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Digital Horizons of Museums

Crossing Boundaries of Education and Practice

Edited by Ladislav Župčán



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Meet the editor



Ladislav Župčán, Ph.D., is a visionary educational consultant and researcher whose work redefines how history and culture are taught and experienced. At the Center for Children and Family in Nitra, he leads innovative educational programs that foster creativity, inclusivity, and critical thinking. As an expert in history teaching methodologies at the National Institute of Education and Youth, he designs forward-looking strategies that modernize curricula and inspire meaningful engagement with the past. Educated at Constantine the Philosopher University in Nitra, he has dedicated over 18 years to bridging the fields of history, museology, and digital technologies. His interdisciplinary approach transforms museums and classrooms into dynamic spaces where tradition meets innovation, making learning both accessible and impactful.

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Preface

The volume *Digital Horizons of Museums – Crossing Boundaries of Education and Practice* emerges at a moment when cultural institutions worldwide are redefining their missions, audiences, and modes of engagement. Museums today are no longer conceived solely as repositories of heritage and custodians of memory. They increasingly serve as dynamic spaces of communication, education, and co-creation, shaped by digital transformation and societal change. This edited collection provides an interdisciplinary lens through which the contemporary challenges and opportunities of museums can be understood, with particular emphasis on the intersections between educational practice and professional innovation.

The chapters gathered in this volume address both theoretical foundations and applied perspectives. The opening contributions introduce the conceptual frameworks of digital museology, presenting how technological advancements have expanded the horizons of museum work. Readers are guided through discussions that illuminate how digital tools alter the very definition of museum audiences, their expectations, and the strategies institutions adopt in response. These perspectives highlight that the digital turn is not a peripheral addition to the museum, but a central element in shaping its identity in the twenty-first century.

Subsequent chapters move towards the practical implementation of these ideas. Educational programs within museums are examined in relation to digital mediation, participatory learning, and inclusive access. Special attention is devoted to how digital platforms can create meaningful connections between museums and communities, offering novel forms of storytelling and interpretation. The contributions demonstrate that digital innovation does not replace the physical encounter with collections, but rather enriches it by layering multiple channels of engagement.

Another important dimension of the book lies in the exploration of professional practice. Several chapters illustrate how museum staff develop new competencies in curatorship, communication, and pedagogical outreach. Case studies from diverse institutions reveal both successful strategies and the obstacles encountered when integrating digital infrastructures. These experiences underline the fact that technology adoption must be accompanied by organizational change, collaborative planning, and critical reflection on ethical issues.

The concluding sections of the volume point toward the future trajectories of museums as learning organizations. They highlight the need for stronger partnerships among academia, practitioners, and policymakers to bridge the gaps between theoretical debate and institutional reality. In doing so, the book emphasizes that digital horizons are not fixed endpoints but evolving frontiers, requiring continuous dialogue and experimentation.

We trust that this edited collection will be of interest not only to museum professionals and educators, but also to researchers, students, and decision-makers who seek to better understand the role of cultural institutions in contemporary society. By crossing boundaries of education and practice, the volume aspires to contribute to a more inclusive, responsive, and innovative museum landscape.

We extend our gratitude to all authors for their valuable contributions and for their commitment to advancing discourse in this field. We also wish to acknowledge the reviewers and advisors who supported the editorial process with their expertise and constructive feedback. Finally, our thanks go to the publishing team for their professional guidance throughout the preparation of this volume.

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Section 1

Museum Education

Perspective Chapter: Digital Pedagogies and Preschool Museum Education

Despina Kalessopoulou and Sofia Trouli

Abstract

This chapter examines the intersection of preschool education, museums, and digital technologies, with a focus on the Greek context. As museums increasingly turn to digital platforms, early childhood educators are presented with new opportunities—and challenges—for integrating cultural content into age-appropriate learning experiences. Grounded in constructivist and multimodal learning theories, the study explores how digital tools can support young children's engagement with cultural heritage both within and beyond the preschool center. A review of international literature highlights the value of museum experiences in early childhood learning, followed by a critical appraisal of developmentally appropriate digital engagement in the museum context. In Greece, however, digital literacy in early education is unevenly addressed, and collaborations between museums and preschools are still limited in scope. An analysis of digital offerings from major Greek museum websites reveals a significant gap in preschool-specific, play-based digital resources. Drawing on our university courses for future early childhood educators, the chapter presents practice-informed approaches for the creation of digital educational content to enrich the museum experience onsite and remote. Challenges—such as limited access to infrastructure, pedagogical concerns over screen time, insufficient training and minimal educator input in content design—are discussed in the light of emerging digital technologies. The chapter concludes with recommendations for museums to co-design digital experiences and to improve their digital offerings for preschoolers, either by integrating digital tools into early-childhood programmes or by facilitating cultural heritage learning through digitally enhanced resources in preschool settings that promote active exploration, multimodal learning, play, collaborative inquiry and creative expression.

Keywords: early childhood digital pedagogies, museum education, digital cultural heritage learning, preschool pedagogy, digital museum literacy

1. Introduction

Digital pedagogies are an all-encompassing term for the strategies and methods of intentionally integrating digital technologies to enhance educational experiences in

different kinds of settings. It cannot be confined to the simple use of digital technologies to facilitate teaching, but it is connected with a vast array of pedagogical practices that transform the learning environment to a more learner-oriented, collaborative, play- and inquiry-based learning experience [1, 2].

As technology becomes ubiquitous in every aspect of life, the integration of digital activities in museum educational services is proliferating, especially after the boost given by the COVID-19 pandemic. Museums and heritage sites, for example, provide blended learning that combine online and onsite activities to prepare and extend engagement with the collections [3, 4]; gamified experiences, such as themed digital scavenger hunts for the location of artifacts and information, sometimes combining AR elements [5–7]; interactive storytelling that combines personalized elements [8] or collaborative dialogic activities that may utilize decision points leading to alternative endings and a rule-based bot acting as a dialog facilitator [9, 10]. However, most of them are targeted to adults, adolescents or children in middle childhood.

Considering the scarcity of relevant publications for young children, the present paper will examine preschool museum education and the ways in which digital tools can enrich young visitors' learning experience and agency in the museum. The first section will outline common features of preschool pedagogy in museums and explore how technological resources are currently transforming the field of early childhood education. The second section will turn to the Greek context, offering examples of museum-based practices, and a review of the digital initiatives of major museums and their relevance to young audiences. The section will also share applied strategies with prospective early childhood educators that enable the smooth integration of digital approaches in museum-related activities. The chapter will conclude with a critical discussion and recommendations for this rapidly evolving area of theory and practice.

2. Preschool education in the postdigital museum

Digital technologies are so thoroughly embedded in almost every aspect of our cultural practices that scholars suggest we now inhabit a postdigital condition, in which the distinction between the “digital” and the “non-digital” is losing its relevance [11, 12]. Postdigital practices have porous boundaries and form co-constitutive relationships, in the sense that technology is not just a tool we use and may affect us in a positive or negative way, but shapes our way of becoming in this world, allowing hybrid connections to emerge among spaces, humans, digital and non-digital entities [13, 14]. Edwards eloquently outlines how the evolution of technologies and accompanying attitudes towards them has changed over time in relation to early childhood education and care (ECEC) [15]. Beginning in the 1980s, when desktop computers started spreading in households and concerns arose that they might distract from the traditional values of hands-on, play-based learning in ECEC, Edwards notes that the advent of touchscreen technologies from 2010 onwards revolutionized the ways in which young children, including infants, are able to interact with the digital landscape, which soon became populated with digital content, apps and games designed for the early years. Digital play was acknowledged as a new form of play, affording all types of play found in traditional forms [16] and has become the focus of scholarly research worldwide, with growing attention to children under 3 years old [17–20]. The proliferation of the Internet led to the introduction of Internet-connected Toys (Internet of Toys), making the screen redundant in some cases and blurring digital and physical play [21, 22], thus leading to converged or connected forms [23, 24].

As a consequence, “digital technologies, once considered largely optional in ECEC, became, at the very least, a required curriculum area” [15, p. 783] and new areas, such as AI literacy, are being researched to get integrated in the curriculum [25, 26]. Edwards argues that we are currently in the third generation thinking about young children and technologies, where the postdigital condition requires a necessary response by those concerned with ECEC in terms of providing equity of access, online safety and privacy, support of young children’s learning using networked technologies “designed for best effect” ([15], p. 784) and “a shift in focus to better understand how children are located and participate in digital networks” in research ([15], p. 792).

Where does preschool museum education stand in this “messy” and “entangled” postdigital world ([14], p. 139, 153) that young children experience in many parts of the world since their birth [27]? Museums are widely acknowledged as valuable resources for early childhood learners, who are in a sensitive period of brain development with lasting implications on learning and positive self-identity [28, 29]. Museums can support multiple domains of early childhood development and learning, such as concept formation, language and literacy, critical and creative thinking, artistic expression, social skills, emotional growth, multicultural awareness and STEM competences [30–33]. Play, multisensory, embodied and inquiry-based exploration, arts- and object-based learning, storytelling and creative expression are among the most popular methods used in museum preschool education worldwide [34–38]. Systematic literature reviews reveal that the early years are not a frequent focus of study [39–42]. Moreover, young children receive comparatively less attention in museums’ educational offerings than older children [43, 44]. In particular, children under 3 years of age have only recently been acknowledged as a distinct target group [45]. However, over the past 10 years, a group of international researchers has generated innovative research on this age group, by adopting a posthumanistic research paradigm [46–48]. Movement and other embodied intra-actions with human and non-human entities came to the fore, highlighting the power of distributed agency and emphasizing that young children are capable of enjoying the museum on their own terms which may differ from those of adults. An important contribution of this line of research is that it posits that children should not be regarded solely as little learners in the museum but celebrated as equitable contributors to shared narratives in enabling environments, where “mutable concepts of personhood” emerge ([49], p. 524).

Children’s agency is also recognized and empowered in other pioneering examples of museum programmes designed for the early years. Cultural residencies that extend the engagement of young children in museums and heritage sites [50, 51], as well as ECEC centers operating within museums and exploring the use of learning stories and boundary objects to connect classroom practices with museum collections [52, 53], represent initiatives that emphasize young children’s competence as meaning-makers when given the space and tools to express their views of the world beyond strictly verbal ways. In line with this aim, multimodal expression and multiliteracies are adopted as approaches that empower young visitors to negotiate and present the nuances of their museum experience in various modes—linguistic, visual, auditory, spatial and gestural—and are recognized as effective strategies for museum pedagogy [54–56]. Digital literacy is an important dimension of multiliteracies, a concept originally introduced as a response “to the evolving communication landscape in the context of globalization and technological advancements” ([57], p. 131). Nevertheless, its application in the museum environment for preschool children usually incorporates low-tech tools and practices [58]. Reggio-inspired pedagogy, with its innovative approach to integrate digital technology into the range of media available

to preschool children for co-constructing knowledge about their social world [59], has also influenced practices in museums. Yet, digital technologies are more often referred to as resources available for remote access to museum collections or as preparatory educational materials [60]. Reggio methods regarding digital creativity seem more appropriately incorporated in some innovative exhibitions developed for young children, such as LightPlay at Ipswich Gallery in Australia [61]. For example, a series of overhead and webcam projections or light table workstations were readily available to young visitors, inviting them to explore key concepts related to light, such as translucency, opacity and shadow, and to create works of art through playful engagement with light.

Multiliteracies pedagogy has significant overlaps with constructivism [59], as both actively support children's meaning-making. Constructivist and sociocultural approaches to learning are, in fact, the dominant theories underpinning most museum educational practices [47, 62, 63]. In this context, the importance of scaffolding by knowledgeable adults or peers is widely recognized as an effective strategy for children's learning in museums [64]. Technology appears to provide support in this direction; however, research has focused on older children [39]. For younger children, museums tend to emphasize hands-on learning with real objects rather than digital counterparts. As noted earlier, children are more likely to encounter digital features in the context of interactive exhibits [65]. For example, Mou et al. discussed the use of slowmotion, a video-based medium that allows for the co-creation of stop-motion animation in a simplified form accompanied by narration, in the context of a purpose-built exhibit of a science museum [66]. The goal of the intervention was to improve story comprehension and learning intention to children 4–7 years old ($N = 317$). Effective and successful digital elements in museum exhibits for preschoolers always incorporate a high degree of embodied performance and open-ended outcomes, as was the case with the Captube system in the aforementioned exhibit in Taiwan that captured children's actions and presented them in slowmotion format at different speeds.

A few papers of academic researchers in collaboration with early childhood groups have been published so far, considering the use of digital technologies for children under the age of 6 years while interacting with various museum exhibits¹. Dardanou explored in a micro-ethnographic study how digital devices used by children 4–5 years old ($N = 12$) in museum visits in Norway enabled them to materialize their embodied wayfaring in the museum through photographs and drawings and to produce a digital story in the classroom that used this visual content. In this way, children as digital wayfarers created “their own lines of movement back to the museum and back to their experiences”, leading to a “contextual meaning making of museum as a place” of their own ([67], p. 357). Performativity and co-creation lie also at the heart of another museum-based research initiative in Sweden [68]. A group of 5 children, 4.5–6.5 years old, collaborated with 15 postgraduate science students to co-design digital musical instruments with the use of vocal sketching (combining action and sonic feedback), along with other modalities, such as drawing and gestures. The instruments, created by the students, often incorporated sounds from everyday interactions suggested by the children, thereby extending the notion of what a musical instrument could be. They were exhibited at the Swedish Museum of Performing

¹ A comprehensive literature search was carried out in ERIC and SCOPUS, as well as the Summon Discovery Service of the National and Kapodistrian University of Athens, using the search string “museum” OR “museum education” AND “preschool” OR “early childhood” AND “digital”.

Arts, where the participating children also had the opportunity to perform them. The article provides a complex and thought-provoking example of digitally supported co-design that fosters intergenerational communication, creativity and a sense of ownership in the museum.

Intergenerational multimodal learning was at the heart of an 8-week research intervention at a Science and Discovery Children's Museum in Australia, which explored how 85 children 5–9 years old, alongside their significant adults, engaged with STEM concepts and literacy practices across physical and digital contexts [69]. The study explored multimodal literacy, including computational thinking (CT) as a literacy practice through decomposition, pattern recognition and algorithmic reasoning. Findings affirmed that transmedia learning can extend significantly STEM engagement and link home-based activities to museum visits with the use of a low-resource transmedia approach to ensure equitable access for all families. Flexibility in the way families opted to engage with the digital content or the physical activities available weekly was also considered an asset, enabling broader participation. The activity pages containing prompts for science exploration at home were co-developed with the museum's creative team and science communicators, and included STEM narratives, curated media from YouTube, TikTok, Instagram, podcasts and animated GIFs, activity instruction videos (providing also scaffolding strategies for adults) and CT challenges. A moderated Facebook group was also used to encourage participants to document and share experience. The intervention, conceived as a cyclical process (home activities as an introduction to specific museum exhibitions-museum visit-home activities to extend and reinforce prior learning), provides an interesting and effective model of digital museum pedagogy, which takes advantage of blended learning to enable “multidirectional engagement between home and museum settings” ([69], p. 10).

As the postdigital museum is already a reality with a range of digital media available for normative use inside the institution [70] and the blending of physical and digital spaces, a recent study in Belgium focused on museum educators' views on digital museum education [71]. Museum educators acknowledge the potential of digital museum education services to enhance visitor engagement, attract new audiences and extend the museum experience beyond the physical visit. Online resources are frequently developed for school use and complementary tools provide additional layers of information and different ways of engaging with the museum collections, as we have already seen [69]. Nevertheless, museum educators identify several challenges, including their lack of up-to-date digital skills, time and budget constraints, privacy and access barriers for the visitors and the fact that digital tools are often not efficiently designed to meet the needs of certain target groups. The study calls for critical reflection on digital practices and the pedagogies involved to address the key factors that would facilitate the “structural embedding of digital museum education in the museum offerings” ([71], p. 411).

Museum educators' knowledge and viewpoints for infants and preschoolers are also crucial for advancing practice. Research on the perspectives of early childhood teachers and museum facilitators on the delivery of museum programmes shows that, for this age group, practitioners' capacity to engage young children with the content is valued more highly than content expertise alone [72]. However, museum “facilitators are not trained teachers” ([72], p. 106) and their knowledge of the early years is often limited and primarily empirical. This poses a significant challenge to developing expertise, particularly on cutting-edge issues concerning the integration of digital tools in ECEC. The challenge is compounded by the fact that their professional

routines may cover a very broad range, including aspects of collection management, exhibition development, and communication [73]. Specialized training and collaboration with experts are essential in this area.

These observations are equally relevant to the Greek museum community. Preschool museum programmes, although present for more than two decades, are sparse in the majority of Greek museums. The museum landscape is dominated by archaeological museums, art museums and folklore museums, which are staffed primarily by content experts [74]². Only a limited number of institutions have exclusive staff for educational services. It is therefore not surprising that published initiatives introducing preschool children to museum objects and heritage sites through the use of digital resources have been developed by early childhood educators—either as classroom projects or in collaboration with academic researchers—rather than by, or in partnership with, museum educators. The next section will focus on the Greek context to examine how digital pedagogies are implemented for preschool children both within and beyond the museum.

3. Museum digital pedagogies in preschool and museum settings: The Greek context

ECEC education in Greece lacks a unified framework. Children aged 4–6 attend compulsory kindergartens, overseen by the Ministry of Education, Religious Affairs and Sports, prior to their enrollment in primary school [75]. Nurseries and crèches for children under the age of 4 are operated by municipalities or private providers (both profit and non-profit) and are supervised by the Ministry of the Interior or the Ministry of Social Cohesion and Family Affairs, respectively (non-compulsory education). At present, only kindergartens have a central curriculum framework, within which knowledge of Information and Communication Technologies (ICT) is incorporated and museum visits (both physical and virtual) appear as a recommended activity. In contrast, it is extremely rare for nurseries and crèches to visit museums or participate in museum educational programmes, which, in any case, are seldom addressed to them.

