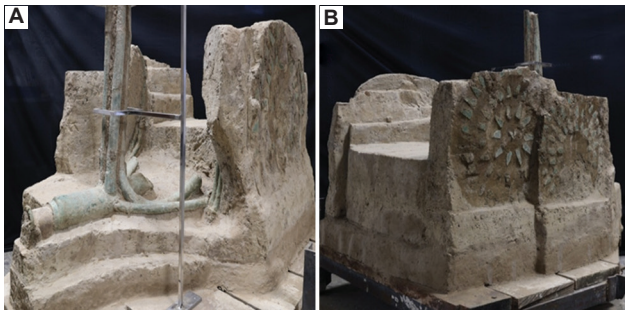

Figure 10. After the complete restoration and preservation of the royal chariot. **(A)** Left side front view. (B) Right side rear view. Source: Archaeological Survey of India

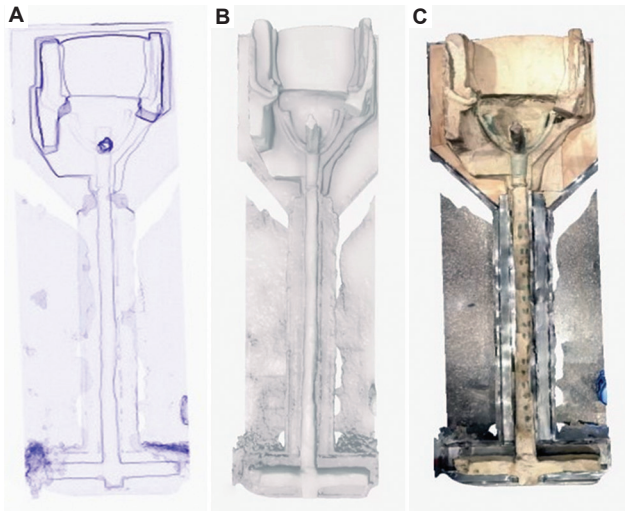

Figure 11. 3D images of the royal chariot excavated from Sinauli after restoration and preservation. Source: Archaeological Survey of India. (A) Sketch image. (B) Black and white image. (C) Color Image

of the main factors that accelerate copper corrosion. In addition, PVA films are relatively flexible, allowing them to accommodate slight movements or vibrations in the copper substrate without cracking or becoming brittle. This flexibility maintains the integrity of the protective coating. PVA is considered non-toxic, making it a safe choice for applications involving direct human contact.[20-22] Due to these properties, a 0.5 – 1% solution of PVA in toluene is commonly used as a preservative coating.

The results of the 3D documentation of the royal chariot (Supplementary Video S1), conducted after the completion of its restoration and preservation are shown in Figures 10 and 11.

4. Conclusion

The discovery of a royal chariot at Sinauli has provided valuable insights into the Chalcolithic era, highlighting its significance in archaeology and history. The numerous copper artifacts found at the site indicate a sophisticated society with advanced technology and intricate cultural practices. These artifacts not only showcase the metallurgical skills of the time but also suggest that copper played an important role in daily life, potentially including religious practices. While the Sinauli findings have greatly enriched our understanding of this ancient civilization, several questions remain unanswered, and there are opportunities for future research. Ongoing investigations aim to explore the cultural connections of the Sinauli people with neighboring regions, offering a more comprehensive view of their history. Continued exploration and detailed analysis of the artifacts may reveal additional layers of cultural complexity. Future investigations, employing more sophisticated techniques, are expected to unveil new insights into the variations in material composition compared to similar objects.

The excavation of the royal chariot not only safeguards a significant archaeological discovery but also enhances our collective understanding of the past.[21] The conservation and restoration efforts have been meticulous and specialized, involving a range of techniques and materials to ensure the chariot's long-term preservation. These efforts included removing consolidators and preservatives, applying corrosion inhibitors, and using protective coatings to stabilize and protect this remarkable artifact. By preserving and showcasing this cultural heritage, we honor the achievements of our ancestors and contribute to humanity's shared history. This underscores the importance of preserving and studying cultural heritage as a means to unravel the mysteries of bygone eras.

Overall, the discovery and conservation of the royal chariot from Sinauli offer a fascinating glimpse into ancient India's rich history. As research continues, it is hoped that further discoveries will shed more light on the ancient societies that once thrived there, leading to a more comprehensive understanding of India's diverse past.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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Ethics approval and consent to participate

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ARTICLE

Culture as a drive for art and architecture: Ugarit's religious architecture as cultural and societal manifestations

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Abstract

Religious buildings are representatives of the cultural and ritual dimensions of ancient civilization, contributing to city morphology and systems. Their architecture provides interpretations and information about past societies' experiences of place, space, and everyday social and cultural practices. Therefore, this paper focuses on the city of Ugarit, the capital city of a Bronze Age civilization that occupied the northwest part of present-day Syria, and explores the relationship between Ugaritic people's ritual and cultural dimensions and the architecture of their central and local religious building (temples and sanctuaries). Through an in-depth investigation of archeological reports and text excavated in the city, as well as onsite architectural analysis and observation, this article investigates how the architectural forms and planning of large and small religious buildings in Ugarit were informed by Ugaritic people's religious practices and cults. The work points out that the Ugaritic people carefully planned their religious buildings on both architectural and urban scales. To fulfill their rituals, the Ugaritic people designed the architecture, structure, and form of their religious buildings based on their religious practices and beliefs rather than being influenced by temple design principles shared in the region. This approach resulted in building forms and architectural/interior arrangements that are distinctive from those of surrounding civilizations and regions.

Keywords: Religious architecture; Ugarit; Bronze Age; Architecture and rituals; Meaning of architecture; Ancient temples; Sanctuaries

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1. Introduction

Architecture and the built environment are representations of people's indigenous values, culture, and beliefs. In his book *The Meaning of Built Environment*, Amos Rapoport explored the links between different architectural, landscape, and urban scales and people's culture, everyday life, and practices.[1] It is important to highlight that the meanings derived from the built environment can inform our understanding of ancient cultures and civilizations where architecture was not intentionally designed; rather, it was a spontaneous response to the civilization's political, economic, social/cultural, and religious dimensions.[2] Furthermore, Christian Norberg-Schulz[3] identified four levels of existential space: geographical and landscape, urban, the house, and the thing. He emphasized that a comprehensive understanding of space, regardless of its

scale, requires exploring it at different scales and their interconnections, where different social, cultural, and epistemological aspects can be understood. This approach is useful in forming and understanding single forms as well as urban agglomerations and/or cities. Norberg-Schulz's contributions regarding existential space or the spirit of place – "the concept of *genius loci*" – are essential in the understanding of the built form from architectural and urban perspectives.[3,4]

In particular, religious buildings are strong representations of the social and cultural aspects of any, but especially Bronze Age, civilizations. The development of these buildings over time reflects advancements not only in political, economic, and cultural systems but also in architectural concepts, principles, and technology. The monumental scale of these buildings has a strong implication for the understanding of the level of the studied civilization and the cultural and ritual attitudes of its people. In addition to main temples, which were central to the city and people's lives and dedicated to dominant gods, ancient cities comprised a variety of other smaller-scale religious buildings (sanctuaries), which were dedicated to religious as well as social purposes on smaller urban scale (neighborhood or district).[5] These two types of religious buildings usually come in different architectural and landscape forms, as they reflect different scales of people's lives and religious practices.[5] Therefore, this paper aims to analyze the influence of cultural and religious dimensions on the religious architecture in Ugarit, a Bronze Age archeological site in Syria. The study uses archeological excavation reports and analyses to inform the understanding of culture and architecture and to investigate how culture has informed the architecture and form of both small- and large-scale religious buildings, as well as their landscape and urban settings and connections.

Located in northwest Syria (Figure 1), the city of Ugarit is a Bronze Age archeological site of outstanding significance, due to the implementation of the first alphabet and alphabetic writing system, not to forget its continuous history. The site was of great importance due to its highly strategic location, which facilitated inland commerce between Egypt and Asia Minor and external trade linking the East (Persia and the Indus Valley civilization) and the West (Greece and Cyprus).[6-8] This strategic position not only enabled Ugarit to establish a unique homogeneity with its surrounding cultures but also to develop advanced architectural principles and techniques for different types of buildings in the city, including the temples and sanctuaries. Therefore, the religious buildings of Ugarit, particularly the temples that follow a unique tower temple form distinct from those of surrounding civilizations, are considered exquisite and unique examples of Middle and

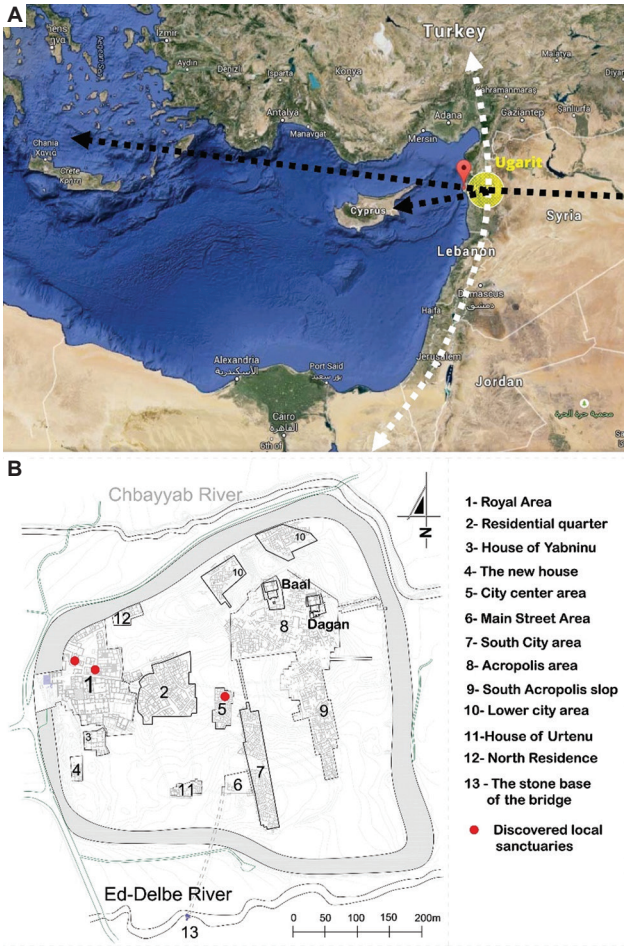

Figure 1. Ugarit's location and discovered areas. (A) Google Maps illustration showing the location of Ugarit, sourced from Google Maps with author analysis added using Photoshop software. (B) Plan of the city of Ugarit showing the locations of the main temples and local sanctuaries in the city, produced by the author using AutoCAD software and based on the author's fieldwork in 2013.

Late Bronze Age religious architecture in Syria. This article aims to provide a better understanding of the meanings behind the forms and architecture of these buildings.

Despite the influence of surrounding powers, Ugarit's activities and links extended beyond its land borders, reaching international communications with foreign civilizations (for example, in Crete and Cyprus) during the 13th century BC. This informed a unique civic life and differentiated the city and its associated sites from other Syrian cities.[8] Accordingly, the discovery of Ugarit in 1929 greatly contributed to the interpretation of religious life in the Middle East (Canaanite, in particular).[9-11] Previously, understanding of Canaanite religion was primarily based on writings discovered in surrounding cultures, which were insufficient for grasping a clear appreciation of this religion and its customs. The Ugaritic discoveries (texts, in

particular)[12] immensely contributed to the understanding of this culture and religion by providing crucial knowledge of the Canaanite religion throughout the whole area. For example, a tablet was discovered listing 60 names of popular gods and goddesses in the kingdom of Ugarit and other Canaanite sites. Under the direction of Schaeffer,[11] the archeological mission to Ugarit, which started in 1929, uncovered two major superstructures, or temples, on the Acropolis, along with three smaller sanctuaries in different excavated areas of the site.[11,13] Therefore, based on the analysis of archeological reports, texts, and onsite architectural analysis and reading of the religious buildings in the city, this paper develops an understanding of how religious practices, as well as social, ritual, and cultural dimensions, influenced the Ugaritic people's architectural and urban planning and forms of their central and local religious buildings.

2. Religious building in Ugarit

Ugarit's inhabitants followed the Canaanite religion and worshiped many deities whose throne was ascended by El, the father of all Canaanite gods.[14] Discoveries in the city have confirmed the worship of several gods, including El and Athirat (the father and mother of all gods, who were worshiped throughout the kingdom), Baal (god of thunderstorms, fertility, and agriculture), Dagan (or Dagon in some publications; god of fertility, multiplying, and cereals), Anat (goddess of war), Kothar (god of crafts), Mot (god of death), and Yam (god of seas and rivers).[12] Among the ruins of the city, two of these gods, Baal and Dagan, are prominently represented by two big temples. Their ruins clearly indicate that these two temples were the dominant superstructures of the Acropolis during the city's life. The temples' footprint (Figure 2) shows that they follow the architectural principles of Middle Bronze Age temples, while Ugarit's architecture has always been distinguished from surrounding civilizations by its developed principles and techniques.[8,15]

The city also comprises small local sanctuaries located in different areas, well-connected to their surrounding fabric. These sanctuaries (small and local temples), such as the Sanctuary of Rhytons and the New Sanctuary, had simpler forms and were dedicated to the smaller-scale, everyday religious, and, perhaps, other social activities. Three local sanctuaries have been unearthed in Ugarit; they are known in the publications of the French mission as the Sanctuary of Rhytons in the city center (Figure 3A), the New Sanctuary in the old royal area (Figure 3B), and the Royal Sanctuary in the new royal zone (Figure 3C). By analyzing the floor plans and compositions of the two buildings, it can be recognized that the first two sanctuaries share the same design principles, despite the long period that separated their construction.

The position of the two large temples (Baal and Dagan) at the highest point of the site reflects their symbolic

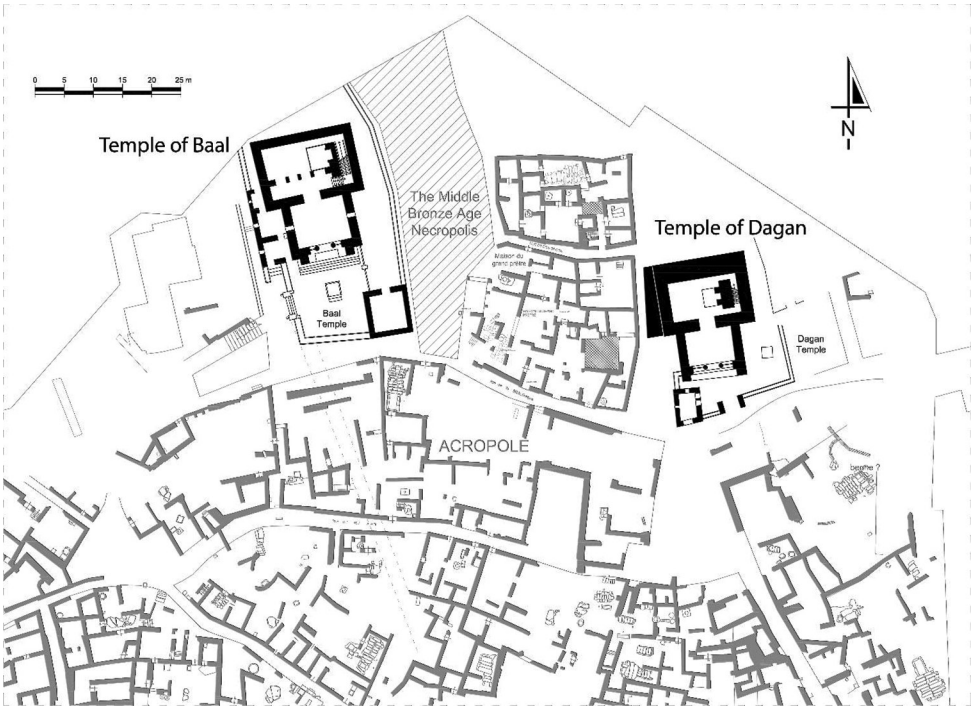

Figure 2. The Acropolis area, Ugarit. Produced by the author using AutoCAD software and based on the author's fieldwork in 2013.

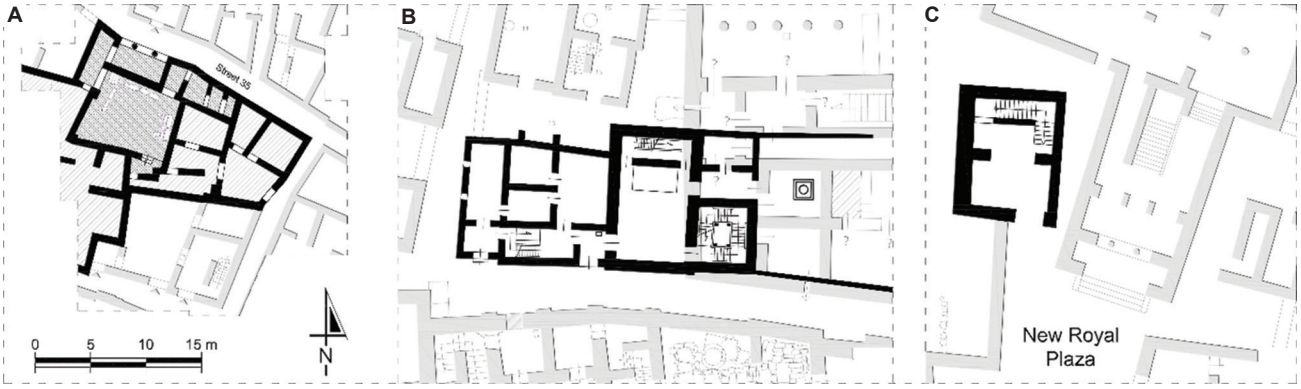

Figure 3. Local sanctuaries in Ugarit. (A) Sanctuary of Rhytons, city center. (B) The New Sanctuary, old royal zone. (C) Royal Sanctuary, new royal zone. Images produced by the author using AutoCAD software and based on the author's fieldwork in 2013

character as landmarks visible from a distance.[16] It is believed that they served as significant beacons for sailors arriving at the port of Mahadou (Minet el-Beida), located < 1 km west of Ugarit.[15] On the other hand, the discovered sanctuaries had a more local character; they accommodated everyday religious and, probably, social activities for civic or royal communities. Moving forward, this article will analyze examples of main temples and local sanctuaries in Ugarit to articulate the influence of political, cultural, religious, and social dimensions on the architectural and urban aspects of these buildings.

2.1. The symbolic temples on the acropolis

The two main temples excavated in the city are located in the Acropolis area (Figure 4). Based on Callot and Monchambert's systematic surveys of the two temples, between 1988 and 1990, and again in 2005, along with the study of some discovered texts – especially the poems and myths found in the House of Great Priest – it has been highlighted that the Acropolis area, with its two temples, is important for understanding this ancient civilization and the city's urban morphology throughout its lifetime.[15]

2.1.1. The main temple of Baal

The two temples show striking similarities in architectural design, arrangement, form, and building techniques, which have informed the interpretation of the temples' ruins where excavation or prolonged exposure had destroyed the evidence; therefore, in this article, the Temple of Baal is analyzed as a case study of the main temples in the city. The temple occupies the highest point where all routes end; its ruins occupy a fortified island yet fully integrated with the urban context, as can be seen in the layout of stairs, ramps, and streets (Figure 2). Following the original excavation (1929–1932) by Schaeffer,[11,13] a comprehensive systematic analysis was conducted by Callot and Monchambert in 1988.[15] Excavation works revealed that the temple's

Figure 4. The morphological settings of the City of Ugarit. (A) Ugarit's topography showing the location of the Acropolis and its morphological settings. (B) The general section of Ugarit showing the city's topography and the morphological settings of the Acropolis area. Drawings prepared by the author using AutoCAD software based on topographic information and the author's filed analysis and observation in 2013.

enclosure had a monumental gate opening to the west, facing the Royal Palace. A direct street probably connected the temple with the palace, with 70% of this street excavated so far (Figure 5). This connection is not surprising, bearing in mind the palace-temple economy that existed in Ugarit during the Late Bronze Age. The temple and the palace had equally empowered the development of various aspects of life in the city. The temple's important role in the

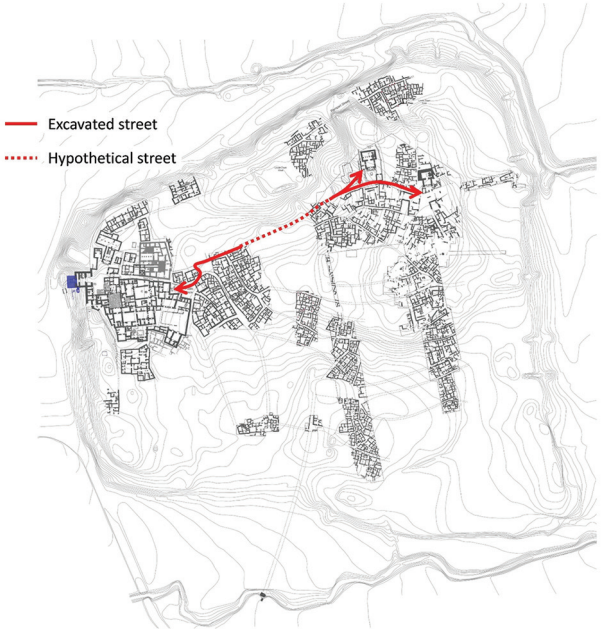

Figure 5. Ugarit's map showing the connection between the palace and the temples with evidence of excavated parts of the route. Drawings prepared by the author using AutoCAD software based on topographic information and the author's filed analysis and observation in 2013.

city's economy, maritime, trade, and agriculture has been confirmed by many texts discovered in Ugarit.[9,12]

The same street, known as Library Street, continues eastward to connect the temple's enclosure with the other temple on the Acropolis, the Temple of Dagan. Furthermore, the Temple of Baal was well-connected to the surrounding domestic areas occupied by the city's workers (Figure 6A), strongly reflecting the relationship between the temple and the local community across all social classes. In his book *Les sanctuaires de l'acropole d'Ougarit: Les temples de Baal et de Dagan*, Callot shows that some remains of the stone steps between the temple and the lower city which were still present during his survey works in 1988 (Figure 6).[15] The relationship with other areas to the south (south Acropolis slope and south city) and to the west (city center) is even stronger through many primary and secondary streets, despite the topographical constraints (Figure 5). This undoubtedly reflects the importance of this temple to the city's people and their way of life. Therefore, it can be concluded that enclosing the temple with high walls was not intended to separate it from its surroundings; rather, the main aim was to ensure privacy and conceal the events (possibly sacred) taking place in the complex's main courtyard.

The enclosure consists of the main temple's building, two courtyards (Figure 7A: no. 1 and no. 4), and two annexes. The main courtyard (Figure 7A: no. 1), (Figure 8B) most probably used for outside ceremonies, is rectangular and located in front of the temple's main access. It accommodates an external altar (2.2 m × 2.2 m), (Figure 8B) which is thought to have been used for large sacrifices. The other courtyard (Figure 7A: no. 4) is located to the east and is thought to have been used for storing sacrificed animals. The foundations of the surrounding walls indicate that these walls were high and thick, though not as thick as the temple's walls. This confirms the thought that these courtyards were not visible from the outside, ensuring privacy for the sacred activities and rituals conducted there.

The annexes (Figure 7A: no. 2 and no. 3) occupy the northwest and southeast corners of the complex. The first one (Figure 7A: no. 2) is located at the main entrance of the enclosure, along with the western wall. It is believed to have had a dual function: serving as an indirect secondary access to the main courtyard (Figure 7A: no. 1) in addition to accommodating the guardians of the temple. The other annex (Figure 7A: no. 3) is a rectangular (or perhaps square) space located at the southeast corner of the enclosure. All plans created before 1988 do not show that this annex existed, but during the last surveys conducted by Callot in 1988 and 2005, the northwest corner of this space was uncovered. This encouraged Callot to assume that there was another (simpler) annex in this corner of the temple complex.[15] The ritual texts discovered in Ugarit reveal that the Ugaritic cults involved preparing a meal for the god after sacrificing the animals[17] (p. 1253). Taking these texts into account, Callot proposed that this annex was most probably used for this purpose, considering that it had links to both courtyards where animals had been stored and sacrificed. Furthermore, the assumed function, food preparation, is plausible, particularly since the space is located in the far corner of the main building and does not conflict with other ceremonial activities that might have taken place in the main courtyard (Figure 7A: no. 1).

The two open spaces constitute significant elements in the temple's operation. The presence of the outside altar in the main courtyard (Figure 7A: no. 1) indicates bringing the blood sacrifice to the outside open spaces, a key development in Syrian temples during the Middle and Late Bronze Age, which is reflected in the building design.

The main building, the temple, occupies the northern part of the complex. It is formed by the juxtaposition of two rectangles, where the North Hall (Figure 7A: no. 9) is double the size of the South Hall (the vestibule). Considering the width and depth of the foundations, it is clear that this building was planned in advance to be a gigantic structure. The foundations, which date back to the 19th century BC as evidenced by archeological analysis,[15] are

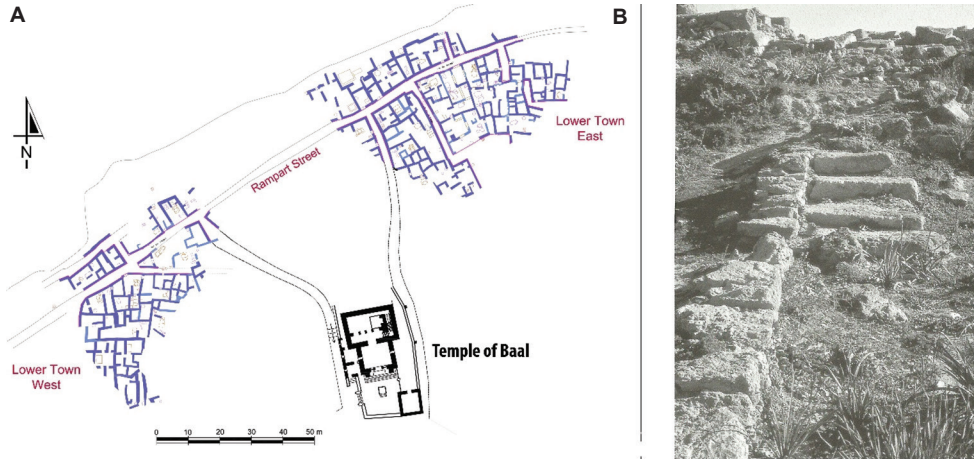

Figure 6. The Temple of Baal urban connections. (A) The relationship between the Temple of Baal and the lower city. Image produced by the author using AutoCAD software and based on the author's fieldwork in 2013. (B) The remains of the street connecting the Temple of Baal to the lower city.[15]

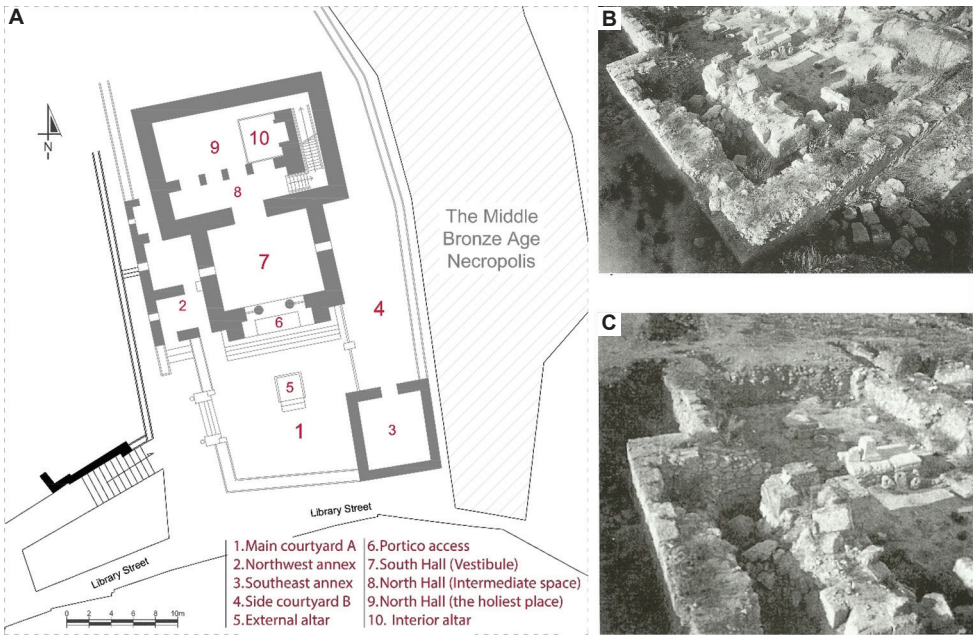

Figure 7. Temple of Baal, Ugarit. (A) The temple's plan. Plan produced by the author using AutoCAD software and based on the author's fieldwork in 2013 and Callot's analysis.[15] (B) North Hall, the most holy place in the 1930s.[15] (C) North Hall and South Hall in the 1930s.[15]

very thick (1.5 m), which indicates the high and thick walls constructed to the very top. The difference in thickness and depth between the foundations of the north and south halls indicates a different height for each hall: the South Hall was only one story high, while the North Hall had one or two additional levels, as Callot proposed. From the remains, the South Hall appears to be a very simple space, perhaps a large vestibule without specific architectural features. The temple's entrance to this hall was also equipped with stone steps, raising the temple's ground floor above the courtyard level, further highlighting the building's importance among its surrounding facilities (Figure 8A).

Callot proposed that the main entrance of the temple would have had two timber columns with a stone base, similar to most discovered temples in Syria.[17] Although no direct evidence was found, this feature is common in the city's houses and the Royal Palace. These columns, along with the two antes, created a portico, with two side spaces that accommodated the god's stelae, which were discovered outside the building. This monumental access system supports the assumption that the South Hall functioned as a large vestibule or gathering space. The North Hall is much more complex. It comprises the remains of different structural elements, and the thicker foundations

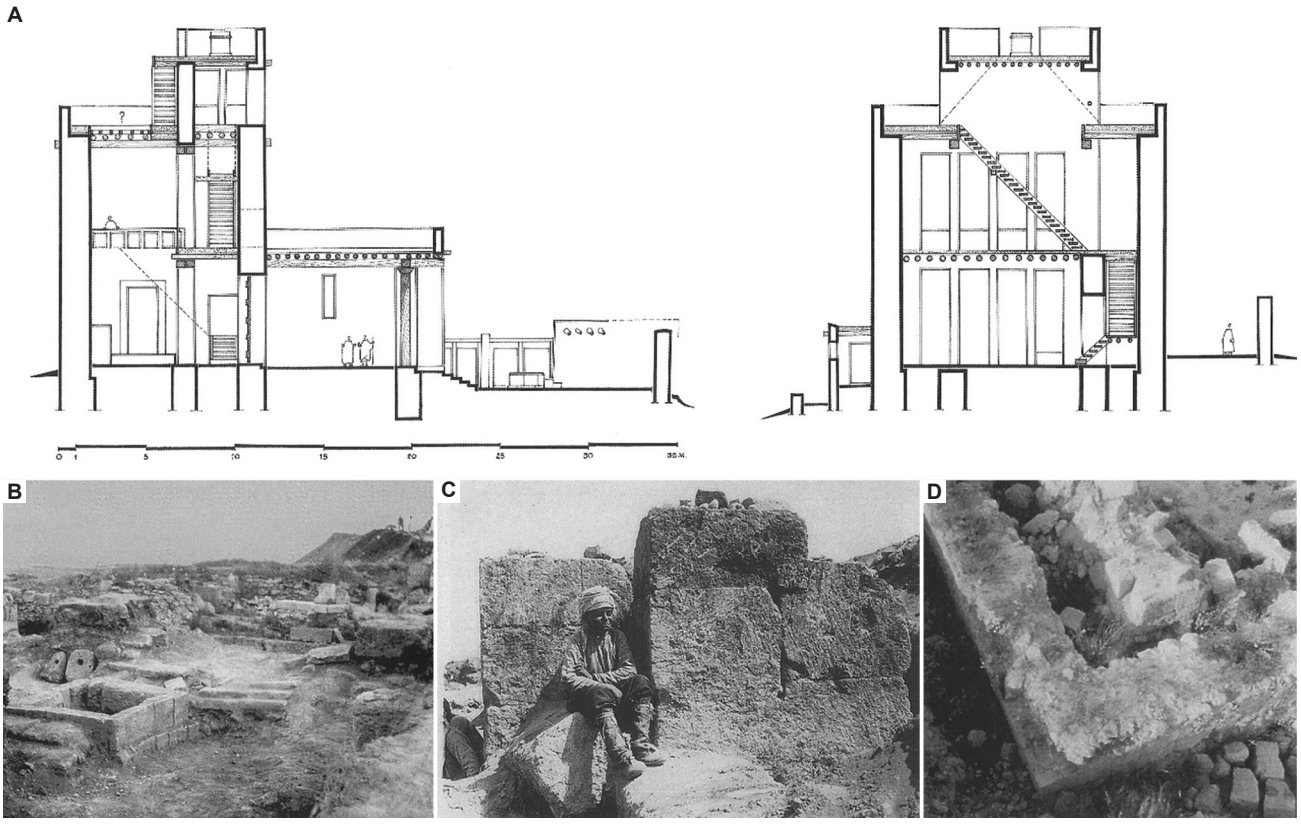

Figure 8. Archeological reading of the Temple of Baal. (A) Temple of Baal. Proposed sections by Callot and Monchambert[15] in 2011. (B–D) Temple of Baal, Ugarit: the temple's conditions in the 1930s.[15] (B) External altar. (C) The temple's ante and corner. (D) The temple's most holy place: the northeast corner.

of the external walls (Figure 8C and 8D) suggest different structural characteristics of this space. The ruins of two huge piers with buttresses are located on the eastern side of the hall, offset by 1.6 m from the southern and eastern walls. Callot believes that the niche created between the northern and southern buttresses constitutes the temple's interior altar (Figures 7B and 7C).[15]

The discovered platform, 30 cm high, between the two buttresses further emphasizes the presence of altar facilities. Another buttress can be recognized in the western wall, which corresponds to the altar's southern buttress to the east. The eastern and western buttresses give an impression that the North Hall was divided into two different spaces. Considering the presence of the altar inside further supports Callot's assumption that the first space, the intermediate space (Figure 7A: no. 8), served as a portico to organize horizontal and vertical movement within the North Hall, the most sacred area. The northern section, where the altar is located, was the holiest space on the ground floor (Figure 7A: no. 9), with its privacy enhanced by the intermediate screen wall between spaces no. 8 and no. 9 in Figure 7A.

Furthermore, the remains of the staircase that guided into upper levels have been recognized in most survey plans (1932–33, 1935, 1988, and 2005) (Figure 9). Only the first three steps remained intact during the last survey. The location of the discovered steps suggests that this staircase continued within the space between the temple walls and the altar's structure (two piers and screen wall) (Figure 7B and 7C). The presence of the staircase in this area, the intermediate space between the vestibule and the holiest place (Figure 7A: no. 9), along with the ruins of the three pillar-like structures (piers) before entering the space,[15] confirms the main purpose of the intermediate space (Figure 7A: no. 8) as organizing horizontal and vertical traffic within the temple while also providing greater privacy for events taking place in the holiest place (Figure 7A: no. 9).

Based on a careful analysis of the foundations' width, depth, and location,[15,18] it was proposed that these internal piers, buttresses, and the altar complex also served structural purposes. Callot[15] suggested that an intermediate balcony level above-facilitated movement to the terrace atop the South Hall and the other staircase, which, in all likelihood, ran alongside the east-west partition above the intermediate space (Figure 7A: no. 8) to the south of the altar section and guided up to the roof of the North

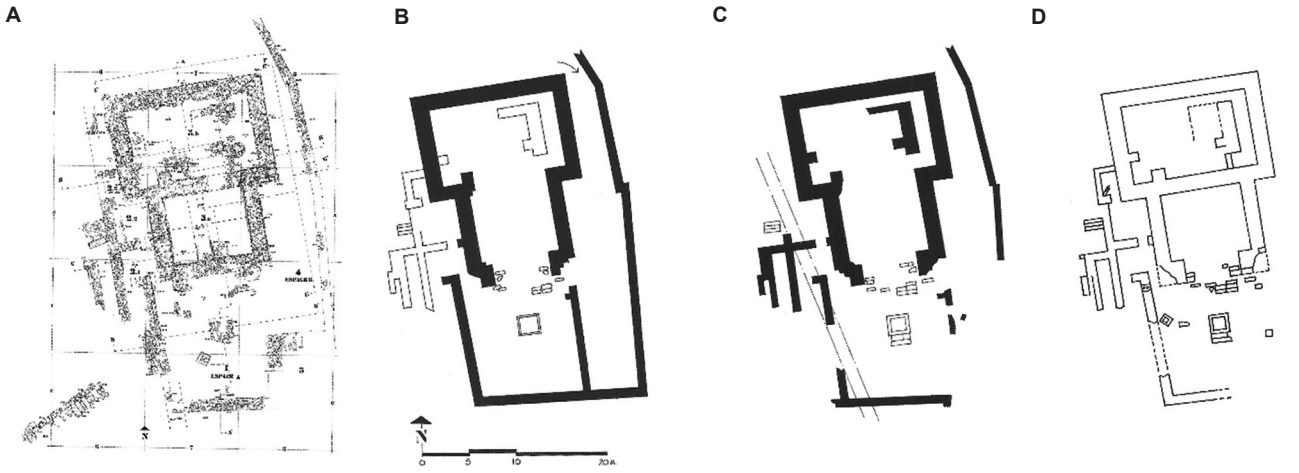

Figure 9. Temple of Baal: Successive analyses:[15] (A) 1988–2005; (B) 1979; (C) 1949; (D) 1933

Hall (Figure 8A). Consequently, the most sacred area (the North Hall) probably consisted of three main levels: the ground floor level, which includes the intermediate space and the holiest place (altar's section), the balcony level, and the roof of the North Hall (Figure 8A). The larger foundations (in width and depth) under the intermediate space (Figure 7A: no. 8) support the proposal that the temple's summit was built above this space,[15] where the king or priest could draw closer to the god.

The religious text discovered in Ugarit (the House of the High Priest in particular) and the architectural models[15,19-22] found in Emar's temples and other Euphrates areas further support Callot's interpretation of a multi-level structure over the North Hall.

Two very important texts discovered in the house of the high priest brought very important clues about the form of the building during the Bronze Age period. The first is "The Legend of Keret," which describes King Keret's sacrificial rites. The text indicates that the king went to the top of the tower, sacrificed a bird (possibly), and then returned downstairs. The text uses the plural form for "steps" or "stair flights," which Dennis Pardee confirms in his studies of the discovered Ugaritic religious texts.[9,12] The second text, "The Palace of Baal," offers a more detailed description of the temple's structure at that time. The text presents Baal's inquiry into the construction of his temple and provides a description of this temple by Kothar, the god of crafts. In the text, Kothar describes the three types of openings in the temple: (hln), (urbt), and (bdqt), which, respectively, mean a window, a barred window, and a gap.[9] It is well known that such texts often contain elements of reality, albeit with poetic license; they closely correspond to the architectural models found in Emar's temples and other Euphrates sites in Syria,[15,19-22] further supporting the interpretation of the temple's form and levels. The foundation analysis further supports the interpretation of the North Hall as a multi-level, tower-like structure. The thick foundations of the Hall's external walls, built with large cut stones, and the strong reinforcement of the four corners (Figures 8C and 8D) are plausible structural testimonies that would enable a large structure to sit on such a topographic site. Considering the equal importance of the temple and the palace, and the temple's location at the highest point of the city (Figure 4), the tower form of the temple likely helped the building serve as an urban and regional beacon for the city and its inhabitants, considering the importance of Baal for the Canaanite cultures.

The rituals of the Ugaritic people also influenced the design approaches of the city's main temple. Canaanites believed that gods existed in sacred places where humans did not intervene. Therefore, their cults involved performing the king's sacrifice at high places with minimal human intervention. The religious text "The Legend of Keret" supports this claim and narrates the king's sacrificial cult that took place at the temple. The text indicates that the king or priest aimed to reach the highest and most sacred place of the temple,[9] aligning with the religious intention of being in a place where they could be immaculate and close to the god.

On examining the temple's architectural structure, it becomes evident that the beliefs of the Ugaritic people greatly influenced its design principles. In contrast to neighboring cultures, the Ugaritic approach to temple construction aimed to align with their beliefs by creating a structure that allowed them to approach the most sacred place closer to the god. As a result, a tower structure accommodated this particular religious route to the top, resulting in a distinct form (tower temples) on the

Acropolis. These temples facilitated the easy and effective practice of cult rituals. By prioritizing the requirements of religious practices, the Ugaritic people departed from the strict adherence to cardinal directions observed by surrounding Syrian cultures in the construction of their religious architecture. An urban analysis of Ugaritic tombs[23] showed that the tombs were not built with a specific orientation or in accordance with cardinal directions, as was popular in surrounding civilizations. This further highlights the Ugaritic people's focus on optimizing structural performance and developing new architectural principles to suit their religious, cultural, and functional needs, rather than simply adhering to inherited principles.

The ritualistic dimensions, such as the pursuit of highly sacred spaces for conducting rituals, influenced the arrangement of sacred spaces within the ground floor of the temples. While the entire temple was considered a holy place, the sacredness of its spaces gradually increased from the open courtyard to the innermost space, the internal altar section (Figure 7A: no. 9 and no. 10). The ritual texts found in the palace, the temples, and the house of the high priest[9,12] indicate that Ugaritic cults also involved ceremonies and food preparation for the god. Therefore, specific architectural arrangements were put in place to respond to the functional requirements of these cults. This is clearly manifested in the Temple of Baal by the external altar and the spacious courtyard around it, which accommodated public ceremonies. Cooking facilities were most probably located in the southeast annex (Figure 7A: no. 3).

2.2. The local sanctuaries in Ugarit

In addition to the two large temples, the city of Ugarit comprises other local sanctuaries that facilitate everyday religious and social activities. This type of religious building reflects the Late Bronze Age religious architecture in Syria, whereas the other large temples (Baal and Dagan) show Middle Bronze Age concepts. The presence of local sanctuaries in the city became a common trend during the Late Bronze Age, reflecting the community's demand for smaller-scale religious and cultural centers distributed across various areas to accommodate everyday rites and social events. It is understandable, especially as the main temples were enclosed by walls and not accessible at all times or for all activities. Consequently, these local religious centers became of great significance.

In Ugarit, three local sanctuaries have been uncovered so far (Figure 3), although it is strongly believed that more will be discovered through future excavation and analysis.[24] The three discovered local sanctuaries vary in terms of regularity and construction quality. Considering the time of construction, location, and architecture of these three sanctuaries, this paper will focus on the Sanctuary of Rhytons (city center area) and the New Sanctuary (old royal area) to investigate how Ugaritic people's culture influenced the architectural settings of these buildings.