In particular, the new Greek Preschool Education Curriculum of 2022 [76] emphasizes the creation of a digital environment in the kindergarten which supports the curriculum across all thematic areas, facilitating the learning process, teacher collaboration and professional development, communication and connection of the kindergarten with parents and the wider community, and therefore with the museums. Within this digital environment, children become familiar with ICT tools, such as computers, tablets, internet, apps, interactive whiteboards, online platforms, and education software. AI tools and algorithmic thinking are not yet incorporated. The benefits of digital technologies that are mentioned include equitable access, alignment with how children learn, play and communicate today, more effective teaching, greater learner autonomy and enhanced digital competence—with an emphasis on critical and responsible use [77]. The Curriculum proposes three main criteria to choose/use digital tools: (a) The content should help children explore,

² According to the research of Boutsiouki and Polydora in 2020 [74], the number of Greek museums is 266. Among them, 171 are archeological museums, 46 are historical and folklore museums and 24 are art museums. However, the actual number includes many more independent, municipal, ecclesiastic, university and military museums.

engage, express themselves, imagine and learn. (b) The digital tools should be developmentally appropriate and responsive to children's abilities, needs and interests. (c) Digital tools should support social interaction and play. Nevertheless, as in the previous version of the curriculum, emphasis is primarily on information and digital literacy and the pursuing of learning outcomes across all thematic areas with the contribution of ICT [77].

Regarding the implementation of museum digital tools in Greek kindergartens, published research and practice is limited. As early childhood educators in Greece publish mainly in Greek pedagogical journals and conference proceedings, Greek literature from the past 10 years (2015–2025) was searched manually across databases of scientific journals and conference proceedings related to art, culture, education and ICT, using the keywords “kindergarten”, “preschool/day-care”, “museum”, “digital” and “museum pedagogy”. Below, we present selected examples from this review that thoughtfully combine museum-related activities and digital pedagogies.

The year-long educational programme “Zooming-in on the museum” was implemented in two public kindergartens of Athens [78]. It involved 37 children and aimed to familiarize them with museums and their objects. The reference sites were the National Archaeological Museum and the Kerameikos Archaeological Museum. During the preparation phase, the educators and children used the museum e-books to select the objects they wished to examine more closely at the museum. They then printed images of these objects and sorted them into various categories with the aim of becoming acquainted with the museum content and the diversity of its collections. In the second phase, the children visited the museums, located the chosen objects using the printed images and photographed them. Afterwards, they connected museum objects with everyday items by photographing objects at home and creating photo diptychs. Children presented the products of all museum-related activities in a public exhibition at the Greek Archaeologists' Association premises at the end of the programme. In this way, digital technologies, such as digital photography and web-based resources, were used for inquiry-based learning, which culminated to a creative association of their museum experience to everyday life.

The value of web-based resources and distance learning in museums was explored in a kindergarten of Ioannina with 17 5-year-old preschoolers over a 2-week intervention [79]. The project combined virtual museum visits and interactive web resources, alongside maps, books and creative classroom activities. Data were derived from pre-/post-structured interviews and teacher observation. Results showed significant gains in children's museum knowledge—reasons for visiting, purposes of object display, exhibit categories and the value of accessing museums from a distance. Children also appropriated ICT vocabulary, displayed high engagement and even expressed increased desire for an onsite visit after the online experiences. The study concludes that distance museum learning is feasible and pedagogically valuable in early education. It broadens access where onsite visits are difficult, supports inquiry and creative expression, and should be seen as complementary to physical visits. Similar results were reached by an educational intervention carried out in a kindergarten with 12 preschoolers on a remote island (Ikaria), which included virtual tours via museum websites and Google earth localization, a live Skype session with a museum educator, an interactive task that used the Hot Potatoes software and the co-creation of a virtual exhibition in Artsteps and a toy museum in the classroom [80]. The use of museum digital resources seems to be a popular method in kindergartens [81–84] and much lesser in nurseries [85], either to substitute onsite visits or prepare and complement physical ones. They are usually combined with more traditional preschool activities,

such as storytelling, puppetry, dramatization and block building, to advance museum, cultural and historical literacy alongside digital literacy, all in playful ways.

Only a few initiatives concerning the use of robots and AI are documented in the literature. One such example is a museum-related programme implemented in two kindergartens in Thessaloniki over a period of 5 months that focused on the museum copies of “Las Incantadas” displayed at the Archaeological Museum of Thessaloniki³. The programme combined creative writing, ICT, museum visits, co-education for preschoolers and parents, and collaboration with high school students [87, 88]. Apart from the digital resources employed as teaching aids and tools for inquiry and creative expression, the humanoid robot NAO—nicknamed *Hermes*—played a vital role, in a fruitful collaboration with UOM Robotics Academy, the Archaeological Museum of Thessaloniki and the French Institute. The robot visited the kindergartens eight times, acting as a historical narrator. Through programmed scenarios, *Hermes* could “travel” through time and space, visiting both the Louvre Museum and Thessaloniki, and bringing messages from “Las Incantadas”. With appropriate programming, the robot engaged preschoolers in pre-scripted dialogs with anticipated responses, fostering interactivity and immediacy in communication.

The suspension of physical museum visits due to COVID-19 served as the incentive for a kindergarten class of 24 children in Rhodes to implement a 2-week intervention in 2022 that combined museum education and robotics [89]. Using Google Earth Pro, the class ‘traveled’ virtually to the museum and then explored the website of the Museum of Modern Greek Art of Rhodes for an online tour focusing on four selected paintings. Subsequently, the children programmed the floor robot Bee-Bot to move across map grids via city landmarks and target paintings, created thematic routes, matched artists to their artworks, developed storylines in an activity titled “The paintings tell stories” and recorded their narrations. Assessment made use of dramatization and drawing activities. According to the educator’s evaluation, the Bee-Bot acted as a bridge between art and computational thinking, fostering inquiry-based learning, problem solving, collaboration, autonomy and a stronger connection with local culture.

The year-long, technology-rich project titled “Unravelling the thread of ancient Greek culture in preschool through the use of technology and Artificial Intelligence” was implemented in a kindergarten of Thessaloniki with 20 children [90]. The project aimed to introduce ancient Greek culture while cultivating twenty-first century skills (critical thinking, creativity, collaboration, communication and digital literacy) in alignment with the national curriculum. Methodologically, it followed a project-based, play-centered approach. The digital tools included AR (e.g. Quiver), VR (virtual screenings), virtual museum tours (Google Arts & Culture, COSMOTE Chronos, 360 tours), educational robotics (Bee-Bot, VinciBot), microcontrollers (Arduino), classroom multimedia tools (e.g. Canva, Kahoot), AI tools (Gemini, DeepSeek, Copilot, Poe chatbot, Lumen5, Suno AI, MiniMax) and Artsteps. Activities involved a visit to the Olympic Museum in Thessaloniki and classroom activities organized in thematic learning centers that combined hands-on creations with digital/robotic tasks, AI-assisted production of lyrics and videos, AR visualizations of the Parthenon and Erechtheion, virtual visits to Ancient Olympia, the Acropolis Museum and the Museum of Cycladic Art, a digital gallery

³ Las Incantadas of Salonica is a group of Roman sculptures, part of a colonnade erected in the second century AD, that were removed in 1864 by a French palaeographer and have since been on display at the Louvre museum in France. In 2015, copies of these statues were sent to the Archaeological Museum of Thessaloniki, where they are exhibited along with a remaining fragment [86].

creation and a class VR session. Evaluation demonstrated that museum-linked digital resources, AR/VR, robotics and AI can be meaningfully integrated into the kindergarten to connect cultural heritage with children's lived experience and emerging digital literacy.

The review concludes with a project implemented in a nursery located next to the European Bread Museum (Attica), an enabling factor for establishing a unique collaboration. It is one of the few published museum-related projects for very young children in Greece [91]. The aim of the action research project was to explore how the museum serves as an alternative learning environment for 18 preschoolers (2.5–3 years old) by combining onsite experiences with digital tools and child co-creation. Children engaged with four objects for a period of almost 1 month, exploring them through digital visual materials provided by the museum and presented them in a virtual exhibition using Artsteps in co-operation with their educator. They also created their own stories about the objects, illustrated with drawings and collages, as well as a multimodal poster and a clay model of an impressive bread exhibit to incorporate them in a “museum kit”. Children presented and donated the kit to the museum upon their visit for future use by other visitors. Research results indicate that learning became more playful and multimodal, while collaboration, patience, initiative and language use around museum objects were strengthened. Children also developed a sense of contribution to their community and expressed positive attitudes towards museums and their digital counterparts.

In summary, the review of the Greek literature revealed that the efforts of early childhood educators to take advantage of the digital technologies that are available in Greek museums are rather conventional and limited. This situation may be linked not only to insufficient training in the use of more advanced digital technologies but also to a lack of awareness of what museum websites and exhibition spaces have on offer, combined with inadequate educational provisions for the early childhood on the part of the museums. In the next section, our online research on the websites of major Greek museums will outline the current resources available to young children and early childhood educators, not only to use either in the museum or the preschool center but also to recommend to their students' families.

3.1 Digital offerings in major Greek museum websites

Since the mid-1990s, Greek museums have been systematically experimenting with digital tools, mainly websites, virtual reality installations [92], digitization of collections and educational materials. Governmental initiatives include digital portals and digital repositories, operated by the Hellenic Ministry of Culture and the National Documentation Center⁴. In 2001, the Institute of Computer Science created “Lefkos”, a tour-guide robot which guided visitors for the first time in the Natural History Museum of Crete, the Byzantine Museum of Athens and the Foundation of the Hellenic World [93]. At the present time, and mainly after the pandemic period and the development of AI technologies, Greek museums are enriching everyday their digital tools [94, 95]. According to Sylaiou [95], digital technologies have been always complementing formal education and operating as a bridge between schools and museums. Sylaiou stresses that in relation to digital museum pedagogy, storytelling

⁴ The Ministry of Culture Portal (https://www.culture.gov.gr/en/service/SitePages/heritage_new.aspx) includes Odysseus portal that operates for approximately 20 years. In 2012, the National Aggregator of Digital Cultural Content of the National Documentation Center was launched: <https://www.searchculture.gr/aggregator/portal/?language=en>

(either through digital platforms and applications or virtual humans/avatars) and serious games and gamification—often using Artificial Intelligence (AI), Virtual Reality (VR) and Extended Reality (XR)—have promising pedagogical potential as they involve visitors emotionally and deepen motivation, critical thinking and immersion [95–97]. However, they frequently lack curriculum alignment and evaluation frameworks [95].

In the context of this chapter, targeted online research was conducted on major Greek museum websites during August–September 2025 to explore current offerings that may have been developed for children under 6 years of age. Museums were selected based on their status as public museums of national standing or major metropolitan museums, including a number of private museums renowned for their child-friendly activities and exhibition spaces. We also aimed to include a diverse range of museums representing art, ancient and modern culture, as well as science and technology. Based on these criteria, the final sample consisted of the websites of 17 museums⁵.

Data was classified into the two main groups mentioned in the study by Mazzanti et al. [98], adding a third one that focuses on the offerings of the websites for children under 6 years⁶. The reason for exploring all available services for the general public instead of focusing only on child-targeted offerings is the fact that early childhood educators frequently use resources developed for the general public to organize activities for the children's museum visit or for museum activities at the preschool center. The three groups are:

- a. Conventional and Standard digital technologies (video and audio recordings, podcasts, web applications, mobile applications, online exhibitions, digitalized collections, digitalized/printable and digital educational materials, distance educational programmes, digitalized interactive maps/timelines, e-books, analytics and feedback tools, social media management tools, ticketing systems, e-shop, links to the museum's YouTube channel, Google Arts & Culture, Europeana, separate specialized museum website)
- b. Emerging and Advanced ICT solutions available for online and onsite use (artificial intelligence applications, chatbots, games or gamification, digital storytelling tools, digital tools for exhibition planning, such as personalized tours through mobile and web applications, AR Apps, social robots).
- c. Under six offerings: digital tools and digitized files of educational material for ECEC centers or families with children under 6 years, online games, kids' website.

The Greek museum websites of the study offer rich information to the visitors, using primarily conventional and standard digital technologies. All of them have

⁵ *Athens* (11 museums): National Archaeological Museum, Acropolis Museum, Byzantine and Christian Museum, National Historical Museum, National Gallery–Alexandros Soutsos Museum, National Museum of Contemporary Art, National Museum of Natural History Goulandris, Museum of Modern Greek Culture, Museum of Cycladic Art, Benaki Museum, OTE Group Telecommunications Museum. *Thessaloniki* (4 museums): Archaeological Museum of Thessaloniki, Museum of Byzantine Culture, Folklife and Ethnological Museum of Macedonia-Thrace, Noesis - Science Center and Technology Museum, *Heraklion* (2 museums): Heraklion Archaeological Museum, Natural History Museum of Crete.

⁶ Boutsiouki and Polydora study was also useful for defining some of the services [74].

visit-related practical information and information for the educational activities, including accessibility information (10 out of 17). Additional information such as promotion of events and links to supplementary sources are offered from all participating museums. All of them have social media (mainly Facebook and Instagram). Notably, 14 museums have a YouTube channel, 5 are registered to Google Arts & Culture and 4 to Europeana. Moreover, 9 museums have e-ticketing, while 6 own e-shops. In general, the websites are user-friendly: they offer search tools (15) and the option to register to their newsletter (14), but only one supports chat availability. All websites have photo and video galleries. They provide educational and short documentary videos (17), web applications (16), digitalized collections and virtual tours or virtual thematic tours (15), mobile apps (13), e-books (7), online exhibitions (6) and podcasts (5). In terms of specialized museum education services, 14 museums offer digitalized printable educational material, 12 have online games and only the National Archaeological Museum offers two distance educational programs for children 9–12 years old. One museum has a separate kid's website (Acropolis Museum kids) that will be also discussed later.

Regarding emerging and advanced ICT solutions, only two museums provide the opportunity to design a personalized tour through mobile and web applications, three have AR apps and one has a social robot. The social robot is used during an educational programme for children 9–12 years old at the Archaeological Museum of Thessaloniki. Only one museum is offering an AI assistant, currently at a pilot phase at the museum's premises (Noesis—Science Center and Technology Museum).

As to targeted museum website services for children under 6 years, most of them use conventional and standard digital technologies, as expected. Seven museums provide digitalized files of educational material for school use and eight for families, which could be also useful for ECEC settings. More specifically, the Acropolis Museum offers the family trail “Spot the Animal”, clearly targeted to 3–5 years old, in printed, digital and printable format. The Museum of Byzantine Culture offers a printable memory game for primary and preschool students. Only the National Museum of Natural History Goulandris provides online games targeted to children less than 6 years, such as labyrinths and memory games. However, some of the other museums' online games could also be used by younger children. For example, the puzzles and the memory games of the National Gallery that have various difficulty levels or the memo, puzzle games or the “Create your own garment” activity of the Folklife and Ethnological Museum of Macedonia and Thrace. Kids' websites and kids' pages also provide very helpful pre-visit materials for ECEC educators. Apart from the kid's website of the Acropolis Museum, which has been already mentioned, the National Museum of Natural History Goulandris has a special kid's page (e-kids) with educational and fun activities, including the online games. In addition, the Museum of Cycladic Art organizes annually a Kids' contest for 4–15 years old that has a separate website containing a digital gallery with the artistic contributions of participating children and thematic educational materials and information. Finally, the Natural History Museum of Crete offers a Virtual Path⁷ about the wolf for younger children and two e-books with fairytales written and illustrated by families or young children. As regards the use of emerging and advanced technologies, the “Cycladic AR” app is

⁷ VIRTUAL PATHWAYS is a project that connects schools with science museums and centres by bringing digital technologies into everyday lessons. It offers online field trips enriched with 3D digitization and AR/VR, so students can explore science topics from the 1600s to today. <https://virtualpathways.eu/#virtual-pathways>

targeted to families and kids without referring especially to children “under-6”, but basically including them. The app can only be used in the Museum of Cycladic Art.

Overall, Greek museums lack a systematic approach for children aged 0–6 on their websites; however, they do publish early-years programmes and family-oriented tools (e.g. AR apps, family kits, virtual/remote modules) that ECEC educators and caregivers can use to create short, adult-driven digital activities combined with hands-on play for preschoolers. However, as we have already observed from the aforementioned examples of museum digital tools implementation in ECEC settings, early childhood educators basically use virtual museum tours.

For the immediate future, a major digital transformation is underway in 107 public cultural heritage sites and museums, led by the Organization for the Management and Development of Cultural Resources (ODAP) in partnership with the Hellenic Ministry of Culture and EU funding [99]. The aim is to modernize the visitor experience by ensuring universal accessibility and providing personalized services and immersive experiences through interactive technologies. Greek museums also benefit from their participation in European-funded projects to develop and test cutting-edge technology, such as CHES⁸ [8], Virtual Pathways and ReinHerit⁹ [98]. The digital tools they develop for the general visitor are frequently useful for younger children, their schools and families.

3.2 Implementing digital pedagogies in the training of prospective early childhood educators

Considering the key role and their expert knowledge on how to motivate, engage and sustain young children’s interest in museums and heritage sites, the training of prospective early childhood educators in digital pedagogies is crucial. The 2021–2027 Digital Education Action Plan of the European Commission prioritizes support to teachers and educators, including training and hands-on guidance on digital literacy as one of the strategic actions to foster digital transformation [100]¹⁰. In the following sections, we offer two examples of digital training embedded in university museum education courses.

3.2.1 Creating virtual museums in the classroom

The New Preschool Curriculum proposes the design of virtual museums by members of the classroom community [76]. Artsteps is an innovative free web-based application for creating and publishing 3D/VR virtual exhibitions or museums. The creator can set up spaces, upload images and videos, add text, activities and audio narration, define routes and navigation via arrows and keys or intuitively [101]. Some premium services and templates are behind a paywall. As we have already seen in the literature review, ECEC educators in Greece already take advantage of this easy-to-use platform. Nowadays, the Artsteps platform has evolved into Metasteps, a next-generation platform, offering more creative tools, mainly on a paid basis.

⁸ CHES (Cultural Heritage Experiences through socio-personal interactions and storytelling): <https://www.chessexperience.eu/>

⁹ ReinHerit (Redefining the Future of Cultural Heritage): <https://www.reinherit.eu/>

¹⁰ <https://education.ec.europa.eu/focus-topics/digital-education/actions>

A recent Greek study examined whether a virtual museum about the Greek War of Independence, built with Artsteps, can support learning and engagement for 51 children, aged 4–6. Researchers used a pre-test/post-test with Likert ratings [101]. Before the activity, most children did not know what a virtual museum is or how to navigate one. Afterwards, they found the experience practical, fun and interesting, while 92.1% said they liked browsing the virtual museum very much. There was also an improvement in their navigation skills. Overall, virtual museums have emerged as an appealing and effective way to bring history closer to young learners.

Another Greek study aimed to assess the Artsteps suitability for early childhood learners and reflect on its potential educational value [102]. The participating class of 35 preschoolers co-created a “Digital Children’s Book Museum” with five thematic zones (storytelling, reading, digital educational content and e-books, a traffic safety simulation room designed for role-playing, and a virtual AI space where children’s drawings were animated). The creation of the digital museum enabled multimodal, hands-on engagement, while researchers also observed emerging digital literacy behaviors. Children reported high enjoyment and willingness to reuse the Artsteps platform. However, some younger children (4 years old) struggled with navigation and found the interface complex (many icons and panels). Older children (5–6 years) showed greater autonomy. Overall, the research indicates that Artsteps is motivating and pedagogically promising for early childhood when appropriately supported.

With regard to university-based pedagogy, the students of the Department of Preschool Education at the University of Crete had the opportunity to get acquainted with the Artsteps platform during the academic year 2024–2025, in the context of the university course “Museum Education in the era of AI”. At the end of the course, they were asked to choose for their assessment whether to take a written exam or to design one virtual exhibition, which they could use, if they wished, during their practicum at the kindergarten. The main challenge that teachers and students often face when designing learning activities related to digital museums is identifying suitable works of art and finding appropriate educational materials and resources [103]. Students selected images for their thematic virtual museums by exploring museums websites, the Greek National Aggregator of Digital Cultural Content, Google Arts & Culture, Europeana and Photodentro¹¹. They were advised to frame activities with Artful Thinking routines¹², a learning strategy that is proposed in the Preschool and Primary School Curriculum. They also studied a relevant university e-book that presents ready-to-use classroom ideas on digital cultural heritage and Artful Thinking routines, drawing on large repositories [103]. After having selected digital material or related museum information, students created their own digital museum, connecting the uploaded images, videos or audio files with activities based on popular museum education methods (narratives, inquiry-based discussion, discovery learning and experiential-creative methods). The results were unexpected. The majority of the students chose to design virtual exhibitions. None of the students knew about this application before, however they found it very easy to use it. Those who chose to use it in the classroom noticed the excitement of their young students. Overall, they argued that the Artsteps platform was an interesting and useful tool for them, offering enjoyable, aesthetic and learning experiences for ECEC settings,

¹¹ Photodentro is the Greek National Aggregator of Educational Content for the Primary and Secondary Education. It is the central e-service of the Ministry of Education for the search and distribution of digital educational content to schools. It is open to everyone. <http://photodentro.edu.gr/aggregator/?lang=en>

¹² The Artful Thinking framework was developed by the University of Harvard: http://pzartfulthinking.org/?page_id=2

provided that the content of the virtual museums and the accompanying activities are developmentally appropriate for young children, and, ideally, co-designed with them.

3.2.2 Augmented reality experiments with museum collections

Augmented Reality (AR) has been a game changer in museums, as it transforms the way knowledge is delivered, experienced and retained [104]. AR superimposes digital content onto the real world (objects and spaces), making learning more interactive, dynamic and fun [105]. It enhances the perception of the real-world environment through various sensory modalities (visual, auditory, gestural and haptic), allowing a multimodal and thus more accessible way for visitors, who may experience various disabilities or language barriers, to enjoy and learn more about the museum exhibits [106]. Videos, animations, digital avatars, 3D models, sound and text may appear when triggered either by scanning markers (such as QR codes or image recognition) or by the visitor's location (using GPS or other geolocation systems) [107, 108]. The virtual content adds different layers of interpretation, such as reconstructions or animated movement of exhibited instruments or animals and offers opportunities for storytelling and inquiry-driven exploration of the museum collections. AR allows for social interaction while exploring the additional digital content, as it does not cut off users from the real world. It is also a more affordable technology for museums because it often relies on devices that visitors may carry with them (such as smartphones and tablets) [105] and on software tools and applications that may be free of use in an educational context.

Several studies in the field of museum education [4, 109, 110] and formal education [107, 111–113] stress that AR applications intensify engagement, learning motivation, memorization and facilitate personalized learning by offering opportunities for curiosity-driven exploration, different modes of interaction and repetition of actions. They also make abstract concepts more concrete through visualization and may enhance empathetic understanding and the sense of achievement. These unique characteristics make AR technology extremely suitable for very young learners. It is a powerful tool for putting exhibits into context and provides visual and auditory cues to their content that “can assist with making connections between museum artefacts and images and visitors lives and memories” ([109], p. 406). It enables experiential learning through movement and senses and invites for a more playful exploration of the museum exhibits that may offer excitement and joy and create memorable moments.

Using AR applications for educational purposes needs familiarization and training to create learning scenarios and activities that are fun, challenging, engaging and with the right amount of cognitive load [107, 112, 114]. This is the reason why, in recent years, AR training was incorporated in a museum education course for pre-service early childhood educators at the University of West Attica, in order to help them develop their own AR-enhanced museum learning resources for children under 4 years old. MuseumAR, co-funded by the Erasmus+ Programme of the European Union (<https://museumar.eu>), offers a comprehensive MOOC that served as a basis for building the training and provides resources for further exploration of the subject from students who want to delve deeper into the topic. MuseumAR was developed for museum professionals and anyone interested in cultural heritage learning in order to help them integrate AR in the museum with easy-to-use software tools and create engaging AR content for educational use. Among other tools suggested by the MuseumAR project, the ARTutor application was chosen for the students' training, and its use is demonstrated at the Hellenic Children's Museum, which was one of the project's partners.

ARTutor is an Augmented Reality platform developed by the AETMA Research Laboratory of the Democritus University of Thrace. It is available free of charge to all teachers and students around the world to help them create educational material and improve their learning experiences. It consists of a web-based application that acts as an AR authoring tool where users can upload the learning material and the learning objects that will serve as augmentations, and an accompanying mobile application to access and interact with the uploaded AR content [115]. The application was initially conceived for the enhancement of existing textbooks and is based on image recognition and the superimposition of augmentations on trigger images. However, photographs of museum objects or elements of interactive exhibits can also be used as image triggers. Caution is only needed when scanning the real objects in the museum environment with a mobile device (either iOS that support ARKit or Android that support ARCore), as there might be changes in lighting or the user's point of view that may impede recognition. After initial registration in the ARTutor web platform using a Google account, pre-service educators can create their own digital book in pdf format with easy-to-follow instructions and upload different types of augmentation (images, videos, sounds, YouTube videos, 3D models and URL Links). When the book is completed with all the corresponding augmentations, the mobile application can be used to share it with everyone without registration (internet connection required). Students are able to create, in a few hours and without coding, augmentations that can make the museum visit with young children more interactive and richer in contextualization with the use of a tablet. They also create augmentations with art posters or art, culture and science books in the classroom, in case a physical visit to the museum is difficult. Future educators are advised on how children can contribute to the creation of augmentations and the ethical issues concerning this participation. For example, children can make the sound of a dog appearing in a painting or contribute to a video that brings the picture to life. The training ends with the discussion of different learning scenarios that educators can create to integrate the use of the AR content in interactive storytelling in the form of scavenger hunts, mystery solving, etc.

4. Discussion and conclusions

The chapter presented various examples around the world with a special focus on the Greek context, showing that ECEC educators and academics are experimenting with digital pedagogies and using museum-related digital resources to advance and broaden young children's contact with museums and their collections. However, Greek museums need to diversify their offerings and include children aged 0-6 years more often in their target audience. The proliferation of emerging and advanced technologies in Greek museums, which currently remains low, is expected to facilitate the use of digital tools for younger audiences.

Furthermore, published research on the integration of digital technologies in preschool museum education remains scarce, a situation that may be linked with several factors:

- a. Limited available infrastructure, user equipment and connectivity in early childhood centers, but in some museums as well.
- b. Budget constraints for the development of audience-specific applications not only in small but also in larger museums.

- c. Low priority of museum services targeted at young children.
- d. Pedagogical concerns about the amount of screen time and lack of a deeper understanding of how digital play forms part of young children's everyday life and the ways it can be further enriched in and through the cultural sector.
- e. Inadequate training of museum educators on digital early childhoods and sparse active collaborations with early childhood educators who are much better equipped with expertise and relevant training to inform museum education initiatives.

The museum community is proceeding with rapid steps towards the integration of emerging technologies that keep evolving every day. Advancements in hardware, spatial computing, AI, VR and AR applications, 5G integration, as well as in gesture and voice interaction [107] will lead to the design of immersive learning experiences in the museum that are more inclusive and easier to use, facilitating young visitors' interaction, play and collaboration with others [116]. The Internet of Toys may also inspire applications that combine digital play and cultural heritage in fun and imaginative ways.

As we have already seen, preschoolers take advantage of the usual available digital assets of the museums that are designed for all audiences, such as digitized collections, videos and e-books, virtual tours and exhibitions, in the context of getting acquainted with the museum world and participating in inquiry-based activities. At the same time, it is important to promote further initiatives that deliberately focus on digital creativity and active participation because of their strong pedagogical potential in early childhood. Interactive storytelling platforms that enable children to create their own narratives around objects—using digital storyboards [117], AR or voice recordings—can make museum collections more meaningful for young audiences while also fostering imagination and critical thinking. Digital tools that allow children to mix artworks or artifacts into their own creations—combining sounds and other multimodal content—offer an empowering practice. As documented through the use of the Artsteps application in preschool settings, this approach supports constructivist learning and provides children with opportunities to become creators of cultural meaning. The creation of participatory platforms where children's drawings, images, stories and perspectives about museum objects can be uploaded is another important pedagogical strategy for making children feel that their "voice" is appreciated and that they are recognized as competent cultural contributors. Such strategies also provide opportunities for cross-context learning by linking the world of the museum and its practices with children's everyday experiences at home and at school, serving as digital boundary objects [52] and promoting intergenerational digital play [16]. In addition, online games and digitally available educational materials are already common practice in museums and can be further developed to include more resources specifically designed for preschoolers. Museum education departments can also design lesson plans and onsite educational programmes that are based on a blended learning model and combine physical and digital play opportunities for engaging with museum collections.

The postdigital museum raises of course a number of ethical concerns and challenges. Young children are particularly vulnerable to opaque data practices, so museums should apply appropriate safeguards for children's sensitive data, as literature reveals significant gaps in this crucial issue [118]. The integration of AI in digital

platforms and other tools should be also critically examined, as it actively shapes the learning experience and may reproduce cultural bias and influence young children's perceptions about the meaning of social interactions [118]. Educator's training in this direction is vital to avoid misuse or overreliance on technology on such issues and be able to select, adapt and scaffold digital resources in a developmentally appropriate, inclusive and culturally responsive way that hits the right balance of offline and online or digitally assisted activities [119].

Preschool museum education has progressed in interesting ways in recent years. Digital technologies undoubtedly offer significant opportunities to enhance young children's museum experiences both onsite and remote, but museum professionals need to remain attuned to and well informed about the ethical and developmental implications highlighted by current research on early childhood education. They should also experiment with co-designing digital experiences that take into account the views and perceptions of young children [120] and invite early childhood educators to participate in the design process of more advanced museum resources targeted at this age group. Largely marginalized in museum digital offerings, ECEC groups are eager to use distance digital content, as museum visits are frequently difficult to organize, especially for children less than 4 years old, and museum visits, when they take place, need thorough preparation and complementary ways to revisit the experience. However, offerings should move beyond the typical information-delivery model and embrace digital creativity and play. The seamless integration of digital technologies in museum exhibitions and onsite services should also consider the needs of this age group in terms of accessible navigation and intuitive user interface, immediate child-friendly feedback, simple and context-aware information, as well as type of engagement. Playful learning, multimodality, open-ended outcomes, curiosity-driven exploration and joint engagement instead of solitary use are among the suggested strategies that promote digital museum pedagogy in appropriate ways. Research on these critical issues is growing, and museum professionals, early childhood educators and ICT specialists could benefit from and contribute to this challenging field of study.

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Facilitating Learning and Student Interest in Social Studies with Virtual Museums

Adam I. Attwood

Abstract

This chapter explores how virtual and physical museum artifacts engage students in social studies. It highlights the effectiveness of Electronic Field Trips (EFTs) and Collaborative Virtual Environments (CVEs) in creating dynamic social studies curricula. Primary studies show that virtual museums stimulate engagement by making historical content more relevant. The study investigates integrating virtual museums into social studies curricula to enhance student engagement and learning. By analyzing EFTs and CVEs, technology's role in facilitating interactive and dynamic social studies lessons may be useful in discussing these tools for social studies education. According to qualitative and quantitative research, virtual museums are a way to make history engaging, contributing positively to various subjects within the social studies curriculum. The study underscores the potential of virtual museums to cater to diverse learning styles, offering a flexible environment compared to traditional methods. It introduces a potential mathematical equation to measure "Learning Units Gained" from virtual museum experiences, proposing this metric for future case studies. Three focus areas are: the background and implications of virtual museums for students with exceptionalities; the mathematical assessment of student learning from virtual museums; and the influence of online learning spaces on classroom implementation. Experiential learning through interaction with artifacts is emphasized as crucial for knowledge retention. Using a conceptual methodology, the study reviews literature on virtual museums and social studies curricula, analyzing case studies and synthesizing secondary research. Findings suggest virtual museums are valuable tools for social studies educators, providing interactive, multisensory learning experiences that enhance student engagement and learning.

Keywords: virtual museums, learning measurement, learner engagement, electronic field trips, social studies

1. Introduction

This study is important for using virtual museums as a tool in social studies curriculum planning for the diversity of many social studies classes. Virtual technology may be less restrictive for more students than the traditional curriculum of pen-and-paper worksheets, textbook reading, and written notes and rote memorization for

testing. Therefore, virtual museums may be more likely to generate and maintain interest among diverse groups of students. This study also proposes a solution to the problem of how to measure student learning from virtual museum visits. A mathematical equation is proposed to measure “Learning Units Gained” from virtual museums. This equation may be used in future case studies to establish data sets for analysis and increase the research base for virtual museums in social studies curricula.

I explain three main items: (1) the background of virtual museums and their implications for students with exceptionalities and other learner groups, (2) my ideas on mathematically measuring student learning from virtual museum lessons, and (3) the features of my prototype online learning space with a virtual museum widget for classroom implementation. This conceptual study focuses on how museums may be integrated into social studies curriculum to maximize student learning. Museums offer the opportunity to use several learning modalities per Howard Gardner’s Multiple Intelligences Theory [1, 2]. In this paper, “learner” is used interchangeably with “student.” To be electronic is not necessarily to be virtual. Nevertheless, in this survey of the literature on virtual museums and the corollary high technology, the integration of electronic media provides the first stage of virtual reality into social studies classrooms internationally. And it is available in the United States and, more specifically, in Washington State. Virtual museums are accessible on the Internet to any school in the world with an Internet connection; therefore, virtual museums are available in Washington State. The literature refers to virtual museums as virtual and the museums’ websites refer to themselves as virtual, because virtual means that it exists within the Internet. In other words, a virtual exhibit does not exist physically or literally. This chapter discusses answers to the following questions:

1. How do virtual and physical museum artifacts and exhibits currently engage students in learning social studies content?
2. How may virtual museums be used in the future to engage students in learning social studies content?
3. How may learning from virtual museums be measured?

This is a conceptual study that discusses several virtual technologies as they relate to student engagement in learning and the modalities that certain types of students may learn with most efficiently. Most of the primary sources are a mix of quantitative and qualitative techniques for their given area of focus. The topic of museum virtualization is still relatively new. Electronic field trips and virtual learning are on the leading edge of current research; therefore, some of these concepts have few directly corroborative studies. The virtualization tools are new for general educational purposes, so although the Virtual Victorians exhibit from Tiverton Museum, for example, may not look impressive, the website is at the beginning stages of a virtual education phenomenon for kindergarten through twelfth grade.

Methodology of research focused on a broad search of literature about virtual museums and social studies curriculum in educational research databases such as EBSCOhost—a web-based database of full-text scholarly journal articles. This study includes historical context using older research and relies upon some of the most recent research through 2010. Most sources are scholarly journal articles supplemented with books, indirect support articles, newspaper articles, and video media.

The guiding questions are answered in a way that may be referred to as efficient and not exhaustive. This paper is a research report that makes a unique contribution with an original hypothetical case study created after synthesizing the literature. This research report analyzes current case studies [3–8] and synthesizes secondary research that cites primary source studies [3, 9–13].

The third guiding question, for example, is: how are museums currently used in the Social Studies curriculum to create a “less restrictive” environment? This research report incorporates an analysis of the implications of virtual technology in the classroom for Special Education students, because Special Education students are a significant student population that research suggests could benefit from virtual technologies in the classroom [9]. Individualized Education Plans (IEP) are intended to maximize student learning for students with exceptionalities. If virtual technology can create a less restrictive learning environment for students with IEPs, then such technology should be used. The least restrictive environment (LRE) has been defined as “the educational setting that most closely resembles a regular school program and also meets the child’s special educational needs” ([14], p. G-8). Virtual museums may be a tool to design some social studies lessons to meet LRE requirements for students.

2. Context, background, and key concepts

Virtual Museums as a part of experiential learning is a relatively new phenomenon. The physical museum as a place-based environment for learning is not new. Although closely related, virtual place-based learning environments are different in terms of logistical efficiency and students’ learning efficiency [15]. In an early twentieth-century article on the benefits of museums in the social studies curriculum, it was noted that teachers visited museums more than previously, because children learned from “the reality of things by museum study” ([16], p. 92). Artifacts are tangible pieces of the past. Teachers may facilitate student learning by fostering students’ interest in artifacts that relate a past person to the present generation.