2.2.1. The Sanctuary of Rhytons

The Sanctuary of Rhytons in the city center area is considered the oldest small Sanctuary discovered so far, dating back to the 14th century BC. It was the subject of intensive excavation and research works between 1978 and 1984 under the direction of Marguerite Yon.[25,26] Archeological analyses identified two main layers in the building,[25] which date back to the Late Bronze Age period[27] (Figure 10). Mallet and Yon reached this conclusion after conducting two archeological soundings: one in the main hall (Figure 10: no. 36) and the other in the residential annex (Figure 10: no. 52 and no. 77). The stratigraphic analysis of the building revealed that the building was developed between 14th and early 12th century BC. The building's complex from the final phase consists of three main units, all closely interconnected: the main sanctuary hall with its annex, the eastern residential unit, and the southwest unit, which has not yet been fully excavated to determine its use. Callot[28] and Yon[24,27] believe that the oil press to the north (Figure 10) was an industrial facility that belongs to this complex for financial support, and both were accessed from the street no. 35. This highlights the strong integration of social, economic, and religious

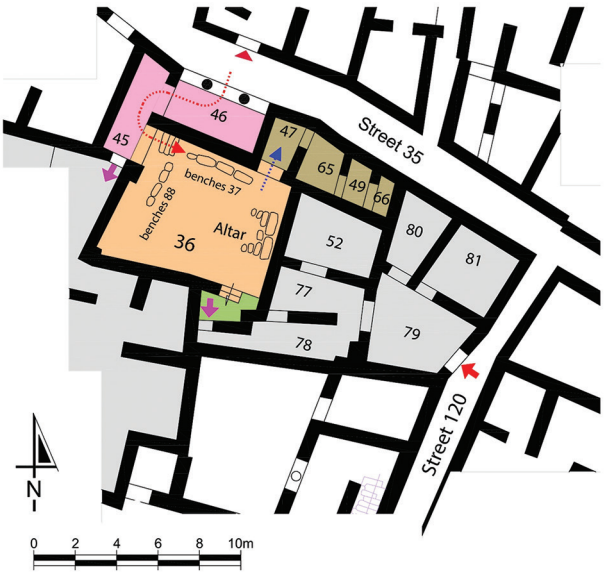

Figure 10. The Sanctuary of Rhytons in the city center area, Ugari. Detailed plan produced by the author using AutoCAD software and based on the author's fieldwork in 2013 and analysis of available archeological reports.[10,11,13,24,26,27]

dimensions in the lives of Ugaritic people during the Late Bronze Age period.

This building is considered exceptional for several reasons. First, its access from the street is totally different from all surrounding houses. It features a portico (Figure 10: no. 46) that was most probably roofed and equipped with two timber columns, a common feature in Ugarit. Second, in addition to the portico, the sanctuary has an indirect access consisting of two doors and a U-shape turn in space no. 45 (Figure 10). This access system is unique and not found in any other houses. Finally, the central hall's (Figure 10: no. 36) location, size, and relationship to the surrounding fabric strongly point out a special use of this building.

The building was always used for cultic and social purposes; the study of its stratification and the discovered elements in the main hall confirmed this. A very interesting arrangement of a stepped altar and two sets of stone (Figure 10: no. 37 and no. 88 benches) were found in the central hall (Figure 10: no. 36). It is also believed that the stone benches might have supported a timber platform above, which accommodated specific offerings and statues. However, no physical evidence supports this assumption. Callot noted that stone set 88 (Figure 10) is located 1 m from the western wall, which was most probably meant to hold a timber platform and its supporting columns.[25,27]

A set of small rooms (Figure 10: no. 47, no. 65, no. 49, and no. 66) are attached to the main hall; they most probably served as annexes and storage for offerings, as Jacques-Claude Courtois assumed after comparing them with the Temple of the Ingot god at Enkomi, Cyprus.[21,29,30] The presence of water ducts and drainage in the main hall and annex supports the interpretation of a public religious function for this building. The presence of the stepped altar, centrally located against the eastern wall of space no. 36 (Figure 10), further confirms the religious function of this hall. Analysis of the altar revealed that it consists of four steps, though only three of them were visible during the building's final phase. The final step is of a higher quality and more regular in construction compared to the three steps below. It is likely that the deity's stele or statue was placed on this stone.

The eastern residential unit is well-attached to the main hall and also has its own access from the street no. 120 to the east. This unit was probably used to support the sanctuary's functions during large social or cultic events. The courtyard and two rooms to the east (Figure 10: no. 79, no. 80, no. 81) served as an alternative reception area for people while another cultic event was taking place in the main hall of the sanctuary. In the meantime, the western part of this unit (Figure 10: no. 52, no. 77, and no. 78) and the first floor (if it existed) provided residence for the keepers. The northern industrial unit was used by these residents for financial purposes. The direct relationship with the sanctuary's entrance, its structure as a separate unit, and its construction during the second phase of the building after 1250 BC all confirm that this industrial unit was another architectural and economic development within the complex. Thus, this local sanctuary was not an autonomous unit within its urban fabric. It established strong relationships with the surrounding architectural fabric as well as with the social and economic life of the people. These aspects were further developed in the newly built local sanctuary in the city, the New Sanctuary at the old royal area, where people had more freedom to present their new principles.

2.2.2. The new sanctuary

This New Sanctuary was excavated between 1937 and 1950 in conjunction with the royal area[31] and again in 1970 alongside the North Palace.[32-34] The analysis of this building has significantly contributed to the understanding of architectural, urban, cultural, and historical aspects of the city, primarily through the analysis by Olivier Callot, who was able to better date the earthquake of the 13th century BC.[25,35] This building also reveals an interesting stratification with the North Palace, shedding light on the development of the city and the attitudes of its people (Figure 11A). The New Sanctuary can be divided into three main sections: the residential unit, the main hall, and the new annex to the east (Figure 11B). The presence of the main hall encourages the thinking of the building's special use as a place of worship. In the 1990s, Callot, and later Yon, in 1997, assigned a religious function to this building;[8,36] both scholars supported their interpretation with further architectural and archeological evidence.[32]

Through intensive analysis, the remains of this building show horizontal and vertical evolutionary aspects that highlight its historical phases. The foundations of the western part date back to the 16th or 15th century BC;[37] however, the upper part is represented by the walls of a new residential unit (Figure 11A and 11B: no. 1–7), which was built after the earthquake in 1250 BC on top of the old foundations, following a similar arrangement (Figure 12A and 12B). A new structure was added to the east, which included the main hall and an annex with a staircase (Figure 11A and 11B: no. 8 and no. 9). The difference in foundation levels between the eastern and western parts is clearly visible at the main entrance B from the Palace Street (Figure 12C), where the jambs are clearly based on different foundations from an earlier period.

The third part is the new annex, which includes the staircase and the eastern access C (Figure 11B: no. 10–13). Archeological excavations uncovered some evidence, such as the ramp at eastern access C, the unfinished staircase, the absence of the roof remains, and the minimal fire damage compared to the residential unit. This lesser fire damage is likely due to the absence of timber rafters and reeds for roof construction. Similar to the Sanctuary of Rhytons, the main hall (Figure 10: no. 36) constitutes the heart of this building and maintains strong relationships with other subsidiary spaces, but with much better regularity and construction quality, as shown in Figure 11B. The organization of this hall led to its assignment as a cultic function within the building. The traces of the altar's foundations and the annex room behind, which includes a staircase, clearly point out a special character. Furthermore, the presence of the wall that divided rooms 8/9 (Figure 11B), functioning as a screen wall behind the altar, enhances the appreciation of the building's worshiping function. These results correspond to broader studies by Jean-Claude Margueron on Syrian temples and sanctuaries.[5,17]

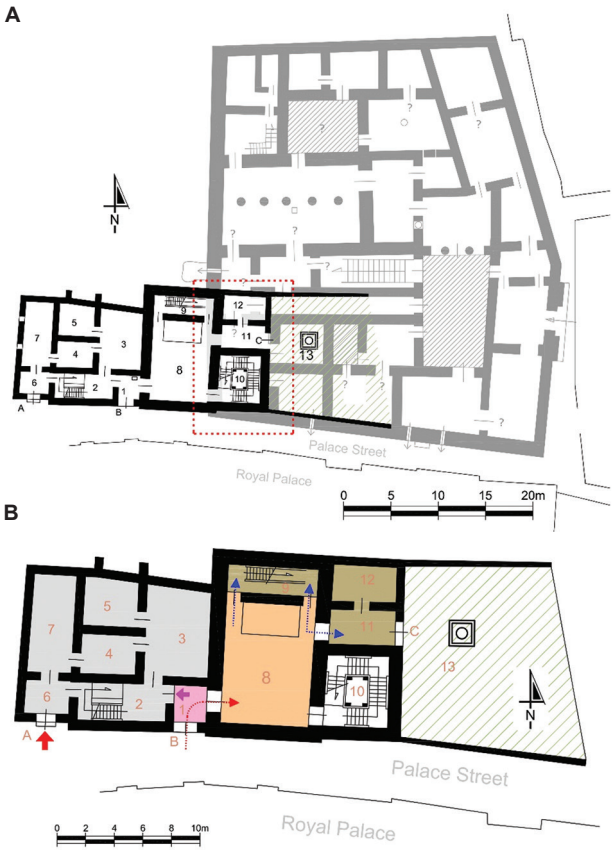

Figure 11. The spatial planning of the New Sanctuary. (A) Architectural plan of the overlapping between the New Sanctuary and the North Palace. (B) Architectural plan of the New Sanctuary, old royal area. Figures produced by the author using AutoCAD software and based on the author's fieldwork in 2013 and available archeological reports.[10,11,13,28,35,39]

Furthermore, the prestigious and expensive basalt seat and trough[38] found in the residential unit indicate the high importance of this building for Ugaritic cultic and social life. These items are very well made and still exist on the site (Figure 13A). The main hall walls are constructed with two layers: the externally facing layer is built with large cut stones, most probably brought from the destroyed North Palace, while the interior layer was built with regular rubble (Figure 13B).

The eastern part's staircase and annex (Figure 11A and 11B: no. 10–13) are considered additional improvements to the building in its last years. They were built over the ruins of the southwest corner of the North

Figure 12. The New Sanctuary, old royal area. (A and B) The ruins conditions in May 2013. (C) The ruins of the entrance B and the main hall, May 2013. Photos taken by the author as part of the fieldwork in 2013.

Figure 13. The construction and materials of the New Sanctuary. (A) The basalt seat and trough in the residential unit, May 2013. (B) The composition of external walls of the main hall, May 2013. Photos taken by the author as part of the fieldwork in 2013.

Palace. The eastern wall of the main hall was also built on the foundations of the western wall of the North Palace (Figure 11A). Thus, it can be concluded that Ugaritic people preferred to build a new local sanctuary rather than reconstruct the North Palace, which highlights the high social and cultural significance such buildings held for Ugaritic communities during the Late Bronze Age.

It is now crucial to extract the main characteristics of the architecture, function, and cultural dimensions of local sanctuaries in Ugarit. A comparison between the Sanctuary of Rhytons and the New Sanctuary shows that the main hall is the dominant space, establishing the religious function of the complex. Furthermore, the organization of this hall and the traces of a podium, which in most cases is centrally located against the assigned wall, indicate the public worship and social function of the building, especially since there is no similar arrangement in the analyzed houses in all residential areas of the city. Both sanctuaries are well-integrated and communicate with the surrounding fabric. The Sanctuary of Rhytons was already in existence before 1250 BC; however, only the residential unit of the New Sanctuary existed. Callot believes that the main hall was planned to be built next to the North Palace, but construction works had not started before the earthquake in 1250 BC.[32] Subsequently, the destruction of the North Palace by the earthquake provided an opportunity to re-plan and construct a proper sanctuary that represented the new Late Bronze Age architectural principles. Therefore, a detailed study of the two sanctuaries reveals a set of evolutionary aspects. The analysis highlights that the Sanctuary of Rhytons (Figure 10) represents the pre-earthquake form, while the New Sanctuary (Figure 11B) serves as an excellent example of the evolution of Ugaritic architecture after the destructive earthquake in 1250 BC. This is clearly demonstrated by the evolution in the quality of architectural planning and building techniques between the two buildings, with more refined and regular spaces and ashlar stone construction evident in the New Sanctuary building.

It has been observed that the Temple of Baal was completely rebuilt after the earthquake, featuring better space organization and regularity, design composition, and technical qualities, despite its use of the same Middle Bronze Age foundations. The resulting new arrangements were also applied in local sanctuaries. The main hall of the New Sanctuary is similar to the most sacred place of the Temple of Baal. A screen wall with a hidden staircase behind it was installed, creating an annex space accessed through two symmetrically located doors on either side of the altar. Furthermore, the New Sanctuary and the Sanctuary of Rhytons share similar arrangements, though the New Sanctuary shows significant improvement in the relationship between the main hall and its subsidiary spaces. Accessing the main sacred hall in the New Sanctuary followed a different system. A small vestibule was inserted between the hall and its residential unit, providing direct access to either part. Consequently, the residential unit was not directly accessed from the main hall, similar to the arrangement in the Sanctuary of Rhytons. Furthermore, another access point was added to the main hall of the New Sanctuary, located in the eastern part of the sanctuary, which is supposedly the latest development of the building. This access was likely established to communicate with the external courtyard, which was supposed to occupy the southern part of the North Palace and accommodate outside ceremonies[39] (Figure 11B).

The analysis of the New Sanctuary shows that the Ugaritic people sought to achieve better privacy for the events taking place in the main hall. The new development added to the east of the main hall (including an access corridor, staircase, and annex space) represents a further evolution in the hall's arrangement and the overall complex. The staircase (Figure 11B: no. 10) was likely planned to create another level (a balcony level) within the space of the main hall, mirroring the main hall of the Temple of Baal. Furthermore, the proposed courtyard to the east further confirms the idea that the Ugaritic people intended to have an open but private space for outside cults. To sum up, it is worth mentioning that the New Sanctuary represents significant developments in Ugaritic religious architecture. It provides ample evidence that the people were inspired to design their local sanctuaries based on principles from the main temples on the Acropolis. This points out that Ugaritic religious practices, as clearly demonstrated in the main temple, informed the architecture of local sanctuaries as well, especially after the earthquake of 1250 BC, when the Ugaritic people increasingly relied on their cultural and religious values to inform the reconstruction of destroyed religious buildings or the construction of new ones.

3. Discussion

The religious structures in Ugarit stand as powerful expressions of cultural and architectural progress. The main temples located within the Acropolis area distinctly exemplify the advanced architectural designs, meticulous planning, and technical expertise of the Ugaritic people during the Middle and Late Bronze Age periods. Furthermore, the development of these monumental structures signifies shifts in societal and cultural attitudes during the Late Bronze Age. The catastrophic earthquake around 1250 BC served as a catalyst, allowing people to express their new thoughts, cults, and beliefs through spatial resolution. Consequently, the temples' architectural

and urban settings started to reflect a strong relationship between the people and their cults, as well as the relationship between the buildings' enclosures and the surrounding domestic fabric of the city. This strongly highlights the importance of these two temples for the city's structure and its people across different social classes. Furthermore, cultural and religious dimensions resulted in an interesting horizontal and vertical hierarchy of sacred spaces, starting with the courtyards and ending with the temple's summit, which, in turn, shaped the buildings' architectural form and planning.

Although the massive volume of the two temples on the acropolis represents their importance to the Ugaritic people, local sanctuaries were also carefully considered and planned to fulfill the community's cultic and ritual needs. As a result, certain architectural planning principles were followed and refined over time. This provides an important clue about the planning skills that the Ugaritic people had, not only for central and massive religious structures but also considering the neighborhood-scale cultic and social centers. These developments are quite significant for the overall understanding of the city and disclose substantial knowledge about the urban structure and the morphology of Ugarit.

Since the discovered religious structures do not represent all dominant gods in Ugarit during the Bronze Age period, it is fundamental to point out that future excavations will definitely uncover other (large or small) religious buildings, as only 35% of the town has been excavated so far. For now, it is essential to carry out comprehensive analyses of the discovered parts of the city to identify other local sanctuaries, if any exist. The main focus should be on structures that have not been fully determined, especially in the South City, where many structures remain incompletely excavated or identified. This initial effort will significantly contribute to understanding each area and to establishing a clearer picture of the different forms in which local sanctuaries might be represented in Ugarit. The results of this preliminary analysis will constitute a good trigger for guiding the planning strategy for future excavations and analysis in the city. This aspect should be further explored through an urban reading of the excavated parts of the city of Ugarit, in which the primary temples on the Acropolis are pivotal in comprehending and admiring the city's urban principles and structure.

4. Conclusion

This study is an original attempt to highlight how the ritual and religious aspects of Ugaritic life informed the creation of the city, its buildings, and its open spaces. Therefore, these aspects should be among the key principles that inform the site's conservation and development, due to the strong architectural and urban representations of these dimensions in the ruined site. The understanding of the religious and ritual aspects of the city has brought to light a new way of reading the City's religious architecture, both as individual buildings or as part of the city structure. Due to the fragility of the ruins and dense vegetation, some areas were inaccessible during the in situ architectural analyses and observations carried out in May 2013. However, the extensive archeological and excavation reports made it possible to understand these areas, with reference to other accessible areas that share similar fabric and architectural principles.

The exploration of the relationships between cultural and religious dimensions, and the architectural and urban principles in Ugarit, provides a framework for further research on the site. Other architects could adopt new approaches and compare their findings with those of this study, which would further enhance the credibility of the findings of this study and contribute to future preservation and interpretation strategies of the site. Furthermore, further analysis of the inaccessible areas could reinforce, support, or clarify the conclusions of this work. Considering the fact that only 35% of the site has been excavated, this line of research will continue to develop as new findings related to religious buildings emerge. In addition, the methodological and analysis framework of this article can contribute to the analysis and interpretations of future excavation at much earlier stages. This is crucial because the analysis of the excavated religious buildings by the mission's archeologists, architects, and the author of this article was conducted on structures that had been exposed for a long time after excavation, resulting in the loss of archeological evidence over time. Aligning new archeological excavations with meaningful analysis of the links between Ugaritic social/cultural aspects and architecture could yield interesting findings and interpretations that would support the site's management and musealization strategies.

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ARTICLE

A study of gestures representing musical emotions

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Abstract

The creation of music has originated from the burst of inspiration of the composer. Many studies suggested that improvisation plays a more vital role than composition in the emergence of new forms of music. The production of music, especially in Western cultures, tends to follow its traditional music theory. With the emergence of Pythagorean music theory, Western musicology has been defined and developed in depth. The composer's creation is based on music creation within the framework of the Western music theory. However, in recent years, with the rise of the topic of music gestures, some scholars have learned that music ontology as a four-dimensional hypercube is inseparable from the performer's gesture. Therefore, some musicians also attempt to create flexible music from the perspective of music performers and based on performance gestures. This kind of music creation breaks the traditional music theory system and has more personal style characteristics, but few people can understand the thinking logic behind this kind of creative behavior. Therefore, this article focuses on the singing gesture and reversely analyzes its impact on musical creation. We use a recent mathematic definition of gestures and we discuss emotion from its etymological origin (from the Latin e-movere) as a gestural movement from inside out. This article conducts an in-depth analysis based on the singer's gesture for the following two reasons: *First*, the literature on the connection between singing gesture theory and composition theory remains scarce. *Second*, gestures produced by a singer are the only performance form that is not enabled by other instruments.

Keywords: Composition; Singing; Gesture; Music ontology; Emotion

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1. Introduction

In mainstream thought in music, gesture was first listed as a subject of music performance theory. A precise definition of gestures is given in Section 2. This seems natural, as our bodies in many ways serve as the physical medium connecting the musical score to the sound acoustics. Precisely because gestures serve as a bridge between performers and musical scores, there is a plethora of studies suggesting that performance is a subject rich of sensibility and emotion. However, its operating logic is often neglected. In fact, the music score, as one of the basic facts of music, is like a "living fossil" that preserves the spiritual changes of the composer when contemplating about music. The score is also a frozen gesture derived from imagination, which can be traced back to ancient time, as the medieval grapheme of neumes encoded gestural cues in scores. These

graphemes subsequently evolved into the current symbols, which abstract the pneumatic thread into discrete dot symbols. As Theodor Wiesengrund Adorno said in 1946, "Correspondingly the task of the interpreter would be to consider the notes until they are transformed into original manuscripts under the insistent eye of the observer; however not as images of the author's emotion – they are also such, but only accidentally – but as the seismographic curves, which the body has left to the music in its gestural vibrations."[1, p. 315] Therefore, apart from the influence of personal subjective factors, the creation of gestures must also be evidenced by objective logic.

Traditional composers add their own unique gestures when performing. However, this kind of creation still involves excessive subjective thinking concerns, including the structure of music design, harmony, counterpoint, *etc*. Hence, what would the acoustics be like if the composition depended entirely on the performer's gesture? This idea has been well expanded by some free jazz musicians, and some publications focusing on this music creation model have been published.[2] However, this idea has rarely been demonstrated in freely composed works by singers.

Singers are the only musicians who barely use other instruments to express music. They add many personal styles and choices when performing, and this musical creation mode is very personal and subjective. In fact, most of the time, being fastidious with every note when creating music is the least of the singers' concern, because music creation is influenced by mood or acquired experiences. It closely resembles the concept of a behavior, which is the result of the interaction of innate cognitive patterns and learned reactive habits. Most of the time, it is this symbiotic relationship that helps singers make choices of musical creativity.[3] However, in music as a whole, the melody created by the singer's choice can only appear in the improvisational score as a single melodic line.

This article extends the basic geometric model of the performer's gestures and uses the four-dimensional hypercube of music ontology (introduced and explained in section 4) to perform a reverse deduction, demonstrating the basic logical thinking mode of the singer's creation of music through free singing. The goals of this article are: (1) to prove that there is an objective logic in the emotional gestures of performers, such as singers, when they freely create works; (2) to reversely deduce the logical pattern of gestures formed by musicians through the four-dimensional structure of music ontology; and (3) to discuss the impact of singing gestures on "free composition" and its possible future prospects.