The genesis of virtualization may begin with the needs generated by special education. The “least restrictive environment” has been the ideal and part of the law in various forms for decades [17]. High technology in the form of computer virtualization provides greater opportunities to efficiently address the needs of students with exceptionalities. As part of a study on how to effectively teach social studies to students with mild learning disabilities, findings suggested that of their sample of 142 teacher respondents only 18% considered audio-visual supplements as the most effective strategy to teach students with mild learning disabilities [18]. Peer tutoring received 42% of the vote while special seating arrangements accounted for 41%. However, those researchers in that same study concluded that social studies teachers who had students with mild learning disabilities felt “constrained” by the “traditional methods” of instruction [18]. So, the seeds for research and technological innovation were present in the professional educator community. Other studies from the 1990s suggested that computers helped maximize student learning [15]. Fast-forward to 2009 and several studies had an even more favorable view toward audio-visual, multimedia supplements—promoting the potential of immersive virtual learning platforms also known as Collaborative Virtual Environments (CVEs) [3, 6, 9–13, 19]. Another study found that 3D technology had especially important use in the classroom because of virtual technology’s “capacity to enhance visualization” across subjects ([19], p. 14). The advance of high technology has made virtual learning a

reality known as Virtual Reality or VR [3, 11]. Museums began to adopt the VR model to market themselves to schools at lower logistical costs while simultaneously bringing the museum to the classroom via virtual Web portals [8, 15, 20, 21].

2.1 The museum as learning ‘toolbox’

In another study, a museum educator and staff associate of the Social Studies Development Center of Indiana University asked: “What are these under-utilized educational resources and why should their materials be added to the teacher’s ‘toolbox?’” [21]. Boyer’s answer to the first part of the question was “museums” and the answer to the second part of the question was that the museum “translates” objects into a more “enriching” classroom [21]. Researchers in a 2008 study observed: “Empirical studies of experiential learning activities for children provide evidence that it is generally the concrete experiences combined with active experimentation that leads to the greatest degree of individual learning” ([4], p. 440). The parallel between the 2008 source and the 1999 source is that experiential learning is an important part of learning for K-12 students. Museums provide a multi-faceted environment for experiential learning. The use of artifacts in learning tends to encourage students to explore and use their curiosity more than the textbook-centric approach [22]. Cassady and colleagues also noted: “classroom-based studies provide a real-world replication and validation for the commonly reported effect demonstrating greater recall for content that was active processed than for passively acquired” ([4], p. 441). The museum environment provides dynamic content for active student learning.

Place-based learning is traditionally achieved by physical field trips ([20], 2008). But high logistical costs have prompted the field to come to the classroom instead of the class going to the field [15]. The Museum of Cultural and Natural History at Central Michigan University created “learning kits” to accommodate this shift. Students learn by studying artifacts. The stories suggested by objects of a past culture may be “reconstructed” in a classroom ([23], p. 27). Artifact-based learning integrated with worksheets that require students to actively assess the significance of the object tends to maximize the use of the learning modalities. For example: “The first task on the log sheet read: ‘pick up the artifact that is nearest to you. Touch it, smell it, listen to it, and look at it, but don’t put it in your mouth. Please write a description’” ([23], p. 29). Other studies suggested that experiential learning maximizes student learning. Museums can be used as experiential learning classrooms [24–26]. A different study suggested that students may play the role of curator by constructing their own exhibit. This activity encourages students to make the same types of interpretive and political decisions as real curators [27]. Thus, students apply social studies concepts by simulating curatorship.

Wax museums are another pre-virtual method of field-based learning that can be integrated into virtual learning. A study observed: “When preservice teachers present that content in a meaningful format to children, learning becomes important for both groups” ([25], p. 281). It may be suggested that teachers should be life-long learners who should encourage their students to be life-long learners—or, at least, get their students to be willing to explore the ideas of other cultures after they finish school. The wax museum provides a “positive collaborative experience” in which teachers may integrate the physical with the virtual by “Develop[ing] a simple Web site for the students” to include information about the historical figure they have chosen to research ([25], p. 281, 283). Even physical objects within the wax museum can be adapted to a virtual environment by digitizing them and featuring the artifacts in a virtual exhibit.

Researchers in a study with teacher candidates concluded that the service-learning museum project between the National Ranching Heritage Center (NRHC) and Texas Tech University College of Education was a success overall because many teacher candidates reported that the museum-based lesson had “a positive influence on their career decisions and motivation” ([20], p. 83). In fact, “Studies of placements of preservice teachers in museum internships showed that social studies students gain valuable teaching experience interpreting resources of the museum with children that visit the site” ([20], p. 83).

Teacher education programs should be a place to foster the use of technology in social studies classes. When preservice teachers learn about virtualization technologies, they are more likely to base lesson plans on such technologies. Building technological skills into social studies lessons helps both the teacher and student interact with history more dynamically. The need for more advanced technological training to accompany virtualization technology in social studies has been on the leading edge of research since 1996 [28]. In a study focused on the Canadian francophone population, researchers suggested that virtual museums are at the beginning stage of development and that a growing number of teachers are integrating virtual museums into their social studies classes [7]. A question about the use of the Virtual Museum of New France (VMNF) showed that francophone teachers used the site. 43% of the teachers surveyed indicated that they use virtual sites for social studies lessons. Researchers asked: “In relation to what you are teaching, do your students acquire new knowledge, perspectives and skills after using the Internet and consulting websites?” A vast majority of the respondents answered yes to all three components of the question ([7], p. 165).

2.2 Student engagement using technology for virtual field trips

In a landmark primary study on the interactive component unique to museums, teachers and students were observed at a museum while they used wireless handheld computers to augment the exhibits. The students—known as “explainers” in the study—were a high percentage of “discovery” learners who completed museum-based assignments because an exhibit “motivates doing” the assignment ([12], p. 314). Teachers considered the handheld effective for maximizing “instructional activities,” although the handheld computers appeared to compete with the primary exhibit because students switched their attention from the primary exhibit to the handheld. The handheld device tended to maintain student engagement with exhibit-specific “problem[s] to solve,” thus adding an additional component to the primary exhibit ([12], p. 315). The addition of a handheld to the exhibit experience was a prototype and needed some adjustments to be better aligned with the primary exhibit and not distract from it. Nevertheless, the handheld is part of a wave of technological advancements that social studies teachers and museum educators may evaluate for a more experiential learning environment that maintains student engagement in learning [28].

Student engagement in learning is critical for long-term knowledge retention. New things will stay in students’ memories when students have dynamic activities. Such activities can be part of the museum environment. But “‘hands-on’ activities” do not necessarily have to be physical. In fact, hands-on may be virtual and just as effective in augmenting the learning activity. More educators are transitioning instruction away from lecture-based pedagogy and, instead, toward student-centered environments. Interactive museum exhibits are an example of this trend because museums can create

an immersive context akin to a dynamic laboratory, not a static classroom [3] Researchers have noted a distinction that is very important for the implications of virtual museums in the learning process: “students can enjoy the benefits of constructivist learning from a distance, facilitated through virtual interaction and current technologies that enable real-time distance learning ([4], p. 441). The implication is that virtualization of the museum environment provides a logistical advantage to schools that would otherwise not be able to transport students to the physical museum and at no cost to student learning.

The study conducted by Cassady and colleagues was, at the time, “the most comprehensive analysis to date investigating the learning effects of electronic field trips (EFTs)” ([4], p. 445). Test scores after the EFT were higher than those of the pre-test. And follow-up lessons in the classroom that are based on a field trip to a museum further enhance knowledge retention ([4], p. 443). This EFT focused more on digital media rather than virtual media, but the EFT experience be transferred to the virtual museum experience if a virtual exhibit exists for a given unit. Students stay in the classroom for the entire learning activity. Students virtually visit a museum with computers and see the same exhibits and artifacts. They may then immediately follow up on the virtual tour with activities. This virtualization as EFTs that are defined as having “three or more of the following: text, audio, graphics, still images, and moving pictures” ([4], p. 444). The Web-based Art Interactive Tool (WAIT) was another example of the nexus between the social studies classroom and EFTs. Researchers have discussed Web 2.0 technology in relation to studying fine art in social studies classrooms. Students access the art from any computer with an Internet connection, thus bring the art museum to the classroom [29]. This is a theme familiar to all virtual museums, because students virtually walk through exhibits instead of physically walk through exhibits.

Online exhibitions are available now. The Smithsonian Institution is virtualizing its exhibits. The United States’ flagship museum is setting a trend for museums throughout the nation. The Smithsonian’s Freer Gallery of Art and Arthur M. Sackler Gallery have online exhibitions with audio commentary (called “audioguides”) and interpretive texts. The virtual exhibition “Garden and Cosmos: The Royal Paintings of Jodhpur,” for example, has extensive audioguides aligned to the paintings. Professional historians and curators describe the paintings and provide interpretive context for what the paintings suggest about early Indian history. Students may virtually go to the Smithsonian via its Web portal and ‘visit’ the exhibition from their school’s computers. Teachers can design lesson plans fully integrated into the sophisticated online exhibition [30].

Technology has progressed at such a rate that the definition of electronic field trips has changed to include interactive virtual field trips that may replace the physical field trips discussed in a study by Spicer and Stratford [8] that EFTs do not replace physical, on-site field trips. Today, EFTs feature richer multimedia experiences that include live broadcasts and interactive real-time activities. Cassady and colleagues emphasized that their “research has confirmed that these newer models of EFT support optimal learning and teaching by addressing Dewey’s four natural impulses for children learning: inquiry, communication, construction, and expression” ([4], p. 444). The “comparative analyses” were based on 1568 4th graders and above. The results indicate that the group that participated in the “Full EFT” showed a significantly higher test score than those who had “prep material only” and “no exposure [to the EFT]” ([4] p. 449). Hsi’s earlier study—although not conclusive—found that the handheld computers “motivated users to try new activities and interact with exhibits

in new ways” ([12], p. 317). Hsi called the handheld innovation “the nomadic web” system. Students and teachers used the handheld computer to augment the learning with interactive content that correlated with the physical exhibit. This system was not fully virtual, but a hybridized predecessor of the full EFT [4]. The nomadic web system was complicated by its tendency to cause users’ attention to fragment between the handheld and the main exhibit. Hsi concludes that “the nomadic web content was not well-coupled with the exhibits” ([12], p. 317). By 2008, technology had become better integrated and more uniformly conducive to learning, not distracting. Cassidy and colleagues concluded: “Previous research has demonstrated that students enjoy the content offered through virtual or electronic field trips” ([4], p. 453). This description closely parallels the findings of [3] who noted that “VR [Virtual Reality technology] refers to synthetic, computer-based, three-dimensional worlds” that may be “immersive [...] or a ‘window on the world’” (p. 50). In other words, VR provides an advanced platform for students to practice inquiry-based learning [31]. High technology has fostered museum virtualization that makes the exhibits more interactive, more student-centered, and more immersive so that social studies are dynamic.

One other form of student-centered and high-technology-based learning is the “webquest.” It may be the next closest thing to EFTs, while not actually being an EFT proper. Webquests are classroom-based “inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web” with the idea that students manage their time more efficiently relative to the learning goal ([32], p. 480). The efficiency of webquests relies upon an intrinsically student-centered approach in which the student summarizes information on websites and synthesizes the main points into a coherent, concise meta-analysis. This system assumes that students are advanced enough to search websites on their own and know how to summarize key points, not just every bit of information they come across. Teachers scaffold lessons that lead up to a webquest so that students have the research skills necessary to successfully complete a complex multipage Web search [32].

Webquests were a popular form of what may be called *proto-EFTs*. In other words, students should have experience with webquests before they participate in an EFT. The webquest has elements of an EFT, but it is not a fully self-sufficient virtual environment. It is, rather, still basically a static virtual environment that is text-based. This does have an important implication for fostering a less restrictive learning environment for students with mild learning disabilities. The implication is that the webquest, as a computer-assisted instructional technique, encourages extended, repeated practice for students who require additional decoding and phonological instruction to help them with contextual word recognition [33]. Webquests foster familiarity with virtual navigation of social studies materials, thus preparing them for more immersive electronic field trips, also known as experiential virtual learning.

2.3 Experiential virtual learning

Experiential learning is the main modality of the museum learning environment. Virtualization is increasingly being integrated into museum learning. In 2008, for example, “Mystery @ the Museum” employed handhelds that engaged students to learn about artifacts by electronically “tagging” them to explore more at “a separate electronic workstation at a later time” ([13], p. 162). This system is built in the follow-up activities that some researchers suggested is important for long-term knowledge retention [4]. Virtual historical figures may now be “‘interviewed’ by clicking on them” ([13], p. 164). Students play characters and follow them through rooms,

learning different things about the historical figure based upon their “character” role. In conjunction with the virtual historical figures there are virtual objects, “which could be picked up and examined” by players (the students). The players may “show” virtual objects to characters [historical figures] who would then react accordingly” and provide additional information to the student ([13], p. 164). Students learn about the historical figure by playing a virtual part in that historical figure’s life. This is an engaging learning environment unique to museums where simulations facilitate students’ long-term knowledge acquisition and retention. Simulations give students the opportunity that they would otherwise not have because of logistical constraints.

The goal of experiential learning is to try to make history “more ‘real’ for students” ([24], p. 698). In a physical simulation of an 1840s wagon train, the researcher found that students “developed and refined such skills as were typical” of the people of the period ([25], p. 698). *Mystery @ the Museum* is an example of a virtual-physical hybrid simulation. According to Berson: “Simulations facilitate the development of students’ problem-solving skills and place students in the role of decision maker” ([15], p. 487). Students are active instead of passive. Another researcher asserted: “It is generally agreed that learners develop understanding for themselves in ways that differ, sometimes quite sharply, from other learners” ([34], p. 554). Museums are dynamic learning environments that “facilitate knowledge acquisition” in accordance with Howard Gardner’s research-based Multiple Intelligences (MI) Theory ([34], p. 554). Increasing learner confidence may lead to increased learner engagement. According to one of that study’s conclusions—on MI Theory-based instructional design and its correlation to student confidence—“Learner’s positive attitudes toward the instructional strategies may have led to confidence which in turn may have led to positive post-test scores” ([34], p. 568). This finding supports the conclusion of the large-scale study by Cassady and colleagues, that electronic field trips increase students test scores vis-à-vis those learners who did not use electronic materials [4]. Bouck and colleagues suggested that Universal design for learning (UDL) “offers a range of options” and is “intended to remove barriers and make learning accessible” ([10], p. 14). A research group used design for learning in their case studies of experiential learning lessons using virtual three-dimensional software. The study focuses on science students, but geography may also be taught using this same virtual technology [3].

The Virtual History Museum (VHM) is a “free, Web-based history learning environment” that “assists teachers in implementing UDL principles in social studies instruction” (p. 15). Currently, the VHM is perhaps a paragon of all-virtual museum learning based completely in the classroom [35]. Students analyze and interpret artifacts, explore various perspectives on those artifacts, and can even “publish their own interpretations of events” ([10], p. 15). The VHM is highly customizable. Curators (teachers) “put any digital information, or *artifacts*, on display for their students” and develop activities that involve students in investigations, interpretation, and history detective work ([36], p. 49).

Multiple Intelligence Theory seems to coincide with the VHM because of VHM’s student-centered approach. In discussing how students in science classes could benefit from virtualization technology, a research group suggested how student participation increases and benefits from cognitive gains over time because of VR and EFTs [3]. Teachers guide students to the web portal and students explore the museum interactively. They become engaged learners at every point in the discovery process. For example, teachers can customize exhibits within the VHM to emphasize text, artifacts, or combination of analytical activities depending on their student’s cognitive

levels and interests. Charts and question-and-answer activities require students to “synthesize across a variety of sources and offer their own interpretations” ([10], p. 16). Student engagement is part of the very design of the VHM—and students do not even have to leave the classroom. The learning experience is virtual and interactive, customizable and proactive. Social studies teachers can even encourage students to apply the past not just to the present but even analyze for the future using artifacts and texts to write a “prediction paper” based on what they have learned in the VHM learning environment ([10], p. 16.).

Students are more articulate and generally more sophisticated after using virtual technology to solve problems. In an early study on this topic, Barab and colleagues [3, 11] studied students working on a solar project with the software program *CosmoWorld*. Students were first confronted with a very confusing problem of planet alignment. Instead of using a handheld device like that used in the learning game *Mystery @ the Museum* [13], the students use the software *CosmoWorld* and ask questions of the teacher in what may be described as a Socratic seminar model. Inquisitiveness prevailed over confusion and disappointment. Students asked the teacher specific questions about how they could solve the problem of aligning the planets within a given view based upon their proportional distance from each other. One student even corrected the textbook because of the experiential lesson that only virtual technology could provide. A more self-sufficient mentality developed among students who used VR as indicated by their higher-level questions after the activity. One student asked about how to make the simulation even more realistic. Barab et al. [11] conclude: “Learners became engaged in the conceptually rich problem that required them to grapple with the nested issue” that was not obvious and probably would have been overlooked had they been in a low-technology classroom environment (p. 71).

Using virtual museums in the classroom addresses the audio-visual modality to energize students of history from a static to a dynamic view of potentially very fragile topics, such as the Holocaust [5]. Increasingly, museums are educational rather than memorial [27]. However, any topic in history is potentially delicate for some groups of students. Multisensory Instructional Packages (MIPs) tend to foster learning maximization. A study of MIPs [5] was in parallel with the EFTs of the study by Cassady and colleagues [4] and the VR study by Barab and colleagues [3]. In other words, the MIP seeks to utilize Gardner’s Multiple Intelligences Theory. MIPs are positioned “opposed to” the “traditional” classroom seatwork model ([5], p. 43). Like the study by Hsi [12], Farkas used a pretest and posttest to assess the control and experimental group of seventh grade students for how the MIP augmented multiple modalities for maximization of learning [5]. Specifically, the second question answered is what the difference in attitudes is after the MIP lesson. Farkas concludes that there was a practical and statistically significant difference between the control group and the experimental group. The experimental group that had the MIP-augmented lesson indicated “achievement, attitude, empathy, and transfer levels significantly greater than those” students who were taught by the “traditional approaches” ([5], p. 49). The implication is that virtual environments that encourage active student interaction with historical material and virtual figures augments student learning.

According to Yarrow, many children “need lots of stimulation to keep their interest” ([37], p. C5). “Virtual friends” and instant online communications “are, in short, the future of every company” ([38], p. xiii). If Gen Y (or “Gen BuY” as Yarrow and O’Donnell called the teenagers of the 2010s [38]) wants immediate virtual interconnectivity to keep their interest outside of school, then school has little choice but to

integrate this same platform into the learning structure. The Virtual Victorians interactive online exhibit integrates this understanding of the current trend in child psychology into educational psychology.

Virtual museum learning channels curiosity into learning to maintain student interest in the social studies content. The Virtual Victorians project makes a “small, successful museum-based education service” available to the greatest number of students ([8], 2004, p. 283). The United Kingdom-based project began in 2000 and is centered within the Tiverton Museum of Mid Devon Life. The interactive online exhibits are available all over the world to any school with an internet connection. The interactive Burma exhibit is likewise based within the Designated World Cultures Collection of the Exeter Museum. Like the Virtual History Museum, the Virtual Victorians project provides students with a virtual exhibit of the social history of the Victorian Age. Many of the artifacts displayed would normally be inaccessible during a physical fieldtrip. But because of technology, artifacts once sequestered away in a vault are now forever available any time at any classroom with internet. The classroom becomes an exhibit hall. The museum is interactive with “Ask a Victorian” and “e-toys” sections that use nearly real-time, multimedia experiences that allow learners to “manipulate” artifacts in simulations “to replicate the original Victorian experience” ([8], 2004, pp. 283–284). Virtualization has moved “place” from the exclusively physical to the virtual, so that the museum becomes the classroom, and students become travelers in cultures and times past.

Place-based learning fosters “wonder” among students, according to a study focusing on teacher candidates’ interaction with museum curricula [20]. This wonderment is tied to place. Museums focus on that wonderment of place vis-à-vis cultures. The place-based environment “allows students to become the creators of knowledge rather than the consumers of knowledge created by others” ([20], 2008, p. 84). But it is specifically virtual museums that may have the most flexibility to foster student-led knowledge creation. New historical methods being used to solve ancient mysteries via reconstruction of the past set a new frontier for the melding of high technology with social studies teaching. For example, the Village Ecodynamics Project “virtually recreated a prehistoric world, including everything from landscape to climate to human behavior. They were intent on solving several puzzles, including a cycle of population growth and decline from 920 to 1280 C.E., by which time the Pueblo peoples had left the area” of the Four Corners region of the United States southwest ([39], p. 140). Social studies lessons based in a virtually recreated environment have great potential for increasing student interest in history and social studies in general. Specifically, interactive virtual environments recreate a place and time that textbooks alone cannot recreate. Virtualization gives students the opportunity to interact with the past. Students do not just passively learn about static facts but, rather, they are encouraged within CVEs to draw inferences and solve puzzles based upon facts. Problem solving is important to team-building in life outside of school as well as in school, so virtual environments may maintain a more traditional academic rigor simultaneously with real-world historical puzzles.

Some researchers have suggested a paradigm with virtual place-based learning: “The virtual learning domain must be sufficiently credible, compelling, and indeed enjoyable, to create and sustain the virtual world in which they can believe” ([8], p. 288). In other words, students must use their imagination because they are virtually “playing a real Burmese xylophone,” or the students are “really asking a 12-year old Victorian girl a question” ([8], 2004, p. 288). Asking questions of virtual historical figures is knowledge creation based on the historical record. Museums may be like

“time machines” that take visitors on a journey back through time “to experience other periods and cultures” ([8], p. 288). With technological advances, virtual museums provide an even more compelling time machine than physical museums. The Virtual Victorians exhibit is not taking students “back” to a static past, however. Rather, it allows students to interact with a dynamic representation of the past. Students really do get to be a “creator of knowledge,” as some researchers mention [20]—but within the context of the traditional, physical museum. The study by [8] on the interactive Victorian exhibit suggested that school children shift the tense in which they ask a question of the virtual “Victorian child.” Students between the ages of 5–14 ask questions of the virtual Victorian exclusively in the *present* tense 35% of the time on average. Students aged 5–7 asked questions with mixed tenses (past and present) about 45% of the time, while students aged 5–11 asked questions exclusively in the past tense about 50% of the time on average. The fact that the study revealed that 35% on average of all students between the ages of 5–14 asked questions of the virtual Victorian in the present tense is pedagogically significant. The study suggests that the virtual museum is a success in immersing students in the interactive component of studying the given time period and culture. The vast majority of students aged 5–14 referred to the virtual Victorians in the second person (about 80%) while only about 2% said “the Victorians” ([8], p. 290). These findings support the notion that students are interacting with history rather than passively receiving information about history. Another researcher concluded that “emersion in a virtual reality world” helps all students—even students with severe disorders—to learn ([40], p. 539). In other words, students are in dialog with the past like they never were with static physical exhibits.

2.4 Virtual museums help foster a less restrictive environment

Virtual learning may be the least restrictive environment for students with severe disabilities [41]. Although virtualization of the curriculum is not necessarily the *least* restrictive environment, it may be a *less* restrictive environment for students with severe, low instance disabilities. A virtual museum may be the least restrictive environment for students with mild learning disabilities and some with low instance disabilities. Students with “severe emotional and behavioral disorders” ([37], p. 539) may also benefit from virtualization. A researcher noted that although much additional research is needed, the possibility that Virtual Reality environments can mitigate defiant behaviors in behaviorally impaired students is promising [40]. Virtual museums create at least a *less* restrictive environment, if not initially the *least* restrictive environment.

More learning-diverse classrooms have increased the urgency for flexible social studies curriculum that helps establish more equitable learning opportunities for all students [18, 41]. A study suggested that diverse student populations in general benefit from lessons designed around three-dimensional artifacts, because artifacts are visually interesting and can be used for audio and kinesthetic learners [23]. Museum artifacts also give students an opportunity to see a “piece” of history and work with each other. Byerly [24] notes that students “benefit enormously from [...] simulations that can take place within their classrooms” (p. 699). Sometimes a physical-virtual hybrid is the best that is available to a school—and that is okay because the learning is experiential and thus more likely to maintain student engagement [24].

Special education students who require assistive technology may benefit just as much as general education students do from the virtual technology models—Electronic Field Trips (EFTs), Virtual Reality (VR), and Multisensory Instructional Plans

(MIPs). A meta-analysis suggested that research on assistive technology should focus on “interdisciplinary collaboration” ([42], p. 28). Virtual museums build upon what their physical counterparts encouraged: peer collaboration. The Museum of Cultural and Natural History at Central Michigan University, for example, created learning kits with a task that included the following directions: “Now that you’ve described your object, go ahead and brainstorm with your partner what you think your object might be used for. Also, tell why you think this is so. What is your evidence?” ([23], p. 29). Students examined the mystery artifact in the first task, so the above directions for the second task required peer collaboration and higher-level thinking. This activity encourages students to learn and practice some basic historical and anthropological skills. Virtual museums—like their physical counterpart—encourage this interaction within the social studies. The artifacts that students analyzed in the study [23] are three-dimensional objects while students in other studies [7, 36, 39] did not necessarily have 3D renditions of artifacts but rather 2D representations. The final task recommended in the learning kit requires groups to explain to the class why they think the given artifact is what it is and what culture it may have belonged to in the past. The learning activity is a seven-step process that scaffolds information in more easily understandable chunks for students who may not have much prior knowledge. In other words, the Museum of Cultural and Natural History created learning kits that teachers could customize for individualized instruction.

The Virtual History Museum (VHM) facilitates learning for all students. Notably, “Students with disabilities made comparable knowledge gains to normally achieving and honors students and demonstrated improved historical reasoning after completing the unit” ([36], p. 49). They concluded: “Students expressed a great interest in the VHM and believed they had benefited from its use” ([36], p. 50). Every student in the study increased their participation in class when the VHM was part of the learning activity and “some students who did not complete their VHM activities within the allotted class time even asked to finish them either during their electives or advisory period” ([36], p. 50). The VHM turns the classroom into a museum, blurring the lines between traditional classroom with desks and traditional museum with static exhibits. Now, teachers are curators and students are participants in having a dialog with the past. Activities are dynamic because teachers customize exhibits to suit their students, thus maximizing the potential learning. Students invest their learning into the VHM in more ways than just the learning activity for a single day: their learning investment can be “published” to the “public side” of the museum. This is an efficient and fun way for students to show their parents or legal guardians what they accomplished at school. Publishing also provides students with the experience that their demonstrated learning is verifiable and memorable.

The success of the VHM with general education and special education students has a history of studies suggesting their usefulness. An initial study of the VHM included three eighth-grade general education social studies classes. Two classes were co-taught by a special education teacher [and] included students with mild disabilities. The third was an honors class. Students used the VHM over six class periods to learn about the contradictions in Andrew Jackson’s presidency [...] Results showed that the three groups of students were significantly different on pretests of knowledge and historical reasoning. However, when posttest scores were adjusted for pretest differences, posttest scores were comparable for all three groups. These results suggested that participation in this VHM unit leveled the playing field, enabling students with disabilities to learn as much as honors students over the course of the instructional unit. ([42], p. 9).

Not only did students with mild learning disabilities remain engaged in the lesson, but they also improved their knowledge retention via the VHM activities. The virtual museum is an interesting environment that gives students an active role; therefore, many students maintained focus. Writing skills, however, did not necessarily improve with the VHM. This is because writing is a skill that requires specifically taught “cognitive strategies” ([42], p. 10). The research on the VHM’s effectiveness as a learning tool—and environment—indicates that the virtual museum is a resounding success in augmenting student interest in the social studies and increasing student learning of social studies material [9, 10, 36, 42].

Freire and colleagues [41] conducted a study on how interactive white boards (IWBs) are a beneficial assistive technology for students with severe sight disability. The teacher used the IWB like a regular marker board while a “mediator” used a regular computer. The student with the eyesight disability used a “reader” program called *Virtual Vision*. The mediator transferred what the teacher wrote, and the reader program transferred to the student what the mediator wrote. The case study is based on a Geography class and the lesson for the day was the atmosphere. Freire and colleagues concluded: “Although the solution is not completely accessible for different groups of users ... the provision of means to make IWBs accessible to blind students is an important initial achievement” and “Making e-learning tools accessible to students with different abilities and disabilities is crucial to make these environments more inclusive” ([41], pp. 873, 875). The significance of this study on e-learning for museums is that it supports virtualization technologies in general to maximize student learning. In this example of students with severe sight disabilities, combinational lesson plans that utilize artifacts with IWBs would benefit these students. The artifacts serve as tactile learning in combination with the IWB.

Collaborative Virtual Environments (CVEs) are a combination of EFTs, VRs, and MIPs historically based upon physical equivalents. EFTs, VRs, and MIPs are interrelated virtual models that focus on providing the least restrictive environment for students to learn. CVEs facilitate communication for all students may interact with a virtual Victorian to learn about the social history of the Victorian Age much more effectively than if that same autistic student visited a physical museum with live actors [6]. Virtual museums also maintain the context for the conversation because the avatar will appear as a Victorian and the theme of the exhibit is clearly historical. The representations of the actual artifact or person are “readily understandable,” so that learners do not lose any time during interpreting and interacting with the CVE ([6], p. 239). Virtual interaction and collaboration is generally “interesting, fun, and easy to use” because the environment is virtually immersive for learning but physically distant ([6], p. 234).

Some researchers have suggested that social studies teachers who had students with mild learning disabilities felt “constrained” by the “traditional methods” of instruction [18]. Peer tutoring received 42% of the vote while special seating arrangements accounted for 41%. Teachers tried to provide a collaborative learning environment by encouraging peer tutoring, adult tutoring, and special seating arrangements. These strategies did seem to promote peer interaction, but the interaction was largely social instead of instructional [18]. CVEs became the answer to this concern. The Virtual Victorians exhibit and the *Mystery @ the Museum* game maintain focus on instruction while providing a peer interaction platform [8, 13]. A researcher summarized this as “Researchers have found many reasons for asserting that inclusion is a best practice in education” ([43], p. 301). CVEs help special education students be fully included in the general education classroom because of the flexibility in communication and the dynamics of the multisensory platform that can be attuned to individual students [6].

2.5 Student as apprentice

Student wonderment in social studies is a laudable teacher's goal for both general and special education students [20]. Perhaps all students should be given the opportunity for an immersive learning environment that encourages intrinsic interest in social studies material. Bouck and colleagues went a step further in their study by evaluating how "apprenticeships" in social studies classrooms with the Virtual History Museum encouraged students to not just learn historical facts but to actually "think as members of the discipline" ([9], p. 22). The diverse nature of the discipline of history and Social Studies presents specific challenges that teachers need to address to enhance student learning. Getting students to think like a historian "requires gathering information, analyzing multiple and often divergent perspectives, and then finally writing one's own interpretation or account of the event, person, or place" ([9], p. 23). This entire model of student-centered curricula is one in relative opposition to the textbook-based, memorization model that is facing increased criticism for overemphasis of "lower-order skills and a one-right-answer approach" that students consider "dull" ([9], p. 23). Although textbook learning is the dominant learning structure today, there is increasing integration of more interactive systems such as the Virtual History Museum (VHM) that fosters dynamic interaction with the past. The dynamic includes thinking like a historian. A research study suggested that "it is possible for students to be apprenticed into the discipline of history and come to understand multiple perspectives if instruction addresses this approach" ([9], pp. 35–36). Bouck and colleagues suggested the effectiveness of the thinking-like-a-historian goal of the VHM by describing the change a special education student exhibited during their study of the virtual apprenticeship model:

"Rick, a student with high-instance disability, did not complete a single paper-pencil activity in class through the entire observational period. However, he did participate in the online activities of VHM exhibits of Andrew Jackson and John Brown. VHM helped to move Rick's participation from periphery to the center, where he was able to contribute and demonstrate his knowledge as well as deepen the apprenticeship into the discipline of history" ([9], p. 36).

The historian "apprenticeship" study further suggests the educational potential of a highly integrated technological social studies classroom [1]. Encouraging students to become historians—to practice the discipline of history—engages them in learning in ways that textbook seatwork alone cannot. More research is needed, but the current research suggests the instructional power of virtual learning environments such as the VHM [9].

The VHM and classroom apprenticeships correlate with Multiple Intelligence (MI) Theory because an apprenticeship gets students to become historians in the classroom [1]. This allows for greater flexibility for the teacher to facilitate learning to the individual student rather than enforce the mono-modality of bookwork. MIT encourages teachers to prepare "learning-teaching environments ... and make educational situations more functional" ([2], p. 66). The VHM and interactive social studies classrooms in general are more functional relative to single learning modality memorization routines. The apprenticeships described by Bouck and colleagues [9] are more functional on a short-term and long-term basis because the interactive component fosters a student-led investment in learning. The function is application of learning. "Doing history"—or being a historian—is, for example, when a student takes

information and synthesizes it together to reconstruct a coherent story of the past. The emphasis is a historical story. There are multiple interpretations of the past. The virtual learning environment encourages students to interact with history instead of memorizing one set of facts devoid of creativity. The creative, interactive and exploratory process of student-as-historian may better induce knowledge retention and understanding of the idea behind history [5, 9, 12].

The apprenticeship model has been a major part of the place-based field trips with handheld computers. Hsi noted: “Learners sort out information, conduct investigations to satisfy their own questions and revise explanations as they gain new knowledge” ([12], p. 311). A study [5] that analyzed multisensory instructional methods for Holocaust history seems to support the findings of the later study [9]. The students in the experimental group who interacted with historical material via games and technologically integrated interaction with primary source documents “evidenced greater achievement gains than did students who received the same content via a traditional approach” ([5], p. 48). Although not an apprenticeship program on the technical scale of the study [9], the study suggests apprenticeship or apprenticeship without the name [5]. The experimental group received a multisensory instructional system in direct correlation to a decidedly “traditional approach” with the control group. The findings suggest a decisive advantage to the interactive approach. The proto-apprenticeship model where students used games and primary source analysis to reconstruct the past instead of memorizing a rote point of view—in other words, doing history in which the students were effectively history apprentices—may account for their higher achievement scores. The experimental group had a test score of 10.9 while the control (traditionally taught) group had a test score of 6.4 ([5], p. 48).

Getting students to learn and retain knowledge is a challenge that the Social Studies teacher may address most efficiently and effectively via the integration of virtual museums into the classroom. The research into the effectiveness of virtual technologies in the Social Studies context is relatively new. Although there is much room for additional research, the current research does suggest that virtual museums are effective in increasing student achievement. This achievement increase is accomplished, for example, by getting students to actively engage with historical material in the Virtual History Museum or with games such as *Mystery @ the Museum* and immersive virtual exhibits such as “Virtual Victorians.” The research generally suggests that all students—general and special education students—may benefit from virtualization technology. High technology allows for more efficient Electronic Field Trips (EFTs) that require fewer resources yet increase student involvement and even immersion into the Social Studies material. More recent studies have suggested the usefulness of virtual museums for student learning across several categories such as “type of artwork, transfer to virtual environment, presentation, transition, navigation, guidance and virtual reality support” ([44], p. 8945). Recent studies from 2020 onward suggest the advances in technology for virtual museum integration into social studies provide an effective way to foster student engagement with the content and discussing the content with each other [44–46]. Virtual museums, then, are a tool for teaching about social values throughout time [47].