2. Geometry of gestures

Following the methodology described by Mazzola and Andreatta[4] we display the diagram of gesture geometry. To define the geometric concept of gestures, one of the authors (Mazzola) refers to two mathematical structures: a digraph (directed graph) and a topological space.[5] A digraph consists of three parts: arrows (A), vertices (V), and a map (P), which are used as connections between vertices.

$$P(a) = [h(a), t(a)] \quad \text{(I)}$$

Where h (a) and t (a) represent the head and tail of arrows, respectively, which are graphically shown in Figure 1.

A topological space is the second concept to define a gesture. For a topological space Z, in each point $z_i \in Z$, there exists a collection of subsets $W \subseteq Z$, the open neighborhoods of z_i. For two neighborhoods of z_i, their intersections should also be a neighborhood of z_i. Next, we define *open sets*, $Q \subseteq Z$, subsets of Z which are neighborhoods for each of their elements $z_i \in Q$. The spatial diagraph Z^* of a topological space Z is the digraph, whose arrows are the continuous functions x: $[0,^1 \to Z$ from the unit interval $[0,^1$ of real numbers into Z. The vertices of Z^* are the points of Z, which are the head and tail $x(1)$ and $x(0)$ of the arrows x. Morphisms e between diagraphs are defined when two digraphs (R and P) are co-present: e: $R \to P$ defines a pair of maps e_v: $V_R \to V_P$, and e_A: $A_R \to A_P$. Such an operation maps the heads and tails of the arrows to their images.

With the foregoing concepts, a *gesture n* can be defined: It is a morphism n: $R \to Z^*$. R and Z^* are called the *skeleton* and *body* of a gesture (see the sketch in Figure 2). It shows a musical gesture whose body consists of curves in the keyboard space with coordinate pitch, position, over the keyboard, and time.

Gesture morphisms are the key elements that relate gestures together. If n: $R \to Z^*$ and x: $P \to K^*$ are two gestures,

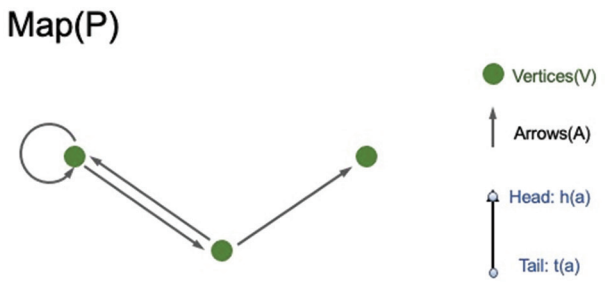

Figure 1. A directed graph consisting of three vertices connected by four arrows. Image created Yuwen Sun

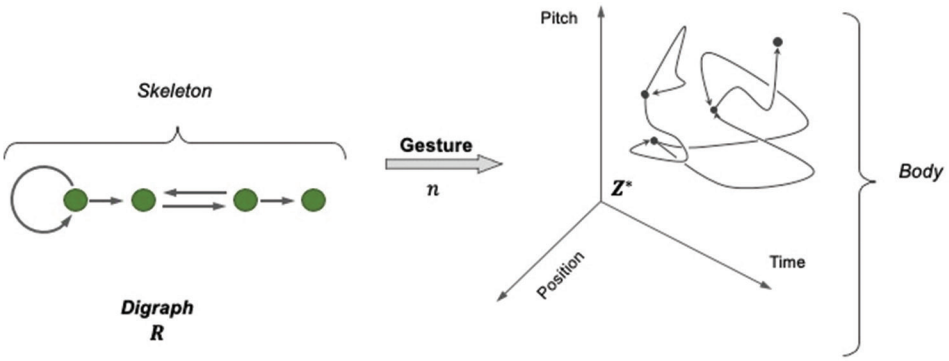

Figure 2. Display of a gesture digraph in music space. Image created Yuwen Sun

a morphism (y, e): $\rightarrow x$ is a pair with y: $R \rightarrow P$ and e^*: $Z \rightarrow K^*$, which are two diagraph morphisms. e^* is derived from a continuous function e: $Z \rightarrow K$. It is also required that $n \cdot e^* = x \cdot y$. Gestures, together with their morphisms, define a mathematical category.

Moreover, the set $R@Z$ of gestures from R to Z^* is again a topological space. Therefore, the concept of hypergestures can also be defined: a hypergesture is a gesture $P \rightarrow R@Z$, which denotes, in other words, gestures of gestures.

The core result of hypergestures is the *Escher Theorem*: if R and P are both digraphs, and Z is a topological space, then the topological spaces $R@P@Z$ and $P@R@Z$ generated by exchanging the skeleta R and P are *isomorphic*.[6]

3. The principles of gestural generation of consciousness

Gestures arise from hand and body movements that people often make when performing strenuous cognitive activities, such as speaking or problem-solving. Some studies[7] have shown that such gestures are often associated with spatial information; for example, when discussing the size and shape of objects, the layout of a room, and movement in space. Therefore, many scholars believe that the creation of gesture has the function to express spatial information. Seminal theories put forward by McNeill[8] and Kendon[9] in 1992 suggested that gestures reflect mental images. It is believed that the "growth point" behind any discourse contains image and language information, and these mental images are the basis for the creation of gestures. The theory proposed by Kita and Özyürek[10] in 2003 claims that representational gesture originates from spatio-motoric representation, which encodes non-linguistic, spatial, and motor-attributed information. Their theory uses information as expressed in a gestural mechanism to produce language. The phenomenon of interaction with spatial motion is the interface between facts and gestures.

As an established fact of music, sheet music, like articles, is the result of "frozen" creative thinking. In addition to the audience obtaining the linguistic information through reading and listening, the performer usually plays a good role in interpreting the spatial information. For example, singers often consider adding their own understanding of musical facts to a new interpretation of the spatial information of these works. To achieve this effect, the singer needs to change the spatial information by reshaping gestures. In other words, the singer changes the encoding gestural order of this spatial representation of motion.

Hence, how do singers encode spatial motion representations? First, the process of encoding is often related to human subjective thinking, such as emotions. Many studies have shown that emotional states can be inferred from human facial expressions. Specific facial muscle movement configurations appear to broadcast or display a person's emotions, which is why they are often referred to as emotional and facial expressions.[11] The etymology of emotion, *e-movere* in Latin, means that in an emotion, one produces a gestural movement from inside to outside. Different expressions are like different codes corresponding to different gestures. The combination of these gestures representing different emotions makes the melody created by the singer richer in its expressivity of colors.

Some scholars have also done some comparative studies and found that positive emotions tend to produce smoother physical gestures.[12] This also means that different emotions will affect the transmission speed of gestural information. From another perspective, emotional expression not only results in the movement of the human face or body, but the very process of emotional creation is itself a gesture. For example, when singers sing upbeat songs, they can't help but raise their arms or smile. At the same time, in the spirit of this mood, the brain will continuously repeat these gestural instructions. In this case, the role of language in

conveying emotions will be strengthening the reliance on spatial information. Therefore, after becoming familiar with the codes of this positive information, the singer will sing faster and faster, or the voice will become louder and louder, to express this emotion. This process of emotional continuation is the emotional gesture. Figure 3 shows three gestures starting from the same skeleton, displaying the emotional "logic." In this gestural display, we see three gestures showing an accelerated performance in time, representing the emotional speed-up of the musician's moods. For reasons of space, we omit a formal explanation of this logic.

4. The connection between gestures and music ontology

According to the classical ontological landscape of music, we can interpret the ontology of music as a four-dimensional hypercube. Its layer of facts consists of three dimensions: realities, communication, and semiotics. Each dimension has the following three "values." First of all, the three values of realities include: (1) physical reality, that is, acoustic phenomena; (2) mental reality, that is, music theory thinking such as musical structure; and (3) psychological reality, that is, emotions and feelings. Secondly, the value covered by communication was proposed by Jean Molino and Paul Valéry: (1) the creative instance (composer) of the work; (2) the nature of the created material and the actual value of the output, also called neutral level by Molino; and (3) the value evaluated based on the aesthetics of different audiences. The three levels of value included in semiotics are (1) expressive surface of signs; (2) deep meaning, that is, the content hidden behind; and (3) the method of transitioning from the surface to the content, that is, the process of generating content.[13] The fact layer is displayed as a classical three-dimensional cube (Figure 4).

According to the description of Mazzola and Cherlin,[2] the hypercube of the music ontology is composed of the dimension of embodiment, comprising the gestures layer, processes layer, and facts layer. The processes and facts layers are both initiated from the most basic gestures layer. Therefore, analyzing the composition of the gestures layer may restructure the facts layer to help composers create from a new direction: first gestures layer, later facts layer. Figure 5 shows a hand gesture by a pianist as a typical representative of musical gestures.

The process layer serves as a factory that produces facts and connects them to gestures. In a popular understanding, it is the process of recording how gestures generate output (Figure 6).

5. Gestures applied to composition by free singing

Typically, traditional music as a fact is subject to extensive research and analysis. Composers have very mature music theory systems to help them create music. In recent years, with the topic of music gesture gaining popularity, scholars have conducted numerous analyses on the gestures and processes produced by musicians when performing musical facts. All embodied gestures made by singers have also been integrated in these analyses. However, if the gestures layer forms an independent system and acts on the facts layer, we wonder whether it will affect the known music theory system of the facts layer.

A critical example is discussed in the following: the famous jazz singer Jeanne Lee has created a large number of improvised free jazz works. A video of her performance is accessible on YouTube (https://youtu.be/QDfXOrlrCJw). The creative ideas of these works hardly follow traditional jazz theory but at a greater extent reflect the singer's own feelings about the sound. As mentioned earlier, under the guidance of positive emotions, the singer's musical gesture will be produced faster and faster when expressing the same information. For example, in this video, it can be observed that the musical material created by Lee occurs from 12th to 28th s, and it proceeds at a tentatively slow speed. Starting

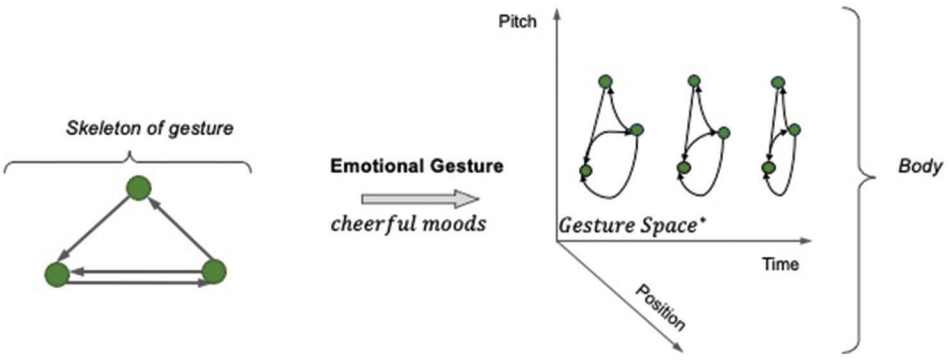

Figure 3. Three emotional gestures with the same skeleton (cheerful emotions). Image created Yuwen Sun

from the 28th s, after Lee became familiar with this melody, under the guidance of a positive mentality, she accelerated the speed of singing this melody. She said: "The voice is a very important instrument; it is part of the body and can emulate bodily feelings. Hence, using the psoas muscles and the diaphragm together you can take it into dance or voice or both you learn to work with the dynamics of the feeling you learn to work with the emotions. When your body is working you do not have to think of a horn but you can think of body movement."[14, p. 3] Since 1960s, Jeanne Lee chose to stay away from traditional musical concepts, detaching music from musicality to increase space and quietness. She tried many ways to achieve her goal, such as reading poems with music accompaniment, paying more attention to the syllables or repeated words of the poem itself, and combining this with some special sounds to convey it to the audience, or training herself to use dance to convey emotions to the audience through body perception. When she performed the music created through gesture, the acoustics often sounded very strange. It did not have the musical structure in traditional music theory, and the sound effect appeared more personal, unique, and impressive.

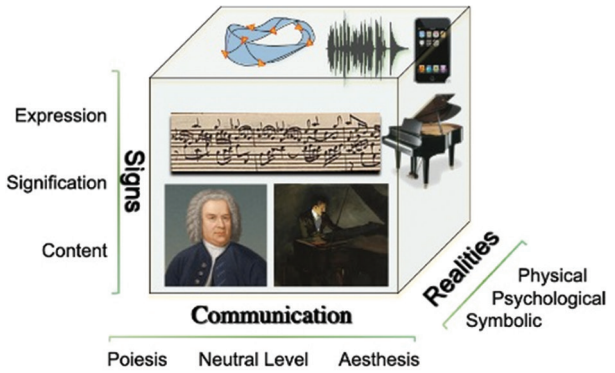

Figure 4. The classical three-dimensional cube of musical ontology.[5] Copyright © 2016 Guerino Mazzola. Reprinted with permission of Guerino Mazzola

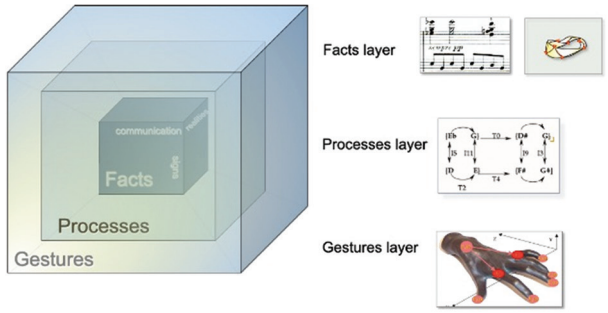

Figure 5. The hypercube of musical ontology.[5] Copyright © 2016 Guerino Mazzola. Reprinted with permission of Guerino Mazzola

In fact, there is a basic logic explaining why singers focus on the music's gestures that were unintentionally created. The authors believe that such a creation can be approached from two analytical aspects: First, it is a horizontal melody development, that is, personal improvisation based on the singer's leading ideas. The second aspect is a secondary creation completed by the accompanying musicians in combination with the main melody, that is, a vertical musical structure. This not only requires the musicians to interpret the poems and the music sung by the singers but also requires their own secondary thinking after interpreting the music. Therefore, regarding the second point, the musician's secondary creation can be called a hypergesture after the gesture. It is

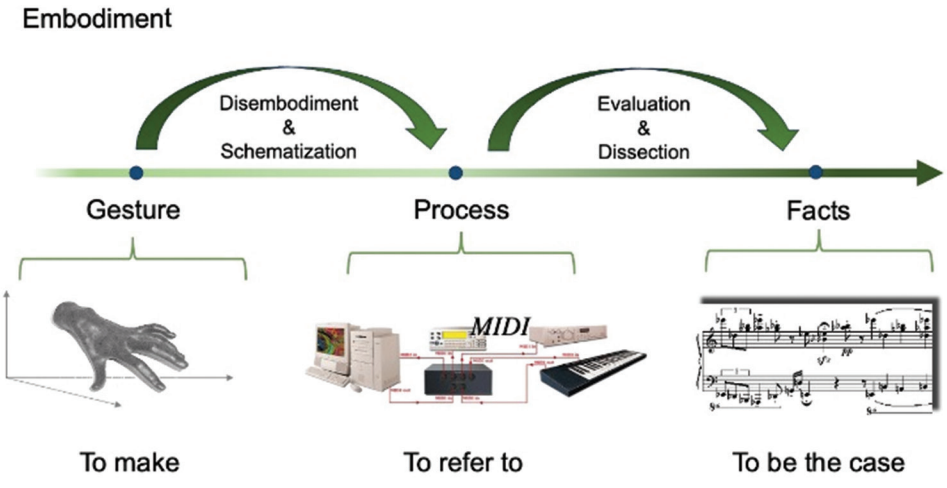

Figure 6. The fourth dimension of embodiment in the ontology of music.[5] Copyright © 2016 Guerino Mazzola. Reprinted with permission of Guerino Mazzola

worth noting that the accompanist here can be a musician who can flexibly operate an instrument or an electronic musician using electronic equipment, such as MIDI. The gesture processing model behind this procedure should also follow a certain logic, as discussed herein.

6. The gesture layer is used for the thinking logic of composing music

To understand the basic logic of the gestures layer, we first need to refer to the hypercube relationship of the music ontology. A more formal presentation of such a logic should be developed in future investigation. The gestures layer has an inseparable causal relationship with the most basic three-dimensional cube of music. In other words, focusing on the three dimensions of the facts layer: realities, communication, and semiotics, we can further infer the physical and mental changes made by the performer, following the logic of the basic gestural setup. Following the previous ideas, the singer's free creation through gesture consists of two aspects, namely, horizontal melody and vertical collaborative musical structure.

The creation of a single melody line is derived from the singer's inspiration. It is a gesture that develops from consciousness and is usually spontaneous and uncontrollable. The singer's performance conveys some factual spatial information to the audience. In traditional music, this fact is often created by the composer first, and then the singer performs secondary processing of spatial information. However, for performers who create freely, this follows from the fact that the spatial information has already taken shape and comes from the singer's inspiration. It follows from the following three possibilities:

(1) *The singer's own music education background:* Usually, musicians who have experienced systematic education in traditional music theory will have more rigorous creative logic than musicians who have not received systematic music education. These musicians have many musical works in their memory as creative materials, so the music they create will be more or less mixed with the shadows of different types of music.

(2) *The intention of the singer:* This element is closely related to the life experiences of different singers. It contains two dimensions: individual intention and collective intention. Personal intention focuses more on self-reflection within the individual. Self-reflection is the individual's thinking after the fact. It includes emotional changes and the understanding of right and wrong. Music and language have very similar aspects, and the concept of communication arises in the context of several individuals. Communication is always a collective endeavor that requires at least two interlocutors to coordinate their contributions and fulfill their respective communicative responsibilities. In the gestural creation and thinking of singers' performances, they serve more as a guide to communicate with the accompaniment musicians and the audience. George Herbert Mead once said: "We are not… building up the behavior of the social group in terms of the behavior of the separate individuals composing it; rather, we are starting out with a given social whole of complex group activity, into which we analyze (as elements) the behavior of each of the separate individuals composing it."[15, p. 165] Therefore, when an individual receives external information from the group, the individual will process the information, changing his/her outlook on life and values. For example, reflection on society and human nature. These experiences will allow singers to perform lyric information when singing, conveying different meanings to the audience.[16-21]

(3) *The influence of the singer's emotions:* To understand it from a popular perspective, it is the change of the singer's mood when singing. According to our previous ideas, we know that the formation of a singer's gesture is inseparable from one's thoughts. When we regard the gesture in the singer's consciousness as an independent emotional expression, the corresponding movement trajectory is a single expression. However, in the compositional process, which is a smooth process of moving the music, the main melody is composed of multiple different emotions. Therefore, the mood in the music piece is often not static; its changes within different gestures will also change the meaning of the lyrics and music. Moreover, this is what the accompaniment musicians need to understand most carefully. The horizontal single melody line, as a reality factor, is usually the most intuitively reflected in musical facts.

7. Concrete application through gesture composition

After understanding the basic logic of the singer's use of gestures to create music, we understand that the accompanying gesture is a response to the singer's gestural creation. Based on this point, the occurrence of the singer's gesture serves as the fundamental reason for musical creation. The most basic element for music to occur is time. In response to this, the singer's breathing gesture becomes a crucial part. Through some videos,[22] we can find that when singing with the symphony orchestra, some singers usually open their mouths, make a surprised expression, and take a very fast breath. This cues the conductor that they will sing at a faster speed subsequently. In some

very slow music processing,[23] it can be seen that singers' bodies are often not in a very active state. They often show a state of musical enjoyment on their faces. In terms of pitch changes, if the interval span of the front and back notes is large, the singer will often prepare in advance, as shown through micro-expressions. For example, when singing a high note, the opera singer will breathe fully, and before singing the high note, he/she will raise the soft palate in preparation for singing the high note.[24] In terms of volume, for improvisational compositions, there is a process of increasing or decreasing the volume. When a singer performs a passage with a high volume, one's body will often be in a more active state to help one's voice have a stronger explosive power to express this emotion. Handling quiet pieces of music is just the opposite.[25]

8. Conclusion

This article presents an in-depth analysis based on a singer's gestures for two reasons: *First*, in recent years, there have been very few documents that study the connection between singing gesture theory and composition theory; therefore, a gap in this aspect motivated the discourse of this article. *Second*, gestures produced by a singer are the only performance form that is not enabled by other instruments; therefore, such a performance process will be more internal and directly linked to the brain's information processing. We believe the insights from our analysis can help reduce the obstacles to the direct creation of music by gesture.

From the previous discussion, we learn that music, in its three-dimensional factual ontology, is generated by the superposition of different musical gestures. Its core musical facts include musical scores, and its dynamic performative trajectory generated by the movement of gestural combinations. Such an operating logic forms the four-dimensional hypercube ontological model of music. The major conclusions of the current analysis can be summarized as follows:

(1) There is an objective logic to the singer's posture when improvising on music creation. In the logic of the traditional music system, facts are used as causes, and gestures are produced as results. As opposed to this approach, this article focuses on gesture as the basis of creation and reversely analyzes its results, that is, musical facts. This results in a new logical system, the logical system of gestural creation.

(2) This objective logic is detailed in three sections in this paper. First, we derived emotional gestures based on the geometric representation of the gestural skeleton. Second, we comprehended the specific structure of music ontology and learned the causal relationships at three ontological layers. Finally, based on the logical relationships at three layers in music ontology, we deduced the impact of the creation of singer's gesture on music facts and combined it with practice by applying concrete gestures in composition.

(3) This research has paved the way for multiple future directions. In addition to encouraging more flexible and free improvisation in music performance, it is also likely to help foster the use of artificial intelligence (AI) in future music creation. Human expressions have been extensively analyzed by AI, which generates a large amount of data about emotions through human facial micro-expressions. When applying this technology in analyzing a singer's creative gesture, musical works created by the human spirit may be produced more efficiently in large numbers.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: All authors
Formal analysis: All authors
Investigation: All authors
Methodology: Guerino Mazzola
Writing – original draft: All authors
Writing – review & editing: All authors

Ethics approval and consent to participate

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Consent for publication

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Availability of data

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ACCSCIENCE PUBLISHING

Arts & Communication

ARTICLE

The art market during a period of class transition in 19th-century England: A case study of the Agnew family

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Abstract

The 19th-century is considered as a crucial epoch in British history, which witnessed profound social upheavals that spanned economic, political, and cultural domains. This paper examines the 19th-century art market through the perspective of Agnew's Gallery in Britain. The gallery demonstrated precise market forecasting abilities by discerning the tastes of various social classes, reflected in its adept procurement, sponsorship, and copyright acquisitions. Thomas Agnew focused on acquiring watercolor landscapes of the English countryside, while William Agnew expanded the gallery's inventory by securing aristocratic collections. Furthermore, it highlighted significant shifts in artwork themes and diversified profit strategies within the art market, highlighting the gallery's pivotal role in adapting to and shaping the evolving landscape of artistic creation and commerce during this era. Simultaneously, William Agnew, as both an art dealer and Member of Parliament, expanded the gallery's clientele and encouraged middle-class art consumption. By combining cultural, political, and economic influence, he positioned Agnew's Gallery as a key player in the 19th-century art market, mirroring the impact of Victorian social structures on art and collecting trends. The gallery's auction and exhibition initiatives provided convenience for the emerging middle class to establish collections and assisted numerous British Indigenous artists, even accommodating the artistic interests of the lower classes. Throughout the gallery's developmental journey, the macro-level business strategies of the Agnew family unveiled the influence of Victorian societal structures and class dynamics on trends in artistic creation and collection within the art market.

Keywords: Middle class; Agnew's Gallery; Exhibitions; Art market

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1. Introduction

During the Victorian era (1837 – 1901), which has long been regarded as a pivotal period for British society, change in Britain's traditional social and political hierarchies was primarily influenced by the Industrial Revolution and the ongoing instability of the monarchy. The British society primarily exhibited a three-class model comprising the working class, middle class, and upper class.[1] The Industrial Revolution laid the foundation for the ascending middle class during the Victorian era. With the continued

progress of industrialization, bankers, textile merchants, and factory owners had already amassed significant wealth, placing them within the upper middle class based on their economic standing.[2] According to David Ricardo (1772 – 1823), an early 19th-century political economist, the working class derived income from wages, the middle class from both wages and profits, and the upper class from their property, rent, and interest, illustrating that due to technological development and changes in labor distribution after the Industrial Revolution, a clear class differentiation incorporating the industrial middle class emerged. The emerging middle class discussed in this article, which was rooted in this differentiation, mainly refers to the businessmen and capitalists who flourished after the Industrial Revolution through various emerging industries, such as factory-produced textiles, railway transportation, and expanded mining, as well as dedicated staff in professions such as banking, trading, law, and medicine.

During this period, a notable cohort of significant art dealers emerged in the United Kingdom. Their ascent and shift in sales strategies were closely related to the arrival of new middle-class collectors. Agnew's Gallery was highly active and played an important role in the art market during the Victorian era. Its business sectors and trading methods influenced the British art market, which was affected by the class transformation. Hence, studying Agnew's Gallery can shed light on new developments in the 19th-century British art market.

Although dealers were primarily driven by profit motives, their attendant behaviors shaped the preferences of a burgeoning class, effectively extending the influence of the middle class, including dealers themselves, into the public sphere. This was the case with Agnew's Gallery as their adopted business strategies included aligning artwork acquisitions with the psychology of the new class, supporting domestic artists, acting as agents for auctions, investing in the development of print businesses, and facilitating the organization of public art exhibitions, among others. Against this backdrop, this study employs a literature review and case analysis. By examining biographies authored by descendants of the Agnew family, extant data from the 19th-century art trading market, and relevant exhibition materials, it aims to investigate the role played by Agnew's Gallery in the art market during the Victorian-era class transition and highlights the characteristics of the period's art market.

Simultaneously, the French sociologist Pierre Bourdieu (1930 – 2002) proposed the concept of "cultural capital," which provided a theoretical framework for the middle class to enter the art market and engage in related cultural activities. Bourdieu believes that capital can be transformed; for instance, economic capital can be converted into cultural capital. Privileges are granted to some individuals based on their possession of cultural capital, which can be unequally distributed due to class differences.[3] Furthermore, Thorstein Bunde Veblen (1857 – 1929) argues that with production advancing to a certain level, conspicuously avoiding all practical occupations becomes a representative characteristic of the leisure class. Elegant polite manners and conspicuous consumption norms explain the behavioral logic of art consumption by some people belonging to the upper middle class.[4] After accumulating significant economic capital, the middle class strives to acquire additional cultural capital and enhance their social prestige, with the hope of further advancing their personal social standing.

To date, research on British art consumption in the 19th-century has mainly investigated two topics: the art market and art activities. In their studies on the art market, scholars such as Thomas M. Bayer, John R. Page, and Barbara Pezzini have noted its overall expansion, with markets for old masters and modern art experiencing fluctuations.[5] Studies on the Agnew family have primarily taken a biographical approach, with scholars typically focusing on its intermediary role and connections to the middle class. For instance, Donghao Chun's "Art Dealing in 19th-Century England: The Case of Thomas Agnew" and Pezzini's "The "Art" and the "Market" Elements of the Art Market: John Linnell, William Agnew, and Artist-Dealer Relationships in 19th-Century Britain" explore the mature market relationship network of Agnew's Gallery.

Therefore, this study aims to conduct a preliminary exploration of the development strategy of Agnew's Gallery in the 19th-century. Regarding inventory, Thomas Agnew (1794 – 1871) redirected his acquisition efforts toward watercolor paintings depicting the English countryside, concurrently adopting the role of a patron. Following this, William Agnew (1825 – 1910) procured aristocratic collections, maintaining a steady inventory to accommodate the dynamic market demands and demonstrating changes in artistic preferences. Despite class and traditional constraints, Agnew's Gallery adeptly functioned as an intermediary within auction houses, securing copyrights at premium prices to produce printed materials, thereby reducing barriers to enter the art market. This article also highlights the initiatives undertaken by the Agnew family in the fields of politics, art, and culture. They adeptly transformed and integrated cultural, political, and economic capital, thereby reflecting the impact of the middle class on artistic activities through alternative avenues in the new era, which is also a hallmark of this period.

2. Cultural and artistic background of the Victorian era

Throughout British history, the social structure has been profoundly influenced by the concept of social class and a longstanding hierarchy. Before the Victorian era, the upper class, comprising the royal family and nobility, consistently maintained an aloof status, a tradition that persisted into the first half of the 19th-century. With the advent of the Industrial Revolution in Britain, steam power and factory systems were driving industrialization in Europe. By 1830s, the initial stage of industrialization had finished, marked by significant capital accumulation and economic development in Britain, which also facilitated urbanization.[6] New business ownership and employment opportunities resulted from the growth of the middle class. After the initial development of certain northern industrial cities, the number of middle-class individuals, including businessmen, industrialists, doctors, and art dealers, increased rapidly, and they accounted for approximately 15 – 20% of the population.[7] The rise of the middle class altered the political composition of British society. The growth of economic power among the 19th-century middle class, coupled with events such as the French Revolution, spurred new demands. Following a series of protests, the political standing of the middle class was elevated by the parliamentary reforms of 1832.

The Victorian period also saw the development of public education. The upper middle class sent their children to schools or hired tutors for homeschooling to teach classical arts and practical skills. Between 1850 and 1872, a series of surveys were conducted in England and Wales to comprehensively analyze the country's educational institutions, and they were used to promote educational reform.[8] The literacy rate of the lower classes increased, and the wealthiest members of the middle class took courses in art appreciation while learning practical skills. Moreover, this period witnessed a significant expansion in art dissemination, with a proliferation of magazines and newspapers, such as *the Illustrated Times*, *the Musical Monthly*, and *Stories Illustrated*. By 1840s, the middle class had gained widespread access to abundant literary and artistic content. Some magazines hired specialized art critics to improve quality and outshine competitors. Concurrently, some upper-class groups invested in libraries, museums, and other cultural institutions to elevate the public's cultural awareness and enhance their city's cultural prestige. Compared to the 18th-century, the 19th-century saw the cultural learning and art consumption activities of the lower middle class and even the working class gradually flourish. The barriers in the art world faded, and artistic activities diversified across various strata, laying the groundwork for later changes in the accessibility of the art market.

3. Astute market prognosticators

In the early 19th-century, Manchester became one of the centers of textile manufacturing, as most cotton spinning activity during the Industrial Revolution took place in towns in northwest England. People from all over the country came to work in the city. Thomas Agnew, born in Liverpool in 1794, also moved to Manchester with his family. He was an apprentice to the Italian engraver and gilder Vittore Zanetti and later became his partner in an art store.[9] Agnew made two developmental decisions while working there. The first decision was to change the company's purchasing and sales direction toward primarily acquiring goods, including many landscape and genre works paintings, from auctions. The second was to expand the business into the field of publishing and printing. This business model is the precursor to the later Agnew's Gallery. Both Thomas and his eldest son William adeptly captured the changing consumer tastes in the early- and late-19th-century. In the early period, the firm acquired many natural scenery and folk-art pieces, whereas, in the later period, it shifted toward selling works by renowned masters, all of which yielded excellent sales results.

After the Industrial Revolution, Manchester "grew larger, dirtier, and smellier,"[10] causing the departure of many aristocrats. Thus, middle-class merchants became the city's primary inhabitants. By the mid-18th century, Manchester's merchants had amassed substantial wealth and begun to yearn for further social esteem and distinctive identities. Simultaneously, they lacked an appreciation for masterpieces and predominantly held fervent patriotic sentiments. Agnew keenly acknowledged this aspect, prompting a shift in his procurement strategies.

Due to the harsh living conditions in Manchester's urban environment, a nostalgic sentiment for the natural beauty of the countryside was evoked among the middle class. Watercolor paintings depicting rural landscapes and virtues gradually gained prominence in the market. Against this backdrop, renowned works like John Constable's (1776 – 1837) "The Hay Wain" (Figure 1) emerged, capturing the scenery before the onset of pollution in the cities. Meanwhile, the robust national pride fostered by developed nations led the merchants to deem everything as the finest in Britain.

At the time, Agnew enacted two initiatives. First, he rejected poor imitations of many masterpieces circulating in Zanetti's shop and redirected his procurement focus toward British countryside watercolor paintings. As shown in Table 1, records indicate that he predominantly

purchased landscapes and genre paintings by modern British painters at London auctions in the 1830s, with prices ranging from £30 to £60.[1] By 1850, Agnew's business included a substantial collection of works by artists such as John Constable (1776 – 1837), J.M.W. Turner (1775 – 1851), James Baker Pyne (1800 – 1870), and Augustus Wall Callcott (1779 – 1844).

In addition to purchasing, Agnew's company also directly acted as patrons. Thomas Agnew sponsored contemporary artists, including Arthur Boyd Houghton, Charles Leslie, and John Linnell, and acquired their works directly from the artists' studios. After Agnew retired, Lionel and William established business relationships, and Agnew's London stock books recorded the purchase of 34 pieces by Lionel (Figure 2), earning a total of £1,900.[11] During this period, outstanding modern artists such as David Wilkie (1785 – 1841) and William Collins (1788 – 1847) were greatly admired by patrons and the public of the early Victorian era. Their works typically depicted rural landscapes of remote regions like Scotland or extolled the virtues of rural labor. Sometimes, their work was so highly demanded that there was a supply shortage. Directly investing in modern artists and establishing good relationships with them allowed for priority purchasing rights, reduced acquisition costs, and opportunities to share artistic opinions with the artist. Ensuring an ample supply of goods in this primary source of the art market further attracted middle-class consumers.

Table 1. Purchase records.[2]

Time	Place	Works/price
1827.7.7	London	George Vincent, "A View of Thames Street" / £68.50
1831.5.19	London	Augustus Wall Callcott's landscape painting / £38.17
1831.5.28	London	Augustus Wall Callcott's landscape painting / £32.12
1834.2	London	William Collins, "Going to Market" / £35.30
1834.2	London	Salvator Rosa, "A Grand Landscape" / £15.40

Figure 1. "The Hay Wain," John Constable, 1821, oil on canvas, 130.2 × 185.4 cm, National Gallery, London. Copyright © National Gallery, London. Reprinted with permission of the National Gallery, London

In the late-19th-century, William Agnew was among the earliest dealers to recognize that the preferences of some collectors were shifting toward 18th-century and old master artworks. Old masterworks experienced noticeable fluctuations in the 19th-century market, showing trends of rise, fall, and resurgence. With the Settled Land Act of 1882, which restricted the rights of the nobility to land holdings, numerous early paintings by British nobility began appearing on the market. Simultaneously, exhibitions displaying exceptional old masterworks emerged, reigniting interest in a market that had previously been disrupted by numerous forgeries. During this period, William Agnew acquired works from the nobility and established a high-quality inventory of Dutch, Flemish, and Italian paintings.[9]

With their grasp of shifting sales trends in the art market and mastery of high-quality sourcing to meet customer demands, Agnew and Co. continued accumulating new clients and have endured to this day. Although the degree of reliance on Agnew's Gallery has varied among clients, the firm certainly became an indispensable art dealer for British merchants in the 19th-century. For instance, textile manufacturer Samuel Ashton purchased watercolor artworks worth tens of thousands of pounds from Thomas Agnew between 1848 and 1856. From 1852 to 1865, the Agnew family sold over 6,000 watercolor paintings. Regarding the sale of old masterworks, Lord Iveagh (Edward Cecil Guinness)[3] purchased 212 pieces from Agnew's Gallery on Bond Street, including works by 18th- and 19th-century British artists and 17th-century French and Flemish old masters, such as Poussin and Van Dyck.[4]

During the Victorian era, the procurement strategies and trading activities of Agnew's Gallery, guided by

Figure 2. "The Sand Pits, Hampstead Heath," John Linnell, 1834, Oil on panel, 24.1 × 38.1 cm. Copyright © Art Institute of Chicago. Reprinted with permission of the Art Institute of Chicago

consumer psychology and art market conditions, offered varied categories of artworks in response to supply-demand dynamics. In the early and middle periods of this era, the middle class strongly preferred landscape works and watercolors, whereas old masterworks were low in demand. However, in the later period, with the enactment of relevant laws and promotion of exhibitions featuring old masters, the authenticity of the supply was better assured, leading to shifts in collectors' tastes once again.

4. The gateway to entering the art market

In 1877, Agnew's Gallery moved from Waterloo Place to Bond Street in London, facing a larger population and increased competition. The aristocratic collectors of the 18th and early 19th-centuries were not inclined to trust dealers and preferred direct purchases from artists or select agents. It was the emerging middle class that relied on galleries and dealers for their purchases.

As Bourdieu highlights, taste is a historical product reproduced by education. Works of art can express infinite nuances through divisions of genre, era, technique, and creator, among others. Specialized knowledge is required to differentiate works of art and interpret their differences.[3] When art became classified as a luxury product, acquiring artwork became a means of attaining fame and status. For the upper class, the threshold of economic privilege and access to the knowledge necessary to cultivate artistic appreciation also erected class barriers. New collectors often lacked this refined taste, necessitating the assistance of dealers and participation in exhibitions to help them navigate and enter the art market.

The inclination of collectors toward purchasing artworks through dealers was tied to the conditions prevailing in art auction houses at the time. Dealers continued to dominate as the primary clientele of these auction houses, and each prominent dealer in the London market had their own distinct areas of specialization.[4] Data show that William Agnew participated as a bidder in 748 separate auctions.[12] Agnew's Gallery employed a clear pricing structure for auction transactions: clients could either select a work, with the gallery bidding on their behalf in the auction and charging a 5% commission, or the gallery could choose works, bid on them in auctions, and the client would then select and purchase from Agnew's inventory, with Agnew receiving a 10% commission.[13] The auction house's customers were mainly dealers who adopted a non-competitive buying strategy. Each trader had a niche and rarely infringed on others. Middle-class collectors who were new to the art market preferred to authorize these experienced dealers to conduct art transactions.

In addition to its high-priced artwork, another significant business concern of Agnew's Gallery was its printing service. Obtaining prints was another way for ordinary people to enter the art market. During the 19th-century, prints and reproductions of masterpieces became integral to the home decor of the middle class and affluent peasants. A traveler once described what he saw in southern England as follows: "Their farmhouses all had an extra drawing room filled with ostentatious sofas and prints in gilded frames."[14] Publishers engaged artists to illustrate novels and independent works, such as books, annuals, and souvenirs, which were particularly favored by middle-class women. Consequently, copyrights in artistic works emerged as a new commodity. In 1855, Thomas Agnew published a print of Clarkson Stanfield's painting "H.M.S. Victory." In 1873, William Agnew paid £10,500 to William Homan Hunt (1827 – 1910) to acquire the copyright for "The Shadow of Death" (Figure 3), the highest price ever paid for the copyright for a work of art at the time. The sales revenue from the initial version alone exceeded £20,000.[9] The prevalence of copyright acquisition and reproduction sales by a distributor demonstrates the art consumption capacity of the lower strata of society during the Victorian era. Despite the relatively modest profit margin for prints and collections of illustrations, the substantial volume still yielded considerable profits.

These phenomena had been nearly non-existent in previous centuries; however, during the 19th-century, the culture of art consumption became widespread across all levels of society. Agnew's Gallery played pivotal roles in the art market, helping the middle class overcome market barriers and guiding collectors lacking artistic education to establish collections. This assistance broke down identity restrictions, providing channels for art consumption and market entry for the lower and middle classes.

Figure 3. (Left) "The Shadow of Death," William Holman Hunt, 1873 – 74, 104.5 × 82 cm, oil on panel; (right) early proof of the print, 130 × 100 cm, mixed-method engraving on ivory chine laid down on off-white plate paper. Copyright © Art Institute of Chicago. Reprinted with permission of the Art Institute of Chicago

5. Intervening in the public art sphere

Pezzini aptly characterizes the Agnew family merchants as "civic dealers."[15] Certain merchants demonstrated a profound civic spirit during the Victorian era. By converting their economic capital into social capital, the middle class established their identity and sought social acceptance. Hence, their commitment to social responsibility and improvement grew. Many affluent merchants and entrepreneurs contributed to society through philanthropic endeavors, community development initiatives, and public utility projects, all aimed at fostering urban progress and ameliorating the living standards of the working class. In the field of art, merchants purchased artworks that reflected their personal cultivation. After a purchase, some emerging merchants chose to donate their personal collections to museums or organize exhibitions themselves to enhance their cultural influence and reputations. Therefore, some initiatives within the Agnew family reflect characteristics typical of the middle class during this period. Besides actively participating in social affairs such as establishing hospitals and supporting canal excavations, Thomas and William Agnew also contributed to establishing significant exhibitions and public institutions in the art market. Because of their special identity as art dealers, these activities secured a position comparable to that of a contestant influencing referees for the Agnews, thereby enhancing their profits in the art market.

In cities, such as Leeds, Manchester, and especially London, employers viewed art exhibitions as occasions of rational entertainment with a public spirit. Consequently, they distributed tickets to their workers to encourage them to attend.[12] There was a sharp increase in public demand for art, leading to high attendance of exhibitions, which became one of the most widely used mediums of dissemination in the art world.

For important exhibitions, Agnew's Gallery not only participated but also took on the role of partial organizer. Inspired by exhibitions in London,[5] entrepreneurs in Manchester sought to enhance the city's cultural prestige, and several were willing to lend their collections to support these exhibitions. Consequently, substantial funds were raised, leading to the "Art Treasures of the United Kingdom" exhibition being held at Old Trafford in Manchester on May 5, 1857.

The exhibition planners drew inspiration from exhibitions of the British Institution for Promoting the Fine Arts in the United Kingdom, which featured works by old masters from Spanish, German, Flemish, and other schools of painting, alongside British modern art. Organized under royal patronage, the exhibition garnered an enthusiastic response from citizens, significantly influencing artistic taste in Victorian Britain. Agnew's Gallery not only provided artworks for this exhibition but also assumed responsibility for collecting and organizing works from various parts of Britain during the exhibition. These efforts helped the gallery establish connection networks with numerous artists and collectors.[6]

In addition, William Agnew was also responsible for co-organizing overseas exhibitions, particularly in Mexico, and lending artworks for display. Later, he maintained a good relationship with the National Gallery, providing curatorial services that ranged from organizing touring exhibitions and participating in auction bids to handling transportation and framing or advising on exhibitions and displays.[15] Furthermore, during auctions, apart from accepting commissions, he generally avoided competing with public institutions.

William Agnew, with his dual roles as a Member of Parliament and an art dealer, adeptly built bridges between different stakeholders. Integrating these political and economic roles allowed him to navigate various exhibitions and public institutions with ease, demonstrating a natural affinity. As a member of the middle class, his public involvement in the art field not only highlighted his reputation for fairness and justice but also highlighted his recognized professional skills. This approach expanded the customer base of the art market, enriching both his cultural capital and legitimacy while promoting the accumulation of financial capital. Consequently, it further solidified his leadership position in the art trading domain.

6. Conclusion

Britain's upper class remained remarkably stable for an extended period. However, from the late-18th to the 19th-century, the Industrial Revolution significantly altered Britain's social structure. With the burgeoning economic strength of the middle class, their political and social status gradually increased, thereby evolving their needs in education, culture, and other domains. The middle class emerged as an influential group in the professional art market and various popular art consumption events. The cultural habits of the upper class expanded and spread downward, and the middle class aspired to continually convert their economic capital into cultural and social capital. The taste and financial prowess of this new consumer group had a discernible impact on consumption categories within the art market.