3. Measuring learning units gained

A question arose after synthesizing the literature: How can a researcher assess the amount of student learning attained from virtual museums? I propose an equation that

may offer a means to measure the “Learning Units Gained” (or LUG) from student interaction with virtual museums. An answer to synthesis assessment question is the following equation, called LUG₁:

$$L = \sum_{k=1}^v k^{[t-p(s)]} \quad (1)$$

The goal of the LUG₁ equation is to find the value of L (or Learning Units Gained), which is how much learning occurred from student interaction with virtual museums. The summation of the number of virtual museums visited (v) by the factor (k) of their average posttest score (t) subtracted by their average pretest scores (p) multiplied by the number of students (s) as a mathematical power allows for researchers to determine an answer for a data set. The reason why this equation has $t-p(s)$ as a raised power to s is because of the presumed exponential nature of learning. L is essentially an absolute number because learning will be a positive number. In other words, test scores are quantitative measures of learning; however, not all learning can be quantifiably measured because of “social and cultural influences” ([48], p. 159). The constructivist view “is structured by our individual minds on the basis of our interaction” ([49], p. 390). Therefore, the learning factor (k) is an exponential to estimate learning within a presumed margin of error in favor of more learning having probably occurred outside of measurable (posttest-pretest, or $t-p$) parameters. This is also necessary because the number (L) is derived from the summation as representative of the learning that students added to their minds and has no comparative numerical measure, per se. In other words, L does not necessarily mean anything quantitatively, but L does suggest a quantitative impression or potential dependent upon the researcher. This impression will have quasi-quantitative implications when more case studies are completed, because L from the first study may be contrasted with L from the second study and the next case study *ad infinitum*.

For example, there is a class of 50 students on a virtual museum visit. They go to one virtual museum. Their pretest score average is 60% and their posttest score average is 80%. The LUG₁ equation is used to derive the answer to the question of how much learning occurred:

$$\begin{aligned} L &= \sum_{k=1}^1 k^{[t-p(s)]} \\ L &= 1^{[0.8-0.6(50)]} \\ L &= 1^{[(0.2)50]} \\ L &= 1^{10} \\ L &= 1.0 \end{aligned} \quad (2)$$

The answer of $L = 1.0$ may be established as the baseline LUG. Divide L by the number of students and the researcher gets an answer for the LUG per student ratio:

$$1.0/50 = 0.02 \text{ LUG per student} \quad (3)$$

The posttest and pretest average scores are in decimal format to keep L a smaller number while retaining potential numerical significance. The next study of 50 students

may have different test score averages, so L would be compared with L from the first study and so on. These data could then be analyzed for patterns and the researcher could more definitively assess the meaning of L (or Learning Units Gained). Also, if v is greater than 1, then the equation may have an increased exponential drift, because if $v = 3$ then those 50 students visit three virtual museums, and this hypothetically allows for an exponential increase in learning. The next example features the same parameters as the first, except that 50 students visit three virtual museums. Test score averages will remain the same (at 80% posttest and 60% pretest scores) in this example:

$$\begin{aligned}
 L &= \sum_{k=1}^v k^{[t-p(s)]} \\
 L &= \sum_{k=1}^3 k^{[.08-0.6(50)]} \\
 L &= 1^{[0.8-0.6(50)]} + 2^{[0.8-0.6(50)]} + 3^{[0.8-0.6(50)]} \quad (4) \\
 L &= 1^{[(0.2)50]} + 2^{[(0.2)50]} + 3^{[(0.2)50]} \\
 L &= 1 + 1024 + 59,049 \\
 L &= 60,074.00
 \end{aligned}$$

Then divide the aggregate L (or LUG) by the number of students (s) to find the per student LUG ratio: $60,074.00 / 50 \approx 1201$ LUG per student.

The exponential drift in this hypothetical is numerically large and perhaps statistically significant. Note that if those same 50 students visited only two virtual museums, they would gain 20.5 LUG per student. Compensate for the exponential drift by dividing it by the number of students again or leave the exponential drift with an explanation of why it remains in the data for constructivist reasons. Either way, the exponential drift may remain in the data for the researcher to explain that the learning gained by students is partially subjective to outside variables not measured. Therefore, the exponential drift is acceptable in the LUG equations because the exponential accounts for the partial subjectivity in measuring the amount of learning a student or group of students attains. In the hypothetical, the first group established a baseline LUG of 1.00 (aggregate) and 0.02 (per student) and the second case study found that the same group of 50 students had 60,074.00 (aggregate) LUG and 1201 LUG (per student) after visiting three virtual museums.

This hypothetical raises the question: Would the third virtual museum visit really cause nearly 58 times more learning units gained based upon the pretest and posttest score averages? There are two answers that are explained in this chapter. One answer is that case studies would have to be conducted to suggest a research-based answer. The second answer is that in addition to more research, the researcher could also use another variant of the LUG₁ equation. The second equation is referred to as LUG₂ equation:

$$L = \sum_{s=?}^v s^{t-p} \quad (5)$$

The goal of the LUG₂ equation is to find the value of L (or Learning Units Gained), which is how much learning occurred from student interaction with virtual museums. The summation of the number of virtual museums visited (v) by the number of

LUG equation LUG ₂ LUG ₁	One virtual museum visited by 50 students	Two virtual museums visited by 50 students	Three virtual museums visited by 50 students
$L = \sum_{s=?}^v s^{t-p}$	$L = \sum_{s=50}^1 s^{t-p}$	$L = \sum_{s=50}^2 s^{t-p}$	$L = \sum_{s=50}^3 s^{t-p}$
Symbols Key	$L = 50^{(0.8-0.6)}$	$L = 50^{(0.8-0.6)} + 100^{(0.8-0.6)}$	$L = 50^{(0.8-0.6)} + 100^{(0.8-0.6)} + 150^{(0.8-0.6)}$
<i>v</i> (virtual museums visited)	L = 2.19	L = 2.19 + 2.51	L = 2.19 + 2.51 + 2.72
<i>s</i> (# of students)		L = 4.7	L = 7.42
<i>t</i> (posttest score average)			
<i>p</i> (pretest score average)			
<i>L</i> (Learning Units Gained)			
Σ (sum of)			
$L = \sum_{k=1}^v k^{[t-p(s)]}$	$L = \sum_{k=1}^1 k^{[t-p(s)]}$	$L = \sum_{k=1}^2 k^{[.08-.06(50)]}$	$L = \sum_{k=1}^3 k^{[.08-.06(50)]}$
<i>v</i> (virtual museums visited)	$L = 1^{[0.8-0.6(50)]}$	$L = 1^{[0.8-0.6(50)]} + 2^{[0.8-0.6(50)]}$	$L = 1^{[0.8-0.6(50)]} + 2^{[0.8-0.6(50)]} + 3^{[0.8-0.6(50)]}$
<i>k</i> (factor)	$L = 1^{[(0.2)50]}$	$L = 1^{[(0.2)50]} + 2^{[(0.2)50]}$	$L = 1^{[(0.2)50]} + 2^{[(0.2)50]} + 3^{[(0.2)50]}$
<i>t</i> (posttest score average)	$L = 1^{10}$	$L = 1 + 1024$	$L = 1 + 1024 + 59,049$
<i>p</i> (pretest score average)	L = 1.0	L = 1025	L = 60,074.00
<i>L</i> (Learning Units Gained)	Then 1.0/50 (# students)	Then 1025/50	Then 60,074/50
Σ (sum of)	$L = 0.02$ per student	$L = 20.5$ per student	$L \approx 1201$ per student

Hypothetical comparison between LUG₂ and LUG₁ equations.

Bolded lines in Table 1 signify the answer to the equation when all inputs are calculated.

Table 1.
Learning units gained (Lug) equations.

students (*s*) and their average posttest score (*t*) subtracted by their average pretest scores (*p*) as a mathematical power allows for researchers to determine an answer and data set. The reason why this equation has *t-p* as a raised power to *s* is because of the presumed exponential of learning.

As seen in Table 1, the key difference between LUG₁ and LUG₂ equation variants is that LUG₂ keeps *L* a smaller number by several factors while retaining potential numerical significance. For example, the hypothetical study of 50 students who visit two virtual museums may have different test score averages, so *L* would be compared with *L* from the first study and so on. These data could then be analyzed for patterns and the researcher could more definitively assess the meaning of *L* (or Learning Units Gained). Also, if *v* is greater than 1, then the equation may have an increased exponential drift, but the drift of LUG₂ is far less than LUG₁. Deciding which equation to use to measure student learning from visiting virtual museums may depend upon how much learning may have occurred outside of measurable variables. For example, if a regular class performs at an honors level on the posttest, then perhaps LUG₁ may be a better measure of student learning from virtual museum visits.

The answers from the hypothetical case studies indicate an exponential increase in LUG per additional virtual museum visited (*v*). There is a smaller exponential drift

with the LUG₂ equation than what occurs in the LUG₁ equation. Therefore, the researcher would select which equation to use based on local variables. The LUG equations also have a default assumption that there is only one posttest; therefore, the score carries through the equation. Ultimately, these related equations comprise a proposal to begin the process of establishing a quantitative data set for qualitative analysis of the amount of learning students gain from virtual museums.

4. Conclusion

The exploration of learning through virtual museums highlights the transformational potential of technology in social studies education. By quantifying the learning gains (LUG), researchers can provide valuable insights into the efficacy of virtual environments as tools for enhancing educational outcomes. The exponential growth observed in the theoretical LUG underscores the importance of integrating virtual museums into teaching strategies, enabling personalized learning experiences and greater accessibility. This approach is not only a step toward bridging qualitative and quantitative analysis but also suggests an additional way for innovative methodologies that evidence diverse learning styles and needs, reinforcing the relevance of this study in discussing the future of interactive and inclusive education with virtual museums in social studies education.

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Chapter 3

Curating at the Threshold: Public History and Museological Listening in the Artwork of Sérgio Panceri

Michel Kobelinski

Abstract

This chapter proposes a sensitive listening to the artwork *Parallel World* and to the curatorial actions it inspired in 2024 at the Deolindo Mendes Pereira Museum in Campo Mourão (Paraná, Brazil). More than an exhibition, it unfolded as a constellation of gestures—artistic, technological, affective—woven around the work of Sérgio Egídio Guevara Panceri (1998–2017), whose fragmented poetics interrogate belonging, pain, and identity in a world in ruins. Like a tear in the institutional fabric, the exhibition *How Did Sérgio Panceri See and Feel the World?* refused clarity and caption. Instead, it embraced folds, shadows, and attentive listening. Art was not explained; it was inhabited. For a moment, the museum ceased to be a showcase and became a shelter: a liminal space, suspension, and relation. Curatorship, grounded in the practices of public history and critical museology, operated as both ethical and aesthetic mediation—with Easy Read materials, digital catalogs, and collaborative activities extending the temporality of the encounter. Rather than offering answers, it invited slowness, implication, and vulnerability. Through this movement, the museum's boundaries expanded: the visible became porous, the sensitive became political, and pain became a shared language. Thus, the exhibition inscribes itself not as a finished discourse but as a shared wound—a pedagogy of the unfinished, where seeing is also a way of being touched.

Keywords: digital mediation, inclusive education, participatory curation, emotional engagement, contemporary art

1. Introduction

On a discreet wall, in a forgotten corner of the room, hung a painting. No caption. No label. No institutional gesture offering clues—nothing that translated, nothing that said, 'Here is the artist'. Just the painting. Expressive in its silence, silent in its excess. There, motionless, waiting for a gaze to linger on it. Not a hurried glance, but one that lingers—and, in the gesture of lingering, begins to unravel meanings. As if the work of Sérgio Egídio Guevara Panceri (1998–2017), housed in the collection of the Museu Municipal Deolindo Mendes Pereira (MDMP), in Campo Mourão (PR),



Figure 1.

Drawings created by visitors during the exhibition How did Sérgio Panceri see and feel the World? interacted with the curatorial display. December 2024. ©Michel Kobelinski. Parallel World, painting by Sérgio Egídio Guevara Panceri (2015–2017) exhibited at the Deolindo Mendes Pereira Museum, 2024.

were waiting [1].¹ Not just exhibition, but listening. Not just presence, but someone willing to glimpse—in this between worlds in contact and distance—what manifests and hides there—**Figure 1**.

Public history is not only found in archives or in the words of experts; it also inhabits paintings, poems, bodies, and gestures. In asking ‘Where is public history?’, Kean shifts the focus from what public history is to where it takes place—inviting us to recognize the multiple spaces and forms through which the past is activated in the present [2].

It was from this inaugural unspoken statement that this study began. It started with a question about absences. What are the conditions for the legibility of the painting *Parallel World*? How can it be made visible without domesticating it? What forms of mediation would be capable of carefully touching a work shrouded in silence? To this end, the curatorial and educational strategies anchored in the principles of public

¹ Sérgio Egídio Guevara Panceri (Guasualito, Venezuela, April 27, 1988 – Campo Mourão, Paraná, March 21, 2017) was a visual artist, poet, and musician. A naturalized Brazilian citizen, he began his career in painting in 2016 as a form of intimate expression and social criticism. His work explores themes such as loneliness, anguish, spirituality, and exclusion, using intense colors and symbolic figures. He passed away at the age of 28, leaving behind a sensitive and provocative legacy.

history and expanded public curatorship were employed. It is not just a matter of conservation. It is essentially about engaging senses and making the museum a space for listening, participation, and emotional interaction.

Part of the 18th edition of Primavera dos Museus (Museum Spring, September 2024), whose theme was ‘Museums, Accessibility, and Inclusion’, the exhibition proposal *How did Sérgio Panceri see and feel the world?* Resisted univocal interpretations. Instead, it offered a sensitive platform—multisensory, textual, visual—for the activation of memories, subjectivities, and emotions in transit. Immersive technologies, accessible resources, and critical pedagogies converged there to expand the margins of engagement with audiences delicately.

Between September and November, the actions unfolded through collaborative educational and curatorial practices with various audiences, culminating in December 2024 with the public exhibition of the work and the launch of the *Easy Read* booklet at an event attended by the artist’s family.² This trajectory reaffirms the procedural nature of curating—understood not as a gesture of Authority but as shared listening, an ethical gesture of sensitive translation, and the creation of bonds.

The curatorial strategies—flute recitals, biographical accounts, images generated by artificial intelligence—did not operate as props. They functioned as aesthetic mediations, as ways of listening. Narratives intertwined with the bodies and stories that approached the work. The researcher-curators left their position as experts to become mediators of shared experiences—not to say what the academic work is, but to open space for what it can be. And even centred on a single piece from the physical collection, the curatorship expanded [3]. It became digital, accessible, and polyphonic. Because listening, when it is ethical, requires a multiplicity of devices.

Contemplating the work was also performed in it, recognizing oneself, questioning oneself, and narrating oneself. The performance here is not a spectacle—it is a doubling [4]. It is part of Panceri’s creative gesture, which, in the literature of O Null (The void) and the paintings, always seems to want a little more: to make itself present. To summon. To breathe in the exhibition space. Not to be shown but to be accompanied. The project was, therefore, born from this impulse to share that pulsates in the painting. One. Silent. And yet immense.

The curatorial team created a digital catalog, collaborative virtual activities, and materials in an accessible *Easy Read* format as an extension of this curatorial gesture. Not to ‘translate’ the artist but to democratize the encounter. To diversify the forms of aesthetic appropriation. To allow more bodies, more voices, and more gazes to meet there—in the interstice between art, memory, technology, and cognitive justice. This study belongs to that fragile interstice where mediation does not resolve but reverberates, where participation does not conclude but continues. It approaches the image not to decode, but to dwell—tracing its surfaces, remaining with it in the company of doubt.

2. Curating in hybrid times: Between public history and aesthetic mediation

The gesture involves shifting the axis. A gesture of curatorial authority toward a shared meaning-making—involving communities, technologies, and sensibilities.

² *The Easy Read booklet How Did Sérgio Panceri See and Feel the World?* (2024), produced as part of the exhibition project at the Deolindo Mendes Pereira Museum, is available online at: <https://drive.google.com/drive/folders/1LxcJnnkVhyQHGUQTBY4VYk3yTt6oSD4g?usp=sharingIFS> 2016 [Accessed: June 11, 2025].

This shift is part of the MDMP's experience with Sérgio Panceri's work *Parallel World*: a situated, tense, porous public curatorship. It was not enough to make the work visible. It was necessary to touch it through other expressive forms [5]. It is essential to build passages between sensibilities and between audiences. The museum, then, ceased to be a space for exhibition and became a place for relational encounters. Mediation became aesthetic and affective, thereby breaking with traditional models of enunciation—both physically and digitally. Public history, in this sense, is no longer just a document or discourse. It becomes a gesture. And the gesture, here, is both historiographical and activist. Rooted in values. Unstable, yes. But necessary.

This curatorial gesture, understood as both historiographical and affective, aligns with the perspective of David Dean, who proposes that public history is not only written but also performed [4]. Drawing from performance studies and collaborative practices, Dean argues that historical storytelling—whether through exhibitions, theatre, or digital narratives—is always embodied, relational, and ethically charged. In this view, curators, like historians, become performers of the past, mediating between sources, technologies, and audiences through gestures of shared meaning-making. Performance, then, is not spectacle, but a mode of inhabiting and reactivating the past in the present, a form of public engagement that emphasizes vulnerability, co-presence, and imagination.

By employing multiple modes of reception—listening, reading, immersive contemplation, and digital interaction—curatorship does not merely expand the museum's reach. It broadens the museum itself as a sensitive form. It repositions it. It becomes a space for the critical performance of memory. A space for listening, not for imposition. And in front of images such as Panceri's—traversed by pain, exclusion, and subjective fragmentation—the public is also transformed. Not just a spectator but part of the encounter.

This concerns constructing aesthetic and affective mediations that can refigure modes of museological enunciation. This practice, rooted in listening and co-presence, aligns with what we might call civic public history—a practice in which the curatorial gesture also becomes a historiographical act committed to democratic values, sharing the meanings of the past, and creating spaces of belonging. As one definition puts it, 'Civic public history involves collaborative practices in which citizens with different skills, perspectives, and experiences actively participate in the design and execution of projects for research, interpretation, and co-creation of narratives about the past' [6]. This is where mediation becomes central—not only technical but ethical. Mediation, in this context, does not translate; it connects. It does not decode; it listens. From this perspective, civic public history projects are geared toward social transformation. They carry, in their structure, a deep commitment to the people and communities involved—to their well-being, their memories, and the safeguarding of their stories. Moreover, they foster sensitivity, imagination, and creativity.

By employing multiple modes of reception—such as listening, reading, immersive contemplation, and digital interaction—curatorship repositions the museum as a space for the critical performance of memory and attentive listening. In this scenario, the public's engagement with the past is transformed, especially when confronted with images that evoke pain, exclusion, and the fragmented subjectivity of the artist.