As a precise forecaster of the Victorian-era art market, Agnew's Gallery grasped the esthetic trends of the middle class in Manchester and continuously expanded into fields such as modern art, prints, and replicas. Serving as a gateway for entry into the art market, Agnew and Co. provided a way for the middle class to mitigate market risks and build personal collections while collaborating with emerging

classes to create a thriving art consumption environment. Agnew's decisions helped numerous newcomers to establish themselves in the art market.

In addition, the gallery's influence in politics and society exceeded its role as a dealer, demonstrating a macro-level business strategy. Although the social role of Agnew's Gallery was merely that of a dealer in the art market, studying its developmental process allows one to gain insights into the evolution of market participants, commodities, and peripheral products of that era. Each strategy of Agnew's Gallery shows a distinct class component and sense of proprietorship, revealing the diverse landscape of the Victorian-era art market.

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ACCSCIENCE PUBLISHING

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ARTICLE

Inclusive elementary school musicking practice for Japanese students with special needs: A narrative inquiry

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Abstract

Musicking is an old, yet new concept of music-making. The term, first proposed by anthropologist Christopher Small, intended to reinterpret music as not merely an act but also as an object. While musicking, anyone can participate in musical activities, which include singing, dancing, improvisation, and listening to musicking sessions. This study examines the use of musicking strategies in a Japanese elementary school with special needs students. The initial participants comprised 10 students from the first to sixth grades from a public elementary school in the northern part of Okayama Prefecture, Japan. Dr. A, the lead researcher of this study, is a violinist–teacher–researcher with professional orchestra experience in the United States. His career as a guest music teacher spans more than 20 years. In addition, two homeroom teachers and two university students supported the research project as participant observers. Based on Dr. A's related practice in this area, this study explored musicking with a special emphasis on student inclusion. By applying a narrative inquiry and multivocal ethnography, this study investigated various events that were experienced in the musicking practice. Finally, the participants co-constructed a research-based narrative, focusing on creating a learning environment enabling all participants to build a musical community together. By synthesizing the participants' thoughts, providing insights into musicking practice, exploring unexpected events, and utilizing the intuitive nature of music, the participants identified an approach for a comprehensive model for musicking.

Keywords: Musicking; Special needs classroom; Case study; Narrative inquiry

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1. Introduction

Musicking is an old, yet new concept of music-making proposed by anthropologist Christopher Small, which expresses music in its present form and reinterprets music as a human action.[1] According to Small, musicking recognizes music as not only an act but also as an object. Musicking considers that anyone can be involved in musical activities from any standpoint and role.[1] In this regard, Small criticized the Western tradition of listening to music at concerts and the lack of communication among performers and listeners outside the musical world.[1] This view was echoed by Dissanayake, who described musicking as a shared sense in local communities, either by singing, dancing, playing instruments, composing, or participating in other artistic endeavors.[2]

Musicking has been explored in the realms of ethnomusicology, music therapy, and music education. Brucher and Reily investigated the diverse ways in which people engage with music in local communities.[3] By investigating musicking in more than 30 countries, they concluded that musicking contributes to identity construction, community-building, and local-global dynamics.[3] Similarly, Ruddock[4] criticized Western stances of perceiving music and labeling musical beings as either musical or non-musical.

In the realm of music therapy, musicking has been increasingly considered as a noteworthy tool for reframing musical companionship in community music therapy. Pavlicevic and Ansdell[5] insisted that musicking construction can naturally and flexibly range between intimate musical companionship and the broader musical community, based on circumstantial needs and the physical and cultural context. Stige[6] considered musicking as an interdisciplinary tool for enriching the health affordance of the arena, activities, and artifacts of music practice. Instead of focusing on the direct effects of music therapy, the study highlighted the importance of focusing on people's use of the musical features of a situation.[6] Previous literature has suggested the personal use of musicking for people living with dementia and explored the psychological, social, and emotional benefits of musicking.[7] In sum, the concept of musicking has been evaluated and scrutinized from diverse vantage points.

Moreover, musicking has questioned the Western tradition of concert music and the design of music performance and listening as the *auditorium model.*[8] In this regard, Small critically analyzed the fact that large concert halls were originally constructed for large performance groups such as symphony orchestras. However, such spaces create a separation between performers and audiences.[1]

Specifically, in auditorium settings, performers are normally on the stage, whereas the audience merely sits quietly and listens to the performance.[1] Here, Small observed that the auditorium's design not only discourages communication among members of the audience but also tells them that they are there to simply listen and not talk back.[1] This auditorium design is also common in Japanese music education, music instruction, and learning, thus discouraging communication among participants in the creation and performance of music while simultaneously reminding them that their role is to listen and not respond.[8] This conventional model of music performance and listening is pervasive in Japanese music education.[8]

In the field of education, Shor echoed this viewpoint when he described students' seating preferences as the *Siberian Syndrome,* or the ingrained tendency to always sit away from the teachers and avoid the front rows.[9] This indicates that there is a teacher-oriented authority rather than a shared learning experience between students and teachers in traditional classrooms.[9] Shor's concept also explored the possibility of "escaping Siberia" by upending the power relationships that typically define the teacher–student relationship and placing the two parties in difficult-to-leave roles that reinforce one another.[9] In related research, Shaw critically analyzed the online instruction during the COVID-19 pandemic and stated that the return to physical classrooms after the pandemic offered an opportunity to disrupt the Siberian Syndrome and the status quo.[10]

I have been engaged in practical/collaborative research on musicking as a performer, music educator, and researcher of music education in various Japanese schools.[8,11-18] Throughout my career, I have recognized that musicking gave freedom and choices to individual learners and allowed them to explore the learning contents. I have also worked with experts in fields other than music, such as those in international education and elementary, secondary, and special education, along with children, caregivers, and parents.[8,11-18]

In recent years, my research team has focused on developing practical models that allow children with autism and severe and multiple disabilities to participate in music activities.[8,12,16] I co-constructed universally designed music activities that anyone can participate in, regardless of whether they have a disability.[8,12,16] The most recent practice highlighted the usage of online distance education systems to conduct musicking in rural schools.[8,14] This series of studies created a practical model for music-making, where anyone can participate and interact with others with different interests, skills, and musical experiences.[8,11-18]

Kaku[19] described the Japanese term *kyosei* as a symbiotic "spirit of cooperation" in which individuals and organizations live and work together for the common good. The symbiotic spirit that Kaku mentioned constitutes the very foundation of musicking practice.[8] Through practical investigations of musicking, it has become apparent that it embodies symbiosis, in which each participant in the musical activity mutually accepts one another and creates a community that shares the same spirit, without excluding others.[8] Meanwhile, related literature has indicated a lack of actual cases and practice models of musicking for inclusion classes.[20-23]

Consequently, the present study includes the following research questions:

1. What is an inclusive process of musicking in a special needs classroom in Japan?
2. What specific variables of musicking foster inclusive practice?

2. Methods

Based on my teaching experience, this study employs narrative inquiry in music education as a research method. Abeles and Conway indicated that narrative analysis is included in qualitative research methodologies in music education, especially when the research is descriptive and co-constructed.[24] Meanwhile, rethinking music engagement, education, and inquiry in music education can be accomplished through the use of narrative work.[25] which reconceptualizes the approaches in which we think about such aspects.[26] This is in line with Clandinin and Connelly,[27] who described narrative inquiry in music education as being more responsive and inclusive of people's lives. As an action-based narrative inquiry, the research team illustrated narratives built upon a succession of cases reflectively based on our actions.

The case in this study was constructed using my 10 years of experience in longitudinal musicking and collaborations with fellow researchers, students, teachers, guest artists, music specialists, and caregivers in Japan.[8,11-18] The overall purpose was to implement a philosophy and research-informed musicking practice in Japanese music education.[8,11-18]

2.1. Participants and settings

The participants comprised 10 students from the first to sixth grades at a public elementary school in the northern part of Okayama Prefecture, Japan. They were classified as having either an intellectual disability or emotional disorder, or both. In addition, two homeroom teachers and two university students supported the research project as participant observers. This study commenced in November 2023, with a special class on musicking followed by a practice session. A 60-min focus group discussion followed the practice session.

2.2. Data collection and analysis

The team of researchers maintained field notes and added information during the planning session and during and after the practice session. Although the data collection did not consider official interviews, the researchers asked the teachers and university students to describe anything that they noticed during the musicking activities. Specifically, by applying the methodology of "video-cued multivocal ethnography" proposed by Tobin *et al.* or the so-called "Preschool in Three Cultures Method," this study presented various narratives discussing the same set of circumstances and practices.[28]

Recent research indicated that multivocal ethnography can be used as a tool for understanding not only visible but also invisible learning outcomes. This technique can also be used in comparative cultural research and as a tool for capturing different perspectives within a single school culture.[29] Regarding story construction, in the present study, to enhance the depth of comprehension of the shared experience, other researchers and teachers also read the narratives that the researchers had individually written. The majority of the narrative review sessions occurred through Zoom meetings, emails, and regular mail. Although Ely[30] defined a theme as a strong statement of meaning that runs throughout all or most of the pertinent data, marginal remarks or minority responses were also incorporated in this study to examine various perspectives on student learning and music-making. Meanwhile, triangulation, that is, the process of conducting peer reviews and participant checks during narrative construction, was important for achieving trustworthiness in this type of research. Finally, this study combined the narratives and commentaries in line with Holt, who outlined the process of creating the practice *in situ*.[31] In *How Children Learn*, Holt observed learning in naturally occurring settings and concentrated on his frequent encounters with young children. His descriptive narratives led him to the conclusion that children learn the best in environments that are free from pressure.[31] Holt also claimed that instead of attempting to explain effective learning, studies should provide a narrative representation of the process.[31]

2.3. Ethical dimension

This study placed special attention on the ethical dimensions of researching young children, as a part of the musicking practice. Although the teachers and caregivers agreed to volunteer all the data for this research, including letters by parents addressed to me indicating the participants' willingness to cooperate, this study protected their right to privacy. Specifically, the names of the children, the teachers, and the facility were presented as pseudonyms. Moreover, no full names or precise locations were indicated in the research logs and all the research data and materials were kept in my private office.[32] Permission to withdraw from this research project for any reason was verbally given to the teachers and caregivers.

3. Results

The following narrative depicts the practice session in this study:

> *That morning, buses going from central Okayama city to the northern mountainous region were crowded, causing delays of approximately 30 min. The northern region was experiencing depopulation, with a serious problem of deer fawns. That day was a special day when one could ride a bus for just $1 – $2, instead of the usual $40 – $50.*

As a result, a large number of passengers rushed onto the bus. The bus, which usually carries only a few people, quickly filled to capacity with 60 people, and it took a long time to get on and off the bus, causing the bus to be delayed.

Dr. A was on the bus, and he contacted the principal of the elementary school via smart phone and asked him to inform the students (through their homeroom teacher) of the delay. He also contacted the three university students majoring in education who had arrived earlier by private car and instructed them to prepare the classroom under the instructions of the homeroom teacher.

When Dr. A arrived at the elementary school around 10:40, he found the principal having a nice chat with the three university students in his office. Dr. A immediately went to the classroom, where the university students and Dr. A introduced themselves. Dr. A always carefully (yet intuitively) considers whether he shall begin the class activity by letting the children explore the violin sound, or play the violin and introduce himself at this time. Dr. A made the decision to introduce himself first because the students seemed relaxed and comfortable in the room with their teachers. Dr. A once again explained the story of how the bus was late, after which several children started saying things like, "I've been to Okayama to visit my grandpa" and "I've never ridden a bus before." This lasted about a minute. Dr. A is always conscious of maintaining a natural dialogue with the students, nodding to their stories, and answering their questions, even if the topic differs from the music and lesson of the day.

Around 10:50, Dr. A picked up a violin from his suitcase, tuned it, applied pine resin, and continued speaking to the students. The students kept their eyes on the violin and bow. In this case, 10 violins were stored in a large suitcase, along with 10 bows. Normally, Dr. A arrives early and finishes tuning and applying pine resin before starting class. However, on this day, he started his preparation after the class started. Consequently, he had to continue talking as he prepared. Meanwhile, the children were curious and stared at the violin and Dr. A's work the entire time.

He also explained that there would be no sound unless pine resin is applied, after which he played the sound while explaining the difference in the sound before and after applying the resin. He explained that pine resin is also used by Kendo players to apply it to their hands to prevent them from slipping when holding a Shinai sword. One of the children said, "I can do Kendo. I know it, the pine resin." Dr. A showed a bow coated with pine resin to the students. He also informed each child that when they touch it with their fingers, it is powdery, a little rough, and sticky, and asked them to experience it for themselves. The children held their fingers close to their faces to look at and smell the powder, after which they discussed what they noticed with each other. In this case, the children were seen showing each other the powder on their fingers.

Around 11:00, Dr. A asked each child to hold a bow and create a violin sound. At this point, Dr. A held the violin parallel to the floor at the knee level of the student sitting, and asked the student to only hold the bow. Dr. A then helped the students place the bow on the string and guided all the students to move the bow back and forth to make sounds without the teacher's help. Every time a sound was produced, he praised the child by saying things such as "Ah, that came out" or "It's a really beautiful sound." If the sound was difficult to produce, he immediately supported them by saying things such as "Can you try moving it faster?" Usually, when a scratchy sound was produced, the students moved the bow faster such that a ringing tone emerged.

In general, Dr. A carefully watched the students and helped them successfully achieve this first step of sound-making. When the children made scratchy sounds, they were completely serious and silent. However, when a ringing sound was produced, the students looked happy and were nodding and smiling at Dr. A, their homeroom teacher, and the children around them. After confirming that everyone was able to produce the sounds to their satisfaction, Dr. A moved on to the next activity.

Around 11:10, the hands-on activity began. Dr. A, with the help of three university students, tuned the violins and put pine resin on the bows. When the students were ready, the university students handed each violin to the students one by one. This took about 10 min. While Dr. A watched as each child freely played the violin, he gave instruments to the university students and asked them to make sounds. The homeroom teacher took pictures of each child, saying things like, "Wow, that's an amazing sound" and "That's so cool." The university students also continued to praise them as appropriate.

Around 11:20, K, a third-grade elementary school student, only held a bow. However, since it was not his turn to play the violin, he asked a university

student if he could borrow a violin sooner. Dr. A noticed right away and handed K an unprepared string that he had in his suitcase and had not been placed on the violin. He asked K to see if he could make a sound. The unstrung string did not make a sound, but several children gathered around K and tried various things together to see if they could make a sound. For example, two older students held the ends of the string and stretched them, while K attempted to make a sound by putting the bow on the string. Although he enjoyed the activity for about 3 min, K got angry when he could not get the right sound. K eventually ran out of the classroom and into the hallway.

The vice-principal immediately ran out into the hallway and chased K. Approximately 5 min later, K returned with the vice-principal. According to the teacher, K was upset because he could not get a violin sooner. However, he understood that Dr. A needed time to prepare the instrument. At that time, Dr. A had just finished preparing all of the violins and was bringing in an electronic keyboard from the music room. Although the classroom did not have an electronic keyboard, he thought that the music would be enriched if an electronic keyboard could accompany the violin. The principal immediately accepted the idea, went to the music room with Dr. A, and brought one of the electronic keyboards into the special needs classroom.

A fourth-grade girl immediately became interested in the electronic keyboard and started making sounds. A university student who was good at playing the piano sat next to the children and improvised accompaniment to her melody. Several other children gathered around her, and some gradually began learning how to play the piano. The three girls were fourth-grade students or older. The university students enjoyed playing together while teaching piano to children.

Meanwhile, the boys in the third to sixth grades, including K, brought out their iPads and began searching for various things. In recent years, it has become common for every child in Japanese elementary schools to have their own tablet device, such as an iPad, to participate in the classroom and learning activities. The third and fourth-grade students began independently practicing on a virtual piano, looking at a website that showed them how to play a song that the students played together at a school recital several months earlier.

K was also holding a tablet, searching for his favorite song, the theme song of the well-known animated series, "Space Battleship Yamato." The homeroom teacher told Dr. A that "Space Battleship Yamato" was K's favorite song. Dr. A immediately began playing part of the melody on the violin, after which K stopped touching the tablet and watched Dr. A. Since he did not know the song very well, Dr. A gradually improvised a different melody, and before he knew it, it had quickly changed into the theme song of "Lupin the Third." Dr. A laughed and said, "The Space Battle song disguised as the Lupine song," causing K to start laughing along with his friends.

The children started searching for their favorite songs on their own iPads. As soon as they found the links, the first and second graders repeatedly listened to the theme song of "Doraemon," a popular anime. They also found and began comparing different styles of performance and orchestration. In this case, the third and fourth graders were practicing their favorite songs using practice tools. As for the girl who was playing the electronic keyboard, she was also using a tablet to reproduce the sounds on the keyboard while looking at sheet music. Some also practiced the Doraemon songs that the first and second graders found. Meanwhile, the fifth- and sixth-grade boys searched for various violin performances, after which they showed Dr. A some performances by professional violinists. In some instances, Dr. A played the violin along with the music that the students found on the iPads and provided explanations.

Moreover, a fifth-grade female student, M, was absentmindedly and repeatedly playing a single rhythm on her violin, without paying attention to the activities. The rhythm was a combination of four sixteenth notes and two eighth notes, "takataka, tatta." Actually, the rhythm is used in the first step of the world-famous Suzuki method for violin studies. Dr. A said to M, "Wow, you're playing the rhythm very well," and went on to teach the rhythm to everyone to play as an ensemble. M gave a big nod to Dr. A's idea and continued to repeatedly practice the same rhythm. Dr. A improvised a sub-melody on the violin to accompany M's playing by using open strings, after which he had the ensemble perform the melody. M was surprised and happily told his homeroom teacher, "I made it!" Some students stopped their activities, listened to the ensemble, and gave them applause.

It was approximately 11:50. The classroom was filled with the sounds of each student practicing, including M repeatedly playing the same rhythm.

Meanwhile, K, who had been angry earlier, had completely relaxed and was sitting on a sofa in the back of the classroom, looking at a picture book. This book featured many pictures of ladders on the cover. Instead of reading the book, K began playing with the picture book and pretending that it was a ladder. Gradually, his movements escalated and he started waving the picture book around. Dr. A sat next to K (with a little distance between them) and started a conversation, asking things such as "Is your house nearby?" Dr. A also brought up the topic of picture books, saying, "the book looks interesting," after which they shared a lively yet relaxed conversation for a while. At the same time, the other children were busy playing their violins, practicing on the electronic keyboard, using their tablets, and listening to music.

Around 12 o'clock, M, who had been repeatedly playing the same rhythm, made eye contact with Dr. A. and asked, "Would you like to try playing together?" Dr. A grinned and nodded, and said, "Let's play the violin together!" Dr. A immediately approached the fifth- and sixth-grade students and asked, "Would you be willing to help out to form a little ensemble?" Then, Dr. A handed them violins and taught them the rhythm that M was playing. The university students also helped teach the rhythm. When the fifth and sixth graders played the rhythm together with Dr. A, like a small orchestra, the homeroom teacher applauded. Other students also joined and said "Wow!" Then, Dr. A stopped the entire activity and practiced the "takataka tata" rhythm by clapping his hands. After the students repeated Dr. A several times, he made the children walk and clap as he played the rhythm on his violin. When Dr. A confirmed that everyone had achieved the rhythm, he said, "Let's practice the violin and play the rhythm together!"

At 12:05, K began to circle the classroom, stopping occasionally to clap the newly acquired rhythm with Dr. A, before abruptly picking up the violin. He ran up to Dr. A and said, "Teach me that rhythm" with his intense eye gaze. M, who was nearby and still practicing the rhythm on her violin, played it for K and said, "This is it." K desperately asked M to play it multiple times, after which he grabbed a violin and began to imitate it himself. M said, "Oh yeah, K played it!" and the homeroom teacher who was watching the process said, "Wow!" and gave a big applause.

At 12:15, near the end of the class, everyone gathered around the electronic keyboard, each holding a violin, and were able to play the rhythm. The homeroom teacher, principal, and vice-principal all burst into applause. The performance was repeated one more time as an encore and the class ended in a state of joy.

4. Discussion

The following section describes the reflections of the two homeroom teachers (T1 and T2), the two university students (US1 and US 2), and Dr. A:

Was there anything unexpected, surprising, or noticed that was different from your usual classes or childcare settings?

T1: At first, I wondered what would happen if the children broke the instruments. However, Dr. A told the students at the beginning that it would be okay to touch the violins and play them freely. The students were able to effectively make sounds and learn from the session. They even took it upon themselves to apply some pine resin, even though it was an instrument that they did not regularly see. Overall, I got the impression that they learned three times as much as usual.

T2: I thought that it would be a mess, but I was surprised to find that the students were constantly engaged in the activities and started using the instruments and iPads. What is unique about my school is that the students are able to learn in such a manner, with the support of the teachers and university students.

US1: We were surprised that the students were doing totally different activities. However, each one was learning individually, instead of learning all at once.

US2: The classroom was divided into two to three spaces.

T2: Both individual assignments and collective activities are routinely incorporated. The special needs class includes more individual assignments than the so-called elementary school classes. Thus, I had the impression that it was somewhat similar to normal classes. However, it was close to my usual teaching style, and this was why I was able to adapt more smoothly.

Dr. A: Musicking's philosophy, regardless of whether you sing, dance, or even just listen as a part of your participation, has given me the confidence to build my own practice. No matter what the students chose to do, they were not judged, but their learning deepened and was gradually shared. In the end, I think a community was formed through

such music-making. I was happy to learn that the activities were similar to those in regular classes. Once again, I realized that musicking and special needs education have a high affinity.

Although K left, what were the factors that allowed him to return and become involved in the learning activities?

T1: I think the main thing was that when he came back, he did not get criticized nor did he receive any particular praise. I believe that this helped him gradually return to the learning activities.
T2: When he came back, everyone was engaged in their own activities and the music. Hence, he was able to calm down simply by watching them. If you say something like "It's good to see you back," it would have made him feel defensive and had a negative effect. I think everyone around me was aware of what happened, but I had gone to the bathroom and the class went on without interruption. I think he was also interested in the electronic keyboard and tablets. It was good to see everyone playing music, regardless of their differences.
US1: The teachers did not try to force K to return, but instead watched over him until he calmed down.
US2: When I returned, the atmosphere was the same as before I left.
Dr. A: Actually, I was thinking about how to involve K from the very beginning. I was worried and nervous when he left the room, but I was glad when he returned. In the end, when he said, "Teach me that rhythm," he clearly showed a desire to learn. I was glad that he could participate in the ensemble. This would not have been possible with a group teaching method such as the usual recorder method.

What was impressive about the interactions between the students in the different grade levels?

T1: A younger student asked an older one to borrow his violin bow. At first, he was unable to organize his feelings and lend the item. However, after the teacher spoke to him, he was able to organize his feelings and do so.
T2: The older students are usually able to take care of the younger ones; therefore, I think the interaction was as usual. As usual, although the older students had never played the violin before, they were learning normally and helping one another, which I thought was amazing. The flow of the class was similar to usual, and there was no need to listen to multiple explanations, practice over and over again, or listen to long songs, which created a relationship with learning. It was definitely different from a normal music class.
US1: It was impressive to see them helping one another and learning together.
US2: The sixth graders were all patient and supportive to the younger students.

Were any other things noticed?

US1: I liked how the students communicated by playing the violin and piano together. I noticed a lot of good things about the students and praised them. For example, there was one child who was playing the violin for a long time and gradually getting better.
US2: There was a child who continued to play the violin even when the other children were researching their favorite music. I felt that he had the ability to continue doing one thing for a long time.
Dr. A: The girl who continued to play the violin, the girl who diligently practiced the electronic keyboard, and the students who listened to music by searching for various things on their tablets: I think they all deeply learned about their specialized contents. I believe that by engaging in a musicking-like relationship, these seemingly different learning contents and personalities were perfectly harmonized, creating a great learning environment. To an extent, I took the lead as a teacher, but I realized that the majority of the activities were structured in dialogue, which is a prerequisite for musicking. I felt that we were able to share an interactive and deep learning experience that cannot be obtained in a so-called music class format where everyone learns the same content.

Overall, this application of musicking was successful in creating an inclusive learning environment. First, the musicking approach involved simply performing music without forcing the students to listen, inviting them to join the activity of listening. Second, the choices provided by the researchers offered students an opportunity to find the most suitable method of participation. In this regard, musicking encouraged the students to participate by offering multiple choices of activities.

Elliot,[33] in the realm of music education, used the term "Musicking" (with a capital M) to describe the broader characteristics of musicking as a multi-dimensional, inclusive, and reflective practice. Elliot[33] also argued that "there can be no such thing as a course or class called general music," and that "any kind of general or liberal education in music must always be a specialized music

education" (p. 56). Nevertheless, in Japan, music curricula in schools and preschools are considered as "general music," which emphasizes collective ensemble playing[16] In addition, in Japan, there is a critical issue in music education where the majority of the musical activities in schools rely on collective listening, singing, instrumental playing, and the creation of simple tunes based on textbooks.[16] The curriculum is also unified, such that every first grader learns the same tune on a melodeon while third graders and higher learn the recorder through collective instruction.[16]

This practice is especially problematic because large ensembles represent the vast majority of the music profession's resources and are often the most visible aspect of public music education, which goes beyond the field's utilitarian functionalism.[34] Meanwhile, instead of sharing the experience of learning among students and teachers, the teacher receives unilateral authority.[34] Conversely, in musicking, "such ideas held in common are about how people ought to relate to one another…" (p. 95). Thus, music is used as an act of community affirmation.[34]

As stated earlier, most of the musical activities in schools rely on collective listening, singing, instrumental playing, and the creation of simple tunes.[35] In this study, the practitioner-researcher and teachers were able to effectively share the new direction and strategies of musicking in which the students played music together.

By the end of the session, the children shared learning activities and played music together. The aforementioned narrative showed that "musicking-like" interactions between students and teachers can be effective for embodying *kyosei* and promoting a universal design.[16]

5. Conclusion

This study examined the use of musicking in a Japanese special needs classroom, focusing on its foundation and specifically emphasizing inclusion. The research approach employed in this study leveraged my extensive practical experience in musicking and narrative inquiry within the realm of music education. The study presented a co-constructed narrative illustrating my designed method of using musicking as a learning tool in a Japanese elementary school special needs classroom. This project also used multivocal ethnography to determine how co-constructing learning environments with teachers, students, and the practitioner-researcher through the art of musicking and creative communication allowed us to include all the participants.

From a sociological perspective, Frierson-Campbel[36] suggested that Small's theory of musicking is particularly suitable because of its focus on ideal relationships between infinite combinations of people, places, and sounds. Similarly, Golden[37] suggested that the characteristic function of musicking is its suitability for addressing the root causes of social and ecological problems by focusing on the active process of engaging and connecting with ourselves. This view was echoed by Lamb,[38] who insisted that music has always been cultivated and fostered in the relationship between people and society.[38] By synthesizing the reflections from the participants, this study offered insights into musicking, the intuitive nature of musical communication, and the transformative potential of my approach in achieving an inclusive musicking model.

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Conflict of interest

The author declares no conflicts of interest.

Author contributions

This is a single-authored article.

Ethics approval and consent to participate

This research was approved by the Institutional Review Board (IRB) of Ritsumeikan University, Japan: 衣笠-人-2023-36.

Consent for publication

Participants gave consent to publish their data in this study.

Availability of data

Data used in this work are available from the corresponding author upon reasonable request.

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Communicating the dialog between painting and music with a mobile application

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Abstract

Contemporary visual artists often collaborate with musicians and composers to enrich their artworks and provide multisensory viewing experiences by leveraging the power of digital technology. In this paper, we present our approach to follow in their footsteps by creating a mobile application that provides "mixed-media interpretations" for a variety of visual artworks and music pieces, spanning over different time eras, with the objective to reflect the creative dialog and multifaceted interaction between their creators through time. Targeting the broader public, we attempt to capture a variety of interconnections between works of visual arts and music that may be of interest and are comprehensible to people with varying levels of knowledge on art or music, including not only inspirational but also personal and social relationships among the artists. We provide a six-layered conceptual model to ease the description of the content produced to that end while reporting several concrete examples. Then, we focus on how to communicate and digitally mediate the intertwined and often intricate interconnections in a concise way, proposing a "three-act" story scheme to progressively display short narratives on screen, combined with music reproduction on the mobile device. Finally, we explore the potential of the proposed approach through a user study with 15 participants and report a series of promising key findings, whereas also discussing future directions and pointing out open issues.

Keywords: Art; Music; Cultural experience; Mobile devices; Digital technologies

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1. Introduction

The relationship between visual arts and music has been widely explored by artists, composers, and scholars, and several comparative theories and related typologies have been developed.[1,2] These theories are typically leveraged within the artistic circles for a variety of purposes. For instance, musicians who are non-experts in visual arts may use them as guides to understand an artwork, or even attempt to translate it into music, and *vice versa* for the artists.[1]

The long-lasting interaction between the two forms of art is also leveraged in music iconography,[3] a discipline within musicology that studies visual representations of musical topics (such as portraits of performers and composers, as well as musical scenes that depict instruments, occasions of music-making or performances), providing a rich source of information on musical practices of the past. Standing at the crossroads between history studies, art history, sociology, anthropology, and ethnomusicology,[4] research in music iconography fosters communication between experts in different fields, contributing valuable insights into the history of both music and visual arts.

However, what about the broader public? How can people who are non-experts in both arts be informed about this long-lasting and creative interchange between the two artistic communities? With the advent of digital technology, exhibition designers and contemporary artists often attempt to communicate this dialog by staging it as a multisensory experience. For instance, the art exhibition titled "No more shall we part" contained paintings of the Greek artist Stefanos Rokos[1] that were inspired by songs from the titular music album by "Nick Cave & The Bad Seeds," and its visitors were enabled to hear the corresponding song while viewing each painting (using earbuds).

Visual art and music appeal to different senses and cultivate diverse esthetic emotions,[5] while different emotional responses may be cultivated when experienced in a combined way. In this line, several contemporary artists, such as Serj Tankian, have been creating "mixed-media paintings", in the sense that each painting is meant to be "experienced" along with a music composition (which, in the case of Tankian, is created by himself). Hence, when the visitors to his art exhibition "Shapeshift: A Dynamic Dive Into Diversity"[2] were standing in front of a painting, they could point their mobile phones at the artwork and listen to the corresponding music piece.

Music influences various facets of human existence, impacting our perception, cognitive processes, and behavioral responses.[6] In museums, galleries, and heritage places, music and sounds are occasionally used to create an immersive environment. Studies show how the use of music in exhibitions creates positive emotions and strengthens memories,[7-9] increases visitors' learning and visit duration.[10] In addition, Chen and Tsai[11] conducted interviews with museum visitors who had heard various musical genres while visiting. The analysis of interview data demonstrated that background music at museums has both emotional and cognitive effects on visitor experience. In addition, a study conducted at the UCL Grant Museum of Zoology in London found that using sounds relevant to exhibits increased visitor interest, engagement, and participation.[12]

The integration of music as a vehicle to enhance visitor reflection has been a topic of interest in various fields including education, ethnomusicology, and sociology. Aaron[13] explored the potential of integrating music with core subjects in the educational setting, emphasizing the significance of music as a medium to facilitate learning and reflection in students. Research studies suggest that music could be a vital tool in enhancing cognitive processes and fostering a deeper connection with the subject matter, thereby increasing reflection and understanding,[13] across different cultures and societies.[14] Another study suggests that music serves as a technology that can facilitate mental well-being through the process of emotional reflection, thereby making individuals feel better and more connected to themselves.[15] Although not exclusively focused on music, research has suggested that narrative experiences can be seen as complementary to the reflective experiences induced by music.[16] Therefore, when music is interpreted alongside any other cultural practice,[17] it can be a potent tool in increasing visitor reflection across various domains.

It is worth noting that, apart from vision and hearing, recent museology advocates for multisensory museums[18,19] that rehabilitate additional senses in the visiting experience, including not only touch but also smell and taste in the interpretation of museum objects. A number of case studies have been developed in that direction,[20] demonstrating how to make sense of "the properties of things"[21] to design embodied interactions and move toward "sensory museology."[22]

This work focuses on the senses of vision and hearing, leveraging mobile devices: when users scan the image of a visual artwork, a related music piece starts playing on the device and short narratives are displayed on screen. In contrast to works that use sounds and other auditory resources to enrich the viewing experience of artworks, in our case, the music piece is a cultural item in its own right (*e.g.*, a music composition by Beethoven, the recording of a Maria Callas' performance, and so on), which is semantically related to the visual artwork on some level.

We present our approach to follow in the footsteps of contemporary artists and provide "mixed-media interpretations" for a variety of visual artworks and music pieces that span over different time eras, aiming to reflect the creative dialog and multifaceted interaction between their creators through time. The contribution of this work is twofold: (1) we present a methodology to create related

[1] https://stefanosrokos.gr/exhibitions/no-more-shall-we-part

[2] https://www.heaviestofart.com/post/in-conversation-with-serj-tankian

content and provide a layered conceptual model that can serve as a communication and analytical tool within multidisciplinary content creation teams, and (2) we report promising preliminary results from a qualitative user study with a mobile application, suggesting that the proposed spectrum of semantic relations between visual artworks and music songs may provide useful "bridges" between the two media, reflecting the long-standing dialog between the two artistic communities in an appealing and concise way.

2. Data and methods

We followed an explorative research methodology that involves three main steps:

(1) First, we organized a multidisciplinary focus group to collect a series of use cases that reflect varying relation types between the two forms of art. Then, we constructed a graph-based conceptual model to reflect the main entities involved, along with a range of potential relationships between them
(2) We defined a story structure that communicates the direct or indirect relations between the two works of art, by starting from the visual artwork and traversing the graph toward its musical counterpart. We accordingly shaped a set of 10 stories and entered them into a mobile app that supports the display of digital images and narrative sequences, along with audio player functionality
(3) Finally, we performed a qualitative user study with 15 participants and investigated their perception and interest over the provided cultural content and its narrative structure.

We describe each one of the aforementioned processes in detail, explaining how the outcomes of each step guided the following actions.

2.1. Identification of different connection types

We organized a multidisciplinary focus group with participants who have expertise in several different fields, including visual artists, musicians, a museum learning program designer, and art communication specialists, as well as digital cultural experience designers and an information technology expert. The group was first gathered and, after discussing the long-lasting relationship between visual artists and musicians, its members were asked to report a few examples that showcase any form of the relation between two concrete works of art, a painting, and a music song, providing a digital presentation of the artwork along with an audio file, as well as a short text explaining their connection. No constraint was set to that end; the group members were free to choose any type of artwork and were prompted to consider different types of relations, from close and direct connections, such as in the case of a music album's visual cover, to more indirect or even personal relations, such as the favorite painting of a music performer – an example mentioned by one of the group members during the discussion. The participants' input was gathered in a shared document for a period of 2 weeks, so all the group members had access to the content contributed so far. This procedure resulted in the collection of about 50 concrete examples, which depicted a variety of relations between works of art and music and served as a preliminary data corpus for the purposes of our analysis.

Following a bottom-up methodological approach, we studied the pool of reported examples and, being informed and inspired by existing comparative art theories,[1,2] we collaboratively created a conceptual model that systematically captures a variety of potential interconnections between visual artworks and music pieces, ranging from direct one-to-one relationships between them to more indirect interconnections among their creators and content.

2.2. Experience shaping to communicate multifaceted connections

The next issue we tackled relates to the communication of the identified relations to the broader public. Each connection involves at least four different entities, namely the visual artwork, the music song, and their respective creators. Considering that the recipient of the information will most likely not be aware of all the related entities, we devised a "three-act" story scheme that includes the following main parts: (1) one (or more) narrative about the visual artwork or/and its creator, (2) one (or more) describing the connection, and (3) one about the music or/and its creator or performer.

To investigate the communicative effects of the adopted approach, we accordingly created a set of stories about 10 pairs of artworks (with each pair including a painting image and a music song) and performed a user study with 15 participants. The content created was entered into ArtStory Beats, a mobile application that simultaneously provides audio-to-visual and narrative content. When the users point their device over a (physical or digital representation of a) visual artwork, the reproduction of the related audio file initiates, and a narrative flow is displayed over the mobile's screen (Figure 1).

Aiming to explore the participants' responses over the different relation types identified, we included stories from all six levels, while giving more emphasis on the personal level, since we posit that it is quite underexplored, and less on the morphological level, which is quite studied by art theorists, and it is more likely to be suited for people that already have an essential understanding of art or/and music forms.

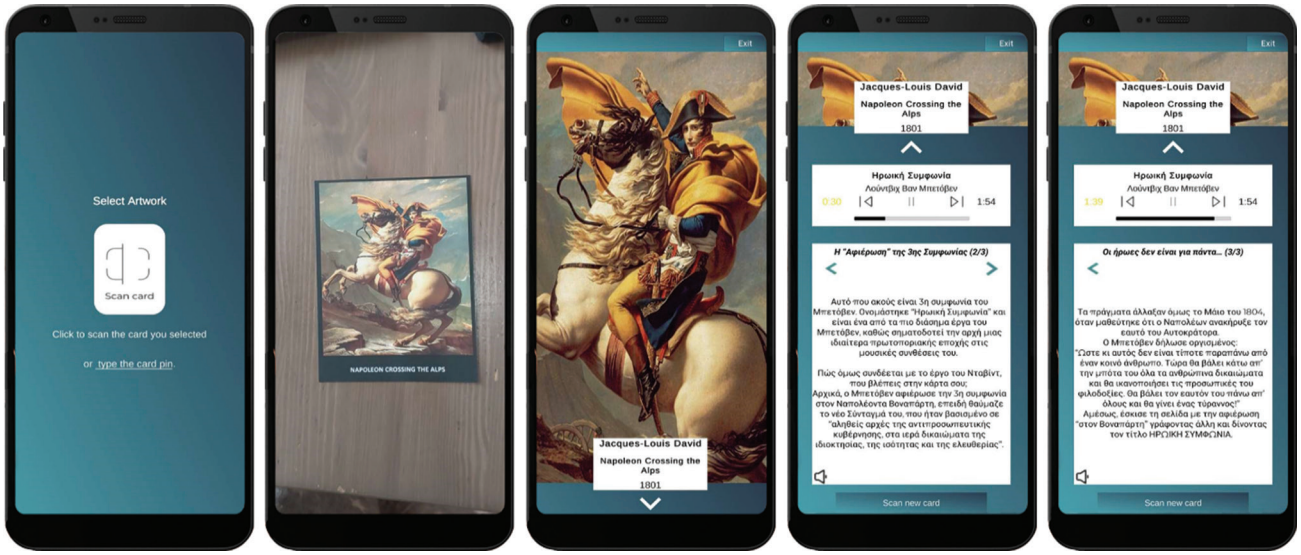

Figure 1. ArtStory Beats' screenshots depicting the main user flow. An Artwork Card is scanned and its digital image gets displayed along with a sequence of narratives, while related audio is playing. Image created by authors

2.3. User study procedure

We invited 15 adults to participate in the study, ensuring that they have varying levels of interest and prior knowledge of art and music. All participants had Greek nationality, with their ages ranging from 24 to 54 years (nine females and six males). The study included three main phases:

(1) One day before the appointment with each participant, the facilitator sent an information sheet describing the main purposes of the research.

(2) At the beginning of the meeting, the participants were informed that their interviews would be recorded and signed a consent form. Then, the participants proceeded to install a mobile app called ArtStory Beats on their personal devices and were provided with a digital file containing 10 "Artwork Cards" (one per slide). They were prompted to turn on the volume of their device and use the app to scan the Artwork Cards and explore the artworks' music-related stories. The facilitator instructed the participants to scan at least three visual artworks so that they could have a discussion over the related content afterward. The facilitator clarified that there was no need to go through the entire collection or explore the whole content offered by the app. The participants were guided to skip the parts they were not interested in, stop or volume down the music at any point they wished, and call the facilitator when they wanted to stop using the app.

(3) Upon completion, the facilitator conducted a structured interview with each participant. First, the facilitator asked the participants if they liked this experience and prompted them to describe three positive and three negative aspects. Then, the facilitator posed a series of questions related to their engagement with the provided cultural content (the related list of interview questions [IQs] is reported in Table 1). At the end, the facilitator initiated a discussion over the potential contexts of its use.

The main objective of IQ1, IQ2, IQ5, and IQ6 was to provoke participants' reflection and recall of specific content (Artwork Cards, stories, or/and music pieces), which would provide potential points of reference and further elaboration in the discussion concerning (1) their perception of the employed story structure (IQ7 and IQ8), (2) their understanding and preferences over the different types of connections uncovered (IQ3, IQ4, and IQ9), as well as (3) the effects these had on participants' experience (IQ10).

The video/audio recordings were transcribed and then analyzed using narrative and thematic content analysis methods.

3. Results

3.1. Layered conceptual model

The constructed model expands over six different levels and is visually depicted in Figure 2. Starting the description from its core, the "Experiential" and "Inspirational" layers directly capture the artists' perspective over the symbiotic and dialogic relation between the two forms of art.

The experiential level includes a series of "complementarity" connections between visual artworks

and music songs that have been defined by their creators when combining the two media into a final product (*e.g.*, a music album including a visual cover) or by shaping multimedia experiences that intrinsically intertwine one or multiple music pieces to imagery or paintings. Such

Table 1. List of interview questions

Interview questions
1. Which were your favorite stories?
2. Which were your least favorite stories?
3. What kind of relations between music and visual arts did you reveal?
4. What kind of connection between music and visual arts did you like the most/least and why?
5. Which Artwork Card gave the most esthetically pleasing result and why?
6. Which Artwork Card offered the most interesting anecdotal story?
7. Did you like the way the stories were structured?
8. Did you find something confusing?
9. Did you like that there were many different types of relations included in the set of artworks? Would you prefer the set to be somehow homogenous?
10. Did you feel that this experience made you understand deeper or somehow resonate with the artworks or their creators? If yes, in what ways?

relations may be "one-to-one," as in the case of Tankian's exhibition (described in the introduction section), "one-to-many," as in traditional music albums where a visual cover complements all the songs included in it, or "many-to-many," as in multimedia products and artistic performances. In all cases, the connection between the involved art pieces is strong and denotes that the two types of media complement each other and are meant to be experienced by the audience together.