Against this backdrop, the experience with Herman Schiefelbein's work resurfaces as an echo and counterpoint [6, 7]. The canvases of the early twentieth-century German artist have not only returned to light. They have been rewritten. They have become living material for projects of public mediation, local memory, and shared creation. When communities get involved—in short films, urban interventions, and intergenerational listening—art ceases to be an object and becomes a process. Here, the past does not return as a document but as a presence to be reimaged. What matters, perhaps, is not what was but what can still be—in the friction between territory, art, and memory. Thus, the potential of public art and the senses of history, place, and past are revealed [4, 8].³

Serge Noiret draws our attention to what he calls the digital turn—but it must be accompanied by critical care. He distinguishes digital public history from digital humanities, and in this gap, a new field emerges: one that is transdisciplinary and permeable [9, 10].⁴ In it, the public historian is no longer the expert who explains but the ethical mediator who articulates between plural narratives, between technologies, and between collective memories. Their task is not to instrumentalize tools but to use them to reinvent ways of listening, interpreting, producing, and sharing. Ways of thinking and doing are based on active listening, public responsibility, and co-authorship. These principles are fundamental to the production of historical meanings in digital environments.

Despite the impact of digital humanities and digital public history, a robust theoretical framework remains lacking. Artificial intelligence is not immune to criticism, validation criteria, algorithmic bias, and systemic opacity. Without them, there is a risk of reducing AI to a mere tool—far removed from public responsibility.

Juliana Marques and Suemi Higuchi [9, 10] illustrate the other side—the power of these innovations [11]. They show how the Semantic Web and AI can transform museums into interconnected data laboratories. At the Center for Research and Documentation of Contemporary History in Brazil—Getúlio Vargas Foundation (CPDOC/FGV)—missing titles of manuscripts were generated by generative AI and validated by human curators. Historical interviews were transcribed with Whisper. Manuscripts by anthropologist Gilberto Velho were deciphered using optical character recognition (OCR) and enriched with language models. The Bodleian Library's neural networks restore engravings.

In Latin America, similar initiatives are repositioning museums as participatory digital ecosystems. The Museu da Pessoa in São Paulo intertwines oral testimonies with open ontologies. It tests neural networks for real-time multilingual transcription. In Santiago, Chile, the Museo de la Memoria y los Derechos Humanos applies computer vision to recognize faces in protest images—and reconnect them to history. Marques and Higuchi are right: open technologies such as RDF, CIDOC-CRM, and

³ For Glassberg ([8], p. 6), there are intersections between the intimate and the historical, where past events of a personal and public nature are intertwined, allowing public histories to reverberate strongly—and sometimes surprisingly—in shared spaces.

⁴ Noiret defines digital public history as a historical practice that aims to engage the public through digital platforms by emphasizing the active and collaborative participation of users in constructing historical narratives. Digital humanities, on the other hand, refer to a transdisciplinary field that uses digital technologies to study and disseminate knowledge in the humanities and social sciences, combining traditional methods with new digital approaches.

IIIF, when combined with AI and supported by ethical governance, do not remain silent⁵. They listen. They expand without silencing the historian's mediation and ethics.

But listening is not enough. What is heard must be qualified. And therein lies the tension: how to democratize access without losing critical density? How can curatorship be opened to participation without dissolving narrative coherence? The public historian, as Noiret proposes, walks this tightrope between technology and commitment. They must keep listening without giving in to dispersion. They must ensure plurality without sacrificing historical responsibility.

They propose another gesture: reframing expertise. Making it an encounter—between specialized knowledge and lived experience: 'what is at stake is not simply ceding control, but reframing expertise as something that takes place in the encounter between specialized knowledge and lived knowledge' ([10], p. 15).

The museum, then, ceases to be a transmitter. It becomes an intercessor. An active listener. A liminal space. That is, historical knowledge emerges from the challenges and possibilities between academia and its audiences. Nina Simon reinforces the promise—and the risk. Yes, the logic of Web 2.0 diversifies experiences. But it can also dilute them. Without clear criteria, participation becomes dispersed.

The museum loses its curatorship and gains noise. And noise, without critical mediation, is not polyphony: it is silence in disguise. The risk of dispersion and superficiality hangs in the air. The absence of strategies to qualify visitors' contributions can compromise curatorial coherence and dilute the critical role of museums.

Myriam Dalal, in turn, offers an ethic of care. In the Ya Bayti project, which supports Syrian refugees in Esch-sur-Alzette, Luxembourg, she demonstrates that participation is not just about being present [14]. It is continuity. It is security. It is listening to other narrative modes—where sound, music, and even silence tell stories. The migrant grandmothers continue to narrate even after the official end of the project. Because memory, when listened to, does not end; it has the power to linger.

From this, a question insists, persists, and returns—like an image that refuses to disappear: how do we reposition technology? How can we make it not a prosthesis of technique but an extension of listening? Artificial intelligence cannot—and should not—replace mediation, listening, or historical intent. The curatorial gesture, on this horizon, cannot be automated because it is born from encounter. It is not about replacing; it is about expanding. Expanding in dialogical, sensitive, ethical, and collaborative terms—like someone who draws a line not over the other but alongside them.

Initiatives such as the Max Planck Institute's CorDeep and DeepMind's Ithaca project demonstrate that artificial intelligence can be more than just a classification

⁵ RDF (Resource Description Framework): W3C standard for semantic description of data in triples (subject, predicate, object), forming the basis of the semantic web and linked data; see W3C – World Wide Web Consortium. RDF 1.1 Concepts and Abstract Syntax. 25 February 2014. CIDOC-CRM (Conceptual Reference Model): Ontological model developed by ICOM to describe and interconnect information about cultural heritage, promoting interoperability between heterogeneous databases—see Doerr [12]. IIIF (International Image Interoperability Framework): Set of open protocols that enables access, sharing, and standardized visualization of high-resolution digital images, especially in the context of cultural collections—more information in: Sanderson and Van de Sompel [13].

machine. It can be a relationship machine. The Venice Time Machine, from the Federal Polytechnic School of Lausanne, also reveals this potential—not as a technical idealization, but as an expanded field of mediation. These projects use algorithms to assign dates, reconstruct historical social networks, and interpret the fragmentary documents. Furthermore, based on the literature, they can create images with AI that connect transnational narratives between Europe, Africa, Asia, and the Americas. These images do not impose; they appear alongside the viewer—co-authored, refracted, shared in the plural time of public history [15].

In this gesture, something bigger is outlined: a radical reconfiguration of the production of historical knowledge. Artificial intelligence, in this context, ceases to be an instrument of surveillance or exclusion, becoming a tool for social mobilization, community education, and epistemic resistance. When combined with listening, mediation, and curatorial intentionality, it does not automate knowledge: it expands it—in the margins, in the interstices, in the voices that were once noise and now become history.

As Noiret reminds us, digital public history is not just a tool [16]. It is an ethic—and, in this case, a civic ethic—an ethic of authorship, memory, and listening. Connecting, collaborating, and co-creating—more than methods, these are ways of affirming that history is plural and, when shared responsibly, also becomes an exercise in citizenship. Making history here is making connections.

3. The MDMP and the volatile experiences of public curatorship

Founded in 1984 in Campo Mourão (PR), the MDMP has become a space for transforming how history is narrated, and collective identities are shaped. Over time, it began experimenting with curatorial practices that focused on public memory—new ways of listening, exhibiting, and fostering a sense of belonging. Although the museum was initially built on a heroic narrative of ‘pioneers’, rooted in a white, male, Eurocentric perspective, it has slowly opened itself to critical reflections and technological experimentation. Like opening windows in an old house, this shift allows fresh air and new temporalities to flow in.

Projects such as Pop-Up Museum: Sharing Stories (2019) and its subsequent 2021 version marked more than a curatorial turn [17, 18]. They represented moments of rupture—shifts toward inclusion, performativity, and horizontality. For a moment, the museum stopped speaking to and began talking with. Drawing on multisectoral curating and protocols developed by Nora Grant and Michelle DelCarlo, these initiatives sought to blur the boundaries between the museum and the street, the collection, and life. They materialized as ephemeral, collaborative, and provocative exhibitions located in public, digital, and institutional spaces. Memory was deliberately spread across unexpected places [19].

During the Covid-19 pandemic, this openness did not vanish—it migrated. In the decentralized structure of Pop-Up Museums Brazil (2021), curatorial practice found ways to persist amid confinement. Without a physical venue, presence took other forms: virtual soirées, poetry readings, home videos, and visual reinterpretations. Memory fragments were collected through public calls and shared on open platforms such as Omeka. These technical tools proved far from neutral; they demanded curating be reconceived as relational, adaptive, and affective. They allowed tension,

welcomed noise, and transformed instability—that uncomfortable matter—into creative and inclusive strength [20].⁶

The proposal gradually expanded—not in size, but in depth. It embraced incisive reflections on Indigenous memory and colonial disputes. Exhibitions such as *Ciclo Mirandino* and *Imagens dos Contatos and Confrontations* (2021) created rather than displayed tension. These were not showcases but fields of friction, where archive and territory, past and present, rubbed against each other. Curation ceased to be a single authorial voice and became a shared platform. Students, artists, and community leaders did more than participate—they imprinted meaning, redrew boundaries, and inscribed their stories onto the images. Documentary research was enriched—even transformed—by oral testimony and local knowledge. This produced a vibrant, living memory. Colonial images were not presented as reiterations of violence but activated as fissures—cracks through which the present could emerge in workshops, conversation circles, and spontaneous creations.

In 2024, exhibitions such as *Womanities* and *Making History and Us*, *Plural Women* deepened MDMP's engagement with feminist curatorial practices [20]. In partnership with women's groups, long-buried images resurfaced: anonymous women, teachers, factory workers, mothers, activists. They came not alone but accompanied by stories, poems, and emotional traces. These elements formed a dense mosaic of subjectivities and silenced histories. Each rescued face became a question of time. The phrase emblazoned on banners—'Do you recognize these women?'—did not seek factual answers. It issued a call, an invitation to discomfort, a prompt for collective memory to move beyond passive contemplation [21].

The impact extended far beyond the exhibition room. It reverberated on social media, in tears, in whispered messages: 'I was moved to see my grandmother in the picture', 'This story is also mine'. Here, public curatorship became more than mediation—it became recognition. It became an act of symbolic reparation: a hand extended between generations that never met but now touch. As Martinon [21] suggests, these are confessional exhibitions, in which what is displayed also reveals what has been left out [22]. Because curating now involves 'engaging with, selecting, arranging, critically evaluating and sharing culture in general', such revelations force us to consider the ethical implications of every inclusion and omission.

This perspective sharpens when visual culture is seen as a site of dispute—where visibility has been shaped by centuries of omission. A review of MDMP's photographic collection revealed a notable void: images of men are abundant, while those of women are scarce. By confronting this absence—not through replacement but through active presence—the museum challenged epistemic inequality. It created a tear in the visual order.

As Tula Giannini [22] has proposed, the museum is understood as a 'contested space', traversed by performances, protests, and digital actions that destabilize hegemonic narratives and establish alternative forms of presence [23]. In this sense, the 'digital ecosystem' establishes new modes of agency: audiences are no longer passive

⁶ According to the author "[...] inclusive curating is an applied process that works to demystify curating by breaking down curatorial tasks and decisions to enable more people to express their exhibition ideas as critical inclusive curators. Rather than a traditional curatorial model whereby a "professional" curator produces an exhibition, alternatively, inclusive curating is a process that empowers community groups to curate exhibitions with the guidance of a facilitator. From this perspective, inclusive curating relates to three basic questions: first, what are the curatorial tasks, second: how do the individuals involved work together, third: how are decisions made? ""

recipients but active co-creators and critics, connected by networks and shared experiences. Consequently, museology is reconfigured not only as an exhibition practice but also as a space for cultural, affective, and political negotiation. This is sustained by institutional listening, adapting content to social demands, and strategically using technologies such as interactive texts, hashtags, and open databases as tools for democratizing museum narratives. Disruptive actions do not imply disorder but rather an ethical openness to dissent, plurality, and the symbolic reinvention of museums within the context of a post-digital world.

This disruptive gesture also reached the digital realm. After the museum's 2024 renovation and online rebranding, its Instagram (@museu_cm) described itself as 'a museum of history, of everyone and for everyone'. But a closer look told another story. An analysis of 200 posts (2020–2025), collected *via* Apify Instagram Scraper and compiled into CSV and PDF formats, revealed what remained unseen⁷.

Of the 196 posts featuring photographs, most fell into two series: 'Photo of the Day' and 'The Owner of the Street'. These series repeated a monumental, masculine visuality—of politicians, engineers, and businessmen. Forty men were featured alone; only four women received similar attention. Terms like 'mayor', 'governor', and 'hero' appeared frequently. In contrast, words like 'mother', 'driver', or 'first lady' were used occasionally and decoratively. Just 4.5% of posts addressed women, Indigenous peoples, or social justice themes.

This imbalance is no accident. It is a gesture—even if unconscious. According to Murley, for example, 'the repeated use of masculine imagery and language produces what could be called patriarchal visuality: a worldview in which progress is associated with white male figures, while everything else is marginalized' [26]. A worldview where progress is aligned with white male figures and all else is relegated to the historical margins [27].

In response, erasure was not proposed. Discomfort was. A gesture of ethical hacking: not to destroy, but to reopen. Hacking here means recombining data, reinterpreting images, and writing alternative captions. It means unsettling the assumed neutrality of institutional imagery. The goal is not to replace one showcase with another but to transform the showcase into an arena—symbolic, affective, unstable. A space where memory can be reclaimed by different voices, bodies, and questions.

Despite institutional instability and technical limitations, the MDMP between 2019 and 2025 became more than a museum. It became a space of critical vulnerability, mutual care, and political reinvention. A place not only to celebrate the past but to question it. A place where the present allows itself to be affected.

Through participatory methods, shared authorship, and a commitment to sensitive exhibition experiences, the museum stopped acting solely as a guardian of history. It became, however, provisionally, a catalyst for transformation. Not through abrupt change, but as one who feels their way forward. As one who opens space.

Various MDMP administrations indeed supported experimental curatorial proposals, welcoming external projects like the Pop-Up Museum and feminist

⁷ CSV (Comma-Separated Values): A simple text format in which each line represents a record and the values are separated by commas or semicolons. Ideal for storing and exchanging tabular data—such as metrics extracted by the Apify Instagram Scraper—because it can be read by spreadsheets, databases, and analysis scripts. See: Shafranovich [24]. PDF (Portable Document Format): A fixed-layout file format created by Adobe to preserve text, images, and formatting across any operating system. It is an archiving format that maintains its original appearance regardless of the device. See: International Organization For Standardization (ISO) [25].

exhibitions. Yet this openness sometimes encountered half-open doors. Access to the photographic collection remained partially restricted. Image releases, metadata availability, and archive mediation were inconsistent—not rights, but favours. Often, access depended on personal connections and quiet persistence.

This ambivalence is not merely a management issue; it reflects a broader field. It reveals how symbolic progress, and collaborative practices coexist with structural barriers. Where powerful gestures intersect with the weight of entrenched systems.

In this light, what matters most is not only what the curatorial actions achieved but what they disrupted: the shaken structures, the disturbed silences, the trembling hierarchies. Cracks in the wall—small but revealing. Flashes—brief but unforgettable—in the still uneven landscape of Brazilian museology.

4. The aesthetic-literary dimension of the O Null: Transmedia and the exhibition of the sensible

Though O Null was not part of the official exhibition, it remains essential to understanding the artist's poetics [28]. Much like in his painting, Panceri used a hybrid logic of aesthetic and narrative forms to radically explore subjectivity and language.

From its dedication—'I dedicate this book to those who helped me complete it, directly or indirectly...'—to its epilogue, which includes protest poems, the book presents itself as a hybrid literary artefact [29]. It functions simultaneously as an intimate diary, a pictorial gallery, a poetic notebook, and a manifesto against the silencing of personal suffering. The text operates like an installation. The prose becomes the 'exhibition hall', and poems serve as 'pictures'; the reader moves among these sensory and emotional stimuli. The experience is immersive. Reading is not only an act of understanding but also of being held in tension.

The book opens with a gesture of negation: 'It's not that I'm some kind of paranoid psychopath in constant depression...' From the outset, the text shifts from clinical discourse to confession, establishing an ethics of speech that both wounds and heals [30]. Words become dual agents: poison and antidote. Soon, they give way to images: 'In one of my hands I held a bunch of keys, in the other, a beating, bloodied heart' [31]. Here, the spatula takes the place of the verb; the text bleeds into colour, and colour becomes a tactile form of syntax.

In this universe, the 'Nulls' emerge—enigmatic 'god-men' capable of touching life and death. These ambiguous figures represent both psychotic episodes and a coded critique of contemporary control systems. 'Nowadays, it is increasingly difficult to hide that you have received a blessing, and if I am right, the O Nulls will probably come after me' [32]. Madness becomes an extreme form of lucidity, suggesting a kind of digital Gnosticism—a worldview in which the subject seeks spiritual and existential loopholes within systems of control.

The book's poems are not decorative interludes; they function as ruptures. Verses like 'Pained soul, already mutilated/travels alone, thinking of nothing else', or 'Pretty girl... How about we save the world from that yellow comet?' are carved 'with a fingernail', breaking open the narrative flow. In O homem triste, the speaker confesses: 'I, who because I was a hateful person/only tried to be happy...' Each poem acts as a lyrical incision—a breach where the sensible breaks through [33]. This aesthetics of rupture reverberates in the pictorial series *Parallel World* (2015–2017), where Panceri employs spatula, impasto, and dissolved contours to forge burning, visceral

bodies⁸. The paintings, like the text, reject sanitized mediation. They demand physical engagement. The painting calls for touch; the writing opens wounds.

Social criticism is not delivered through slogans. It is staged as an experience. Paraná becomes a microcosm for global tensions: the precariousness of care, the aestheticization of pain, and the commodification of trauma. Panceri offers no solution. Instead, he offers a labyrinth: 'To err is strategy: to deviate and fail'. The reader is made to stumble, much like the narrator caught between confession and revelation: 'I cannot let this slip from my mind... such heavy thoughts cannot break the barrier between worlds' [36].