On some occasions, visual artists and music composers explicitly tackle the dialogic relation between the two forms of art and state or implicitly denote their approach to draw transmedia inspirations in their artistic processes, uncovering directed, "one-to-one" relations between visual artworks and music songs. These connections are typically rather strong and may be encountered in both directions, that is, visual artists draw inspiration from music songs and music composers from artworks. For example, each painting included in the exhibition "No more shall we part" by Stefanos Rokos is perceived as "the visualization-with tangible consciousness" of a (vocal) music song included in the referenced music album. Going the other way

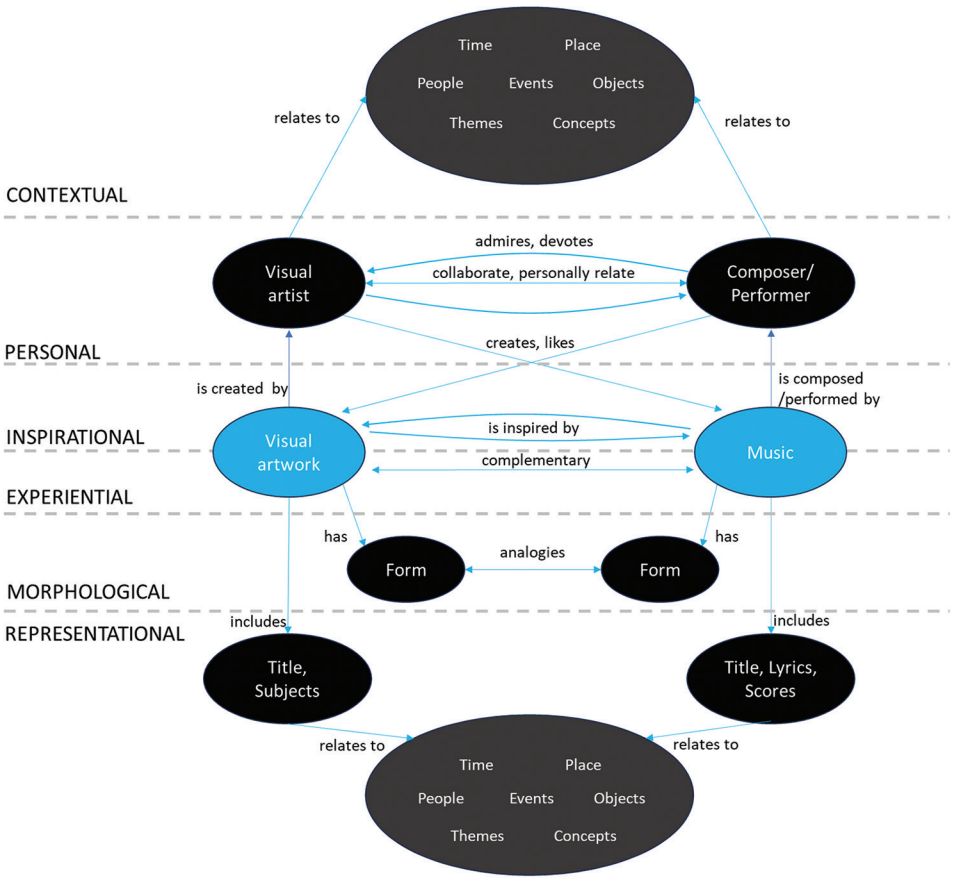

Figure 2. Proposed conceptual model. Image created by authors

around, the orchestral composition "La Mer" by Claude Debussy is said to have been inspired by "The Great Wave" by Katsushika Hokusai. Artists that master both arts may be moving both ways around (as Tankian does), getting inspiration from either visual or music pieces to transcend to the other medium.

The morphological level includes all aspects related to the forms and their structural attributes included within two works of art, visual, and music, which have been extensively analyzed and (more or less) compared by artists and scholars with the objective to define analogies between them, considering a variety of elements such as pitch and hue, colors and shapes, recurring patterns and so on. It is worth noting that such analogies have also been pursued by artists with synesthesia (*e.g.*, seeing colors when hearing sounds or listening to music, as Wassily Kandinsky did), often actively exploring the cooperation of the senses within their artistic processes and works.

The representational level includes semantic connections between the two forms of art based on the semantics of their content. For instance, the painting titled "The Music Lesson" by Henri Matisse (Figure 3) bears multiple connections to music on this level: it depicts a piano, as well as violin, and a music sheet with the name of the music composer HAYDN on top of the piano, while the word "music" is included in the painting's title. Furthermore, considering that this painting is a family portrait and Matisse was a violinist himself, one may suggest that this artwork is also connected to music on a personal level.

The personal level focuses on the creators of the artworks and may include a wide variety of relations between them, from admiration of one artist to another to personal relationships developed through their joint work or social life (*i.e.*, collaborations, conflicts, friendships, and so on). It also includes transmedia connections between artists and particular works of art, such as ownership or personal attitudes (likes or dislikes) toward a visual or musical piece. For instance, it is said that Debussy had a copy of "The Great Wave" hanging on the wall of his living room, while one of the most uncanny connection examples (offered by a focus-group participant) was between the soprano Maria Callas and the painting titled "La sacra famiglia" by Giambettino Cignaroli, which is said to have been gifted to her by her husband before her performance in "La Gioconda" and had always a place in her dressing room ever since. The personal level also encompasses the dual role that some artists may have, creating (or performing) both music and visual works of art (as was the case of Matisse).

Finally, the contextual level of the proposed model includes all aspects that may have an impact or influence on the artists' intellect, attitudes, and works, including time, place, social surroundings, as well as historical figures, events, *etc.* In this level, we particularly highlight Artistic movements, which, although typically defined in the context of one form of art (*e.g.*, in painting), often have a notable impact on multiple arts (ranging from architecture to literature or music). For instance, painter Diego Velázquez and composer Domenico Scarlatti are both connected to the Baroque style, so we decided to reflect this indirect connection by accompanying the viewing of "Las Meninas" (Figure 3) to the listening of "Sonata in D minor K. 9." In this case, the two pieces of art may not be directly connected, yet they provide tangible examples of Baroque's imprint on painting and music, offered in a combined way. We suggest that such connections may contribute a more holistic perspective on art movements and their wider influence on the artistic circles of each time period.

In the same line, we also wish to stress the role important historical figures may have over not only

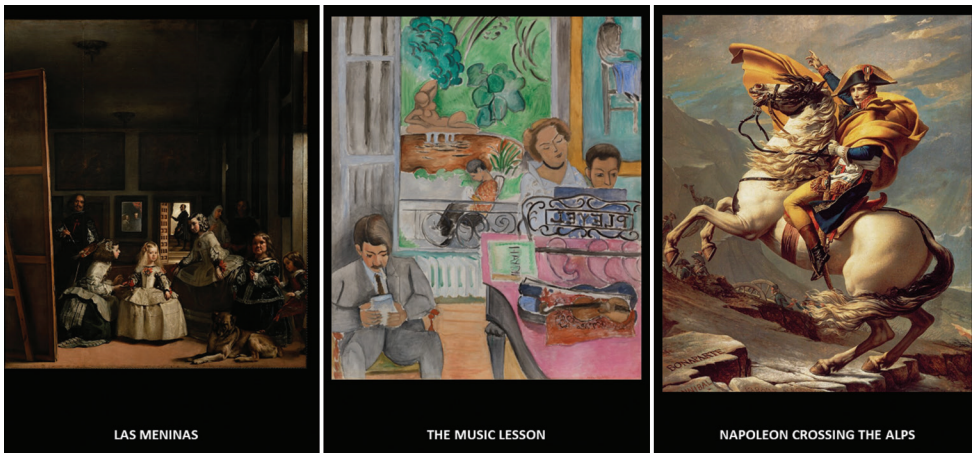

Figure 3. Artwork Cards depicting some of the paintings referenced inline, as used in the scope of the user study: a) Las Meninas, Diego Velázquez, 1656, b) The Music Lesson, Henri Matisse, 1917, c) Napoleon Crossing the Alps, Jacques-Louis David, 1801. Image created by authors

the contextual level but also the representational level, forming indirect connections between two concrete works of art, yet revealing rather interesting and multifaceted connections between the two artistic worlds. For example, painter Jacques-Louis David and composer Ludwig van Beethoven both strongly related to Napoleon Bonaparte, although in very different ways: the former having a personal relation with the historical figure and depicting him in a series of artworks, and the latter being inspired by his accomplishments, developing "the heroic style", and devoting him the "Eroica Symphony" (while later disappointed and scratched Napoleon's name from the score's title page). Thus, in this case, the historical figure depicted in a painting may provide "the story link" to contextually transcend from the world of visual arts to the world of music.

3.2. Perception of story structure

The three-act story structuring was well received (IQ7), and all participants stated that it was comprehensible and overall provided a good flow between the different topics covered. Some participants (P6, P10, and P11) commented they would probably wish to include an additional story part (focusing on the visual art "axis" of the proposed model) that would describe in more detail the subjects depicted within a painting (*i.e.*, over the representational level). Referencing the painting "Las Meninas," P10 gave some examples to that end: "*Who are those little ladies? Where are they and what are they doing there?*" The same Artwork Card was reported as an example of this issue by P6 and P11 when describing their least favorite stories (IQ2).

The majority of participants (14 out of 15) stated not to have been confused at any point (IQ8), whereas one participant mentioned that he was slightly confused when exploring the narratives of the Artwork Card "The Music Lesson," which included multiple different connections. The participant had indicated this story as his least favorite one (IQ2) and, when discussing the three-act story structuring scheme that was overall followed in the offered stories (IQ7), the participant pointed out "The Music Lesson" and commented that the story structure seemed different and confusing in that case (IQ8), saying: "*At the beginning it talked about the artist's family in the painting, the strong role of music in his household, then about his self-representation through the violin, I was checking them out on the painting image, so far so good. But then it switched to the composer and talked about him. It felt kind of abrupt there, maybe that was too much, it did not have as good flow as the rest did*" (P9).

It is also worth noting that, while reflecting on the employed story structure (IQ7), one participant (P12) strongly took on a dramaturgy stand and, perceiving the connection between the two forms of art as the story's climax, proposed to maybe keep it for the final act instead, providing a kind of resolution to the "Big Question" raised, that is, "How are the two pieces of art related?"

3.3. Perception of connection types

Regarding the different types of connections conveyed (IQ3), the participants expressed varying preferences (IQ4), referencing several examples (summarized in Table 2).

The majority (13 participants) commented that each connection type has its own merit and value, noting slight preferences for some connection types over others, whereas two participants expressed very low interest in the ownership relationship – it was captured through the example of Maria Callas and the painting "La Sacra Famiglia." Both participants commented that this connection is "too personal" and has no wider impact or significance, as the rest of the relations uncovered.

On the other hand, two participants highlighted the Artwork Card depicting "La Sacra Famiglia" as the one with the most interesting anecdotal story (IQ6) and included it in their favorites (IQ1). "*By looking at this painting, I did not expect it to be connected to Callas, I was really surprised to find it out*," commented P1, whereas several other participants made positive references to the feeling of being surprised with respect to this connection, during the interview.

Regarding the connection between works of visual arts and music through the same art movement (as it was manifested in the collection of cards with the painting "Las Meninas" described above), several participants pointed it out as the least interesting connection type, negatively characterizing it as "loose," "indirect," or "abstract."

However, taking an opposite stand, three participants pointed out this Artwork Card as the one that gave the most esthetically pleasing result (IQ5), reporting the combination of its visual and sound as a considerable added value for their viewing experience, and highlighting the perceived complementarity between the two pieces:

Table 2. Participants attitudes toward the examined connection types

Attitude	Connection type (attribute)	#Participants
Liked the most	Personal (direct)	5
	Inspirational and artistic influence	4
	Art movement (complementarity)	3
	Relation to a historical figure	4
Liked the least	Art movement (indirect)	4
	Ownership (narrow)	2

> "*It just looks Baroque and sounds Baroque, it is so representative of the style's esthetics. It is not just an interpretation, it is Baroque over both senses.*" (P8)
> "*With the music, the painting got alive!*" (P3)
> "*The music makes you feel immersed in the painting's "stage," as in the movies.*" (P15)

The sense of complementarity between visual and music content was particularly appreciated by P15, indicating "Las Meninas" as the most favored story (IQ1) due to this aspect. In the same direction, P8 proactively elaborated on this topic at the beginning of the interview, highlighting it as one of the main positive aspects of her experience. Before going through the IQs, P8 took the initiative to propose the creation of thematic sets (of Artwork Cards) based exclusively on art movements, suggesting that they would support her to explore Baroque (or impressionism, cubism, among others) in an experiential and constructive rather than theoretical way, that is, through a series of multisensory examples.

Examining the stories that were indicated as participants' favorites (IQ1) we observe that several participants reported high interest in Andy Warhol's cover for the album "Velvet Underground and Nico," often particularly referencing the part talking about the legal conflict over copyright issues (IQ6). Some participants particularly appreciated the story of the visual artist drawing inspiration from contemporary music songs, whereas others pointed out the story relating David and Beethoven through Napoleon: "*I knew the artists and when about they lived, but I hadn't really placed them 'together' chronologically, I hadn't thought that they shared common references and context*," commented P5.

In the question investigating participants' response to the diversity of connections included within the employed set of Artwork Cards (IQ9), most participants (13 participants) stated to have strongly appreciated the variety, either highlighting it as a positive aspect or expressing concerns about the effects that a "homogenous" collection could potentially have. Some indicative comments on that matter are the following:

> "*I liked it a lot that the artworks and their music-connections were so different, it was like a huge range of potential relationships was revealed to me, which is not obvious at all, it was not about just one kind or connection—painter to musician, or art movement—it covered many different aspects, and that was so eye-opening. I had it in mind, to some extent, but it took 'flesh and bones,' with all those different stories I had no idea about!*" (P5)
> "*If there were intricate stories about all (visual) artworks, such as the one with the Banana cover, then I would like it, even if they had the same type of connection, but if they were all like Baroque, then no, I would be bored.*" (P7)
> "*I would be interested in collections that are based entirely on art movements, but I would like it to include many art movements, not just artworks from the same one.*" (P6)
> *"Maybe it would be boring if they all had the same type of connection… I liked that I did not know what to expect next." (P11)*

In a different vein, one participant (P1) pointed out the lack of Greek music songs in the employed set, commenting that even the Artwork Cards depicting works of Greek visual artists were connected to foreign music. The participant stated that she would like to have a few Greek songs by well-known composers added in the set, offering concrete examples, and suggesting that their inclusion would benefit her overall experience, by better enabling her to personally relate, and thus engage, with the offered music content.

Finally, by investigating the effects of participants' experience with respect to achieving a deeper understanding of the artworks or resonating with the artists (IQ10), we observe that participants' related responses referenced mainly the "inspirational" connections uncovered in the employed set of Artwork Cards, often explicitly mentioning the artists' names and reporting emotional resonance:

> "*Rokos' artwork is in a way 'explained' by the song, the song explains to you how the artwork was done. I had seen the artwork in the past, but it didn't strike me, I did not clearly remember it. Now that I've heard it along with the music song, and read some of its lyrics, I definitely got more into it. I'd say you really have to be listening to the music when you look at this artwork.*" (P12)
> "*I felt that the music got me into the head of the person who was painting it.*" (P8)
> "*By just looking at the painting I saw flowers, something like a garden, a joyful picture. But with the song and the lyrics, you realize that's not the case… The music bears emotions, I felt his pain.*" (P4)
> *"Seeing or listening to the artwork that inspired another artwork is very interesting. It brings you closer to the artist, to how he felt." (P2)*

3.4. User satisfaction and context of use

All participants, independent of their prior knowledge or interest in art, stated that it was a pleasant experience and their knowledge was enriched. Discussing its contextualization as a casual activity that takes place in everyday environments, for example, from the ease of their home, by scanning sets of physical Artwork Cards (that

they have somehow been provided with), some participants framed it as a fun, social experience to be shared with their families and friends. Two participants particularly commented on the physical aspect of the described hybrid experience, expressing the desire to obtain many "collection packs" – similar to the extensions of board games. In a different vein, many participants enthusiastically suggested its use within the cultural environment of art museums, providing a music-oriented alternative to traditional "audio-guides." Table 3 summarizes the main user study results reported above.

4. Discussion

The user study results indicate that the dialogue between the two arts, painting, and music, may provide an appealing topic for communication, as well as a promising medium to cultivate the public's engagement with visual artworks and to promote learning within formal and informal environments.

Apart from technical, contextual, and representational narratives that are typically offered in fine art museums, one may create cultural experiences with stories that convey more inspirational as well as personal connections between the two artistic communities, reflecting their vibrant interaction. Although varying preferences were reported over the stories' content and the connection types they manifested over music, we observe that the participants overall appreciated the wealth and diversity of connections revealed between the two forms of art.

Table 3. Summary of main user study results.

Perception of story structure
• Three-act story structuring well received overall: comprehensible, good flow between topics • Request for an additional story part focusing on the painting's content • Proposal to reveal connection at the last part of the story, perceiving it as the story's climax.
Perception of connection types
• Varying preferences, consensus that each connection type has its own merit and value • Contradicting strong attitudes in two cases: a) Ownership relations as "too personal, no wider impact, insignificant" for some, versus "interesting and surprising" for others, b) Art Movement relations as "loose, indirect, abstract" for some, versus "complementary, multi-sensory" for others. • Integration of different connection types within a single set was a positive aspect • Inspirational connections afford deeper understanding and resonance with the artists.
Perception of cultural experience
• Pleasant and informative experience for all participants • Contextualized as an informal leisure activity or "audio-guide" alternative for on-site visits.

Considering also the positive references to elements of surprise and climax, we suggest that the wide spectrum of personal relations and collaborations developed between the two artistic communities provides a path that needs to be further explored for content creation purposes.

Based on the participants' detailed remarks related to deeper understanding, inspirational, one-to-one connections between artworks and music seem to be the most promising ones to that end, fostering stronger emotional responses and cultivating resonance with the artists. We suggest giving particular emphasis on such connection types and attempting to integrate them into the design of related content development activities.

Furthermore, focusing on the "got alive," "staging/movie" remarks made in the case of "Las Meninas" painting, we propose that the digital medium may provide a valuable tool for cultural content communicators, enabling them to create a novel form of "mixed-media interpretations," following the paradigm of "mixed-media paintings" that are now created by contemporary artists. According to the participants' suggestion, such mixed-media interpretations may be offered on-site, providing audio-enriched experiences while viewing the exhibited artworks in the museum's cultural environment. They may also take place in casual environments, as leisure activities, leveraging physical printed cards that resemble traditional postcards. In this case, the physical cards may depict a variety of visual artworks, while at the same time providing digital access to their "music world" and its related stories.

The creation of the proposed content is an inherently multidisciplinary process and includes several key tasks, such as: (1) identifying which visual artworks and music to use together, (2) obtaining and processing their digital representations, (3) creating a compelling story flow to describe all the aspects covered in the connection between the two pieces of art, and (4) uploading the content onto a digital platform (so as to be finally accessible by the users of the mobile app).

Focusing on the first task, as explained through the description of the conceptual model we created (along with specific use cases), there is not just one way to go. Aspiring content creators have many options here, from focusing on direct, one-to-one relations between two concrete pieces of work (visual and music), to leveraging more abstract or indirect relations, as with art movements and historical figures. We suggest that the proposed conceptual model may serve not only a useful communication but also an analytical tool to that end, establishing simple terminology and a shared visual reference for all the involved parties.

In addition, the proposed conceptual model may pave the way toward the design of data models and information management systems that will support content creators in various steps of the described process, from automatic identification and recommendation of such music-visual artwork pairs (based on their registered meta-data) to retrieval and processing of related digital files.

An important aspect not covered in this work relates to the tailoring of content (*i.e.*, selected visual artworks and music songs) to the characteristics of different target groups. In the reported user study all participants were Greek, that is, had the same nationality, so the set of Artwork Cards that we shaped was accordingly European-focused, while ensuring that a few Greek visual artists were also represented. The effects of this choice were not examined in the study, yet a related participant's comment has been reported, highlighting the under-representation of Greek music in the devised set. Cultural attributes and personal preferences may raise different user expectations and additional studies are needed to explore how such aspects may be effectively considered within the content creation process.

Finally, it is important to point out that, in the mobile-based flow of user actions presented in this paper, the visual artworks essentially provide the "entry points" to the digital experience, thus always transcending from visual arts to music. What are the implications of this order? Does it make the role of the artwork more prominent with respect to the music piece's? Would it make sense to go the other way around and scan music, as done with famous music discovery applications such as Shazam, to display stories about related visual artworks? Moreover, in what contexts? These are some issues that we plan to investigate further in our future work.

5. Conclusion

In this paper, we present our exploratory research work on the communication of the open dialogue between visual artists and musicians to a "broader audience," that is, requiring no particular interest or knowledge of the related art fields. We describe the content creation approach we followed and present a six-layered conceptual model that captures the various related entities along with the relationships considered, showcasing its use as a communication and analytical tool.

Aiming to investigate the communicative effects of the proposed approach and explore the potential user responses over the different connections we identified between music and visual artworks, we performed a qualitative user study with 15 participants. The preliminary results seem promising, indicating that this path warrants further investigations with a focus on content creation processes.

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Conflict of interest

The authors declare they have no competing interests.

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Writing – original draft: Maria Vayanou, Angeliki Antoniou
Writing – review & editing: Maria Vayanou, Angeliki Chrysanthi, Angeliki Antoniou

Ethics approval and consent to participate

The study has been approved by the Ethics Committee of the Department of Informatics and Telecommunication of the National and Kapodistrian University of Athens (approval ID: DIT_231120_01). Informed consent was obtained from all subjects involved in the study.

Consent for publication

Informed consent for publication was obtained from all subjects involved in the study (some participants opted not to have their photographs displayed on any publication or dissemination materials, and their photographs are not displayed in this manuscript).

Availability of data

The data presented in this study are available on request from the corresponding author. The data are not publicly available because they include mainly the participants' perspectives and opinions and the participants do not feel comfortable to release the data on the public platform.

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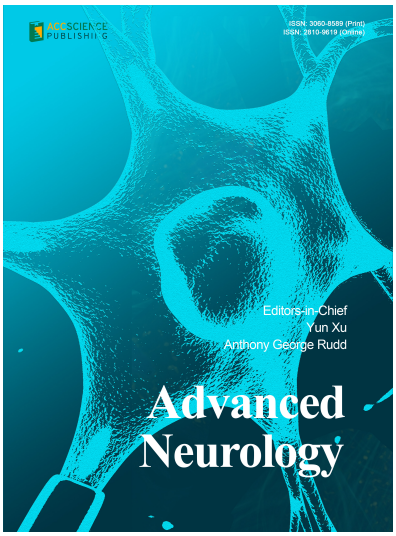

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