The ethical dimension intensifies as pain becomes a central concern. In one scene: 'There was blood and more blood all over the floor, it was all you could see at that moment'. This confronts the reader with the dual edge of representation: does it heal or re-victimize? The author-character does not resolve this; he performs it. He stands exposed before the reader: 'My destiny, of course! ... I'll try to calm down and act naturally so that no one notices what I am going through' [37, 38].

This exposure of pain—as text, as body, as performance—can be understood through Judith Butler's concept of the 'body in alliance' [39]. In *Bodies in Alliance and the Politics of the Streets*, Butler argues that public bodily exposure, even when it makes one vulnerable to violence, can become a political act of resistance. A body shown does not only seek recognition—it asserts its complexity, its opacity. In *O Null*, the author-character does not merely recount trauma; he enacts it, placing himself under symbolic and discursive risk. Trauma is not resolved but dramatized, repeated, and witnessed. Panceri does not aestheticize pain; he inscribes it as a language that refuses to be decoded and insists on being seen.

Butler also reminds us that the political power of shared pain does not depend on proximity but on the capacity to create affective bonds across distance. Panceri's text does just that. Through aesthetic mediation, he transforms localized suffering into a trans-local experience. The body situated in Paraná during the 2010s reaches readers across time and space. Butler notes that street protests achieve genuine political potency only when their sights and sounds are transmitted live to the public; likewise, Panceri's pages become visual and audible stages of trauma, restaged with every reading. The text thus turns into a performance—and a political act.

The *O Null* constructs an ethics of fracture. It offers neither solace nor catharsis. Instead, it invites the reader into a zone of irresolution. Trauma, here, is not to be healed or neatly represented but to be performed in all its opacity, fragmentation, and repetition. Like a wounded body that will not stay silent. Intertextual and transmedia, the work's strength lies not in its sum of parts but in the visceral friction between them. It is, in essence, a rite of passage: 'We are our own existences in parallel worlds that collided for some reason' [40].

The text proclaims truths in ruins. Its fractures—formal, ethical, perceptual—serve as acts of critique. Meaning is not its aim; presence is. Understanding becomes secondary to accompanying. In this way, *O Null* operates as a vector of expansion between literature and visual art. It affirms Panceri's dedication to an art of vulnerable presence and embodied dissent.

⁸ Impasto is a thick application of paint (oil or acrylic) that leaves raised brushstrokes or spatula marks, aiming to add texture and light effects to the pictorial surface. It is a technique used since the Baroque period—as seen in the works of Rembrandt—and later adopted by modern artists such as Van Gogh. See: Merriam-Webster [34]; Encyclopaedia Britannica [35].

Though not part of the curatorial framework, the book deeply resonates with the exhibition's sensibilities. It invites the reader to find themselves among images, ruins, and traces—or, as the narrator says while falling: 'I open my arms and slowly throw myself toward the ground. I feel myself falling slowly and observing everything so full of details, colours, plants, and flowers that made the place infinitely beautiful' [41].

Like a painting lodged in the corner of a room—unlabelled, uncategorized, but fiercely expressive—O Null imposes itself as a raw and almost indescribable presence. It is a surface, a site where the tangible and intangible coexist in tension. In this space of contact—between what is shown and what is withheld—the reader is summoned not to explain but to witness. It asks for radical attention. Not understanding, but presence. Perhaps, like a painting without a caption, its power lies precisely in what it refuses to say—and yet insists on leaving behind.

5. The museum as a shared surface

As Hilda Kean argues, history is not the exclusive product of archives or academia, but something that emerges wherever memory is activated and shared [42]. This view resonates strongly with the efforts to implement accessible curation through Easy Read materials, affective mediations, and co-created experiences at The MDMP. Rather than simplifying the narrative, these formats deepen the encounter, requiring new forms of attention and generosity. From this standpoint, each accessible sentence, each poetic fragment, and each shared silence operates as part of an ecosystem for meaning-making. The museum becomes not merely a place to look, but a place to feel—and curatorship becomes an ethical presence: a commitment not to control the narrative, but to share in its weight.

Sérgio Panceri's work *Parallel World* was not only included in the pedagogical practices of the 'Public History and Museums' course at UNESPAR's Graduate Program. It became a catalyst for curatorial methodologies grounded in active listening, accessible aesthetic mediation, and co-authorship of meaning—transforming the museum into a place that does not explain but shares. We began to imagine the museum as a space of subjectivation, creation, and the communion of fragilities.

During the 22nd Spring of Museums (May 2024), the project *Weaving Knowledge, Intertwining Inclusions (II)*—a collaboration between the MDMP and the Center for Support and Development of the Elderly (CADI)—opened pathways for a curatorship of belonging. Panceri's work was not simply observed but felt. Participants over sixty engaged with the images through memory, gesture, and silence. Artist and historian Camila Danuta responded with her own painting, 'Invisible in the Rush, Present in Memory';—not to illustrate a concept but to create a relational surface. A surface that listens as shown in **Figures 2 and 3**.

This approach reflects an epistemological and ethical shift. Silvia Alderoqui [42] calls for dismantling the notion of the museum as a repository of knowledge [43]. Only when visitors are acknowledged as subjects of experience does the museum become democratic: 'We therefore reaffirm that, in order to bring about this paradigm shift, it is necessary to conceive of visitors as actors, authors, and subjects of experience within the framework of cultural and educational museum policies' [44].

In this same spirit, the intersection of public history and public art is not limited to shared space; it invites gestures that exist only when made with and for the public. These encounters foster reflection, skills, and community bonds—like learning to feel before one theorizes. In this expanded horizon, curatorship and mentorship are not



Figure 2.
Elderly participants from CADI engage with the Parallel World project at MDMP (2024). © Michel Kobelinski. Workshop ‘Weaving Knowledge, Intertwining Inclusions (II)’.

just technical roles; they become practices of attentive care. Care for heritage, yes, but also for people, for affections, and for those fleeting impressions that pass through us.

When public historians and artists engage with communities, they do more than listen to them—they listen with them. Through this dialogical act, they co-construct narratives that rise from below rather than descend from above. Working in interdisciplinary networks and collaborative projects, they sustain mutual recognition of stories shaped by pain, silencing, and resistance. These are memories measured not by geography but by intensity.

This was the founding premise of the project: public art and history can generate meaningful practices. Not to teach the past but to activate the present. Not to represent territory but to listen to it. Not to simplify aesthetics but to place it under tension. Here, creative capital is not something to be stored but a gesture to be shared—a dynamic energy flowing among bodies, images, and words.

This shift—from passive observer to co-creator—rewrites the role of the visitor. It echoes Michael Frisch’s [44] notion of shared authority and Nina Simon’s [45]

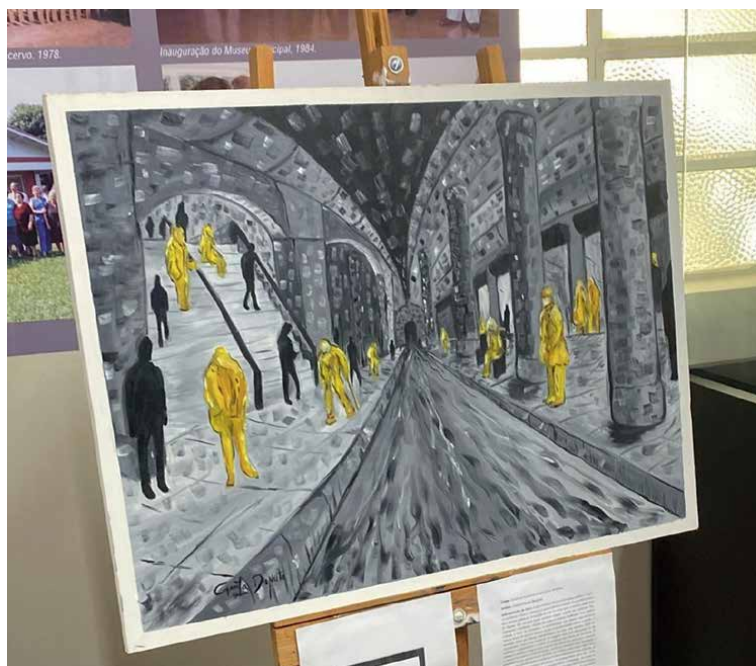


Figure 3. *'Invisible in the Rush, Present in Memory' by Camila Danuta. Camila Danuta responds to Parallel World with a painting that listens rather than illustrates. © Camila Danuta. Image rights granted for this edition.*

expansion of it: the museum as a space of symbolic negotiation, where listening holds equal weight to display, and conflict becomes the core substance of experience [45, 46].

Guided by this philosophy, the MDMP exhibition project adopted a critical and engaged stance, aligning with Sandell and Nightingale ([47], p. 4) in its view of the museum as a site of social transformation. It is no longer a temple of unilateral celebration but an unstable arena—a place of narrative destabilization where dissent is not only allowed but welcomed [48]. Through active accessibility [48], the exhibition transcended symbolic participation, treating audiences not as extras, but as co-creators of sensory and interpretive experiences [49].

From September to November 2024, a set of curatorial and educational practices unfolded around Panceri's *Parallel World*. The goal was not merely to study the image but to inhabit it—to explore its voids, blurred backgrounds, and effaced faces. These efforts culminated in the booklet *How Did Sérgio Panceri See and Feel in the World?*, presented in an Easy Read format. This was not simplification but an invitation to slow down—a gesture of sensitive attention crafted for readers with diverse literacy levels, neurodivergent experiences, psychological distress, or a history of exclusion from cultural spaces as shown in **Figure 4**.

This material does not explain the work. It listens to it. It preserves affective density and replaces interpretation with open-ended, suspended, and introspective questions. Each sentence becomes a pause. Each silence becomes a space of encounter.

The December 2024 exhibition brought this participatory model to life. What was once a silent, captionless display now featured expanded labelling, QR codes, and devices for sensory mediation. AI-generated images created with MidJourney were

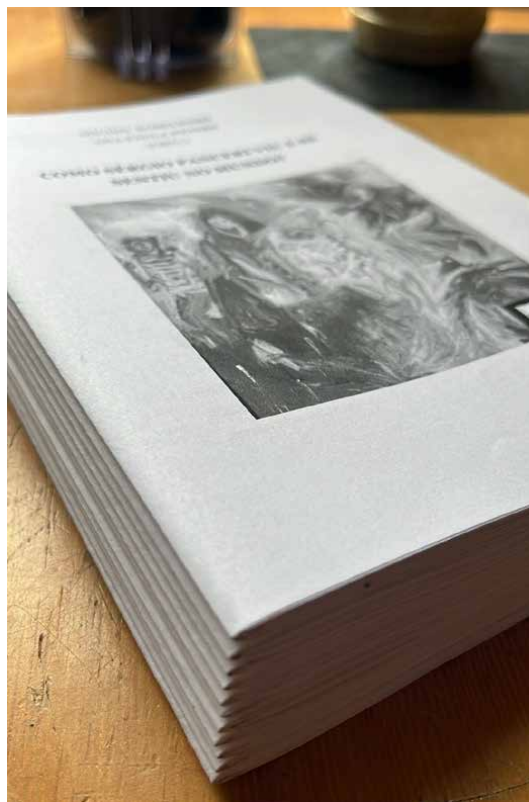


Figure 4.
Black-and-white proof of the booklet How Did Sérgio Panceri See and Feel in the World?, created as an accessible curatorial extension of the exhibition at MDMP (2024). © Michel Kobelinski. Proof copy of the Easy Read Booklet.

transformed into tactile tools for collective engagement: colouring, recombination, and reinterpretation. What was previously confined within a frame opened into a mosaic. And within this mosaic, students, relatives, and visitors found themselves. They arrived with songs, dedications, memories, and words written with trembling hands. The final installation was not an endpoint. It was a memory in motion. An aesthetic of care extended to museum visitors.

Designed as an editorial extension of the exhibition, the booklet enhances rather than simplifies. It moves beyond mediation to become a curatorial gesture in itself—one that is both critical and inclusive.

Its form—direct language, short phrases, dialogical rhythm—does not impoverish meaning. It relocates knowledge into a space of shared experience. Mediation, here, is not instruction. It is listening. It is welcome. It is a response.

The scattered questions throughout do not guide—they open. They offer space for readers to recognize themselves or to experience estrangement, which is itself a form of ethical engagement. The curatorship refuses linearity. It invites multiplicity. It does not provide a manual. It offers a bridge.

Panceri's paintings—*Insane*, *Suffering*, *The sad man*, *The other side*—compose a fragmented visual language. Faces without names. Bodies are out of balance.

Backgrounds in suspension. This is not an art of pathology. It is a language of transition. Panceri does not idealize pain. He tensions it. And in doing so, transforms emotional disorder into a space of aesthetic perception. A space not for looking but for feeling.

The inclusion of a poem by Panceri's mother, Izabel Cristina Panceri, adds intimacy and vulnerability to the catalog. This gesture shifts the curatorial frame from institutional distance to emotional proximity. The collaboration of students and visitors strengthens the project's commitment to decentralizing authority and rooting meaning in community as shown in **Figure 5**.

The use of artificial intelligence (MidJourney) did not take centre stage. There was no fetishization. Technology functioned as an instrument for expanded listening. It allowed others to carry on Panceri's creative impulse—to paint, reimagine, and recombine. Here, AI was not a rupture. It was a resonance.

Together, the editorial and expographic ensemble offers a museology of vulnerability—an ethics of the unfinished. Panceri's work speaks from in-between: between pain and care, silence and gesture, invisibility and emergence. The curatorship affirms this position. It stands against ableism, against the pathologization of suffering, against affective normativity. It chooses empathy. It listens deeply.

In this reframed museum, display gives way to shelter. Cold lights and closed captions yield to warmth, shade, and openness. Images are not objects to be viewed but presences at rest—waiting for those who linger.

How Did Sérgio Panceri See and Feel in the World? is not a catalog. It is a curatorial manifesto in accessible form. By giving voice to a non-normative subject, the project defies technocratic curatorial paradigms. It proposes a poetics of doubt, fragility, and



Figure 5. Panceri family and curatorial team at the end of the exhibition at MDMP (2024). From left to right, top row: Silvestre Lissekeivo Manuel Gamba, members of the Panceri family (Bruno Arthur Sestito, Luiz Egidio and mother Izabel Cristina Panceri), Michel Kobelinski, Ana Maria Peters, and Rita Gabrieli de Godoi Lima. Bottom row: Maria Eduarda Romanhuk Povodenhak, Sintique Raquel de Castro Eleutério, and Joaquim Manuel Francisco. © Panceri Family Collection. Opening of the exhibition *How Did Sérgio Panceri See and Feel in the World?*

incompletion. Its most radical act is not to resolve pain, but to make it sharable. A language of presence. A language that invites us to feel. And perhaps, to transform.

6. Conclusion, or curating as a gesture that listens to what is not shown

In a quiet corner of the room, a painting rests. *Parallel World*, silently occupying its place in the MDMP collection, worked as that which insists on being seen—even when the institutional gaze hesitates. This image, initially marginal, became central, not by asserting discourse but by listening. Listening to what hurts, what lingers, what fragments—and, precisely for that reason, calls to us.

Curating, in this context, is not a tool or an illustrative pedagogy. It is a gesture. A gesture of approach, of sharing, of care. A gesture articulated not about the other, but with them. In *O Null*, Panceri's imagined Nulls navigate layered terrains of visibility and trauma, occupying the liminal zone between articulation and the unspeakable. The sensitive curatorship proposed here does not aim to translate this interval but to dwell within it, transforming it into a space of relation.

Just as the text of *O Null* bleeds into images, and the pictures of the exhibition echo text, the museum becomes, through this project, a site of passage—between affections, technologies, knowledge, and absences. What appeared there was more than paintings or objects; it was the emergence of an ethics of looking. An ethics that understands that not all pain needs to be explained—but that all shared pain deserves to be heard.

To conclude, in this case, is not to end. It is to remain with the image—like someone who returns to the painting in the corner. This time, not alone but accompanied. Accompanied by those who came, looked, were moved, and left their marks. Between brushstrokes and questions, *Parallel World* revealed itself not as a forgotten work reclaimed but as what it had always been: a place of encounter between visibility and sensitivity, between pain and dignity, between silence and memory. In this encounter, public curatorship disclosed its deepest potential—not the arrangement of objects but the ability to unsettle certainties.

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Section 2

Modern Museum Concepts

Perspective Chapter: Offering 4D Space, Colored Timescale for Next Museum

Kuni Ito and Tatsuya Ide

Abstract

This chapter proposes a new concept of the museum for the next era. The study uses the idea of four-dimensional (4D) space, which the author has explored for more than sixty years. It begins with a theoretical study of 4D space, focusing on higher-dimensional structures created by spatial rotation and interpenetration. Through the introduction of the author's previous works, the concept of 4D space is presented more concretely, while also revealing the potential of the museum as a space that appeals to human sensibility beyond differences of scale or function. Finally, the study extends the idea of 4D space from space to time, leading toward a new type of museum that reflects the digital age. In this context, the focus is on color as a key medium for expressing time. The ongoing renovation of Ito House demonstrates this idea in practice, presenting a family museum that preserves objects and memories through the use of digital technology. The idea of 4D space, together with color and digital technology, suggests a new form of museum that connects the past and the future.

Keywords: 4D space + time, interpenetration of 3D spaces, diagonal transparency, colored timescale, family museum

1. Introduction

In 1964, while studying at Tohoku University and working on my diploma project (**Figure 1**) [1], I discovered that the Wachsmann-type space frames [2] could be composed of square cubes without any useless clearance. That moment left a lasting impression on me, and since then, I have continued to pursue architectural design with a conscious awareness of composing space in four dimensions (4D), rather than three (3D). This chapter begins with an explanation of the fundamental concept of 4D space [3].

1.1 Perception of space

Humankind originated about 6 million years ago, and the daily use of fire began around 300 thousand years ago. Modern humans started to spread from Africa only about 70 thousand years ago [4]. Therefore, I think it is natural that our sensibility of spatial recognition was shaped through life in natural environments such as jungles, and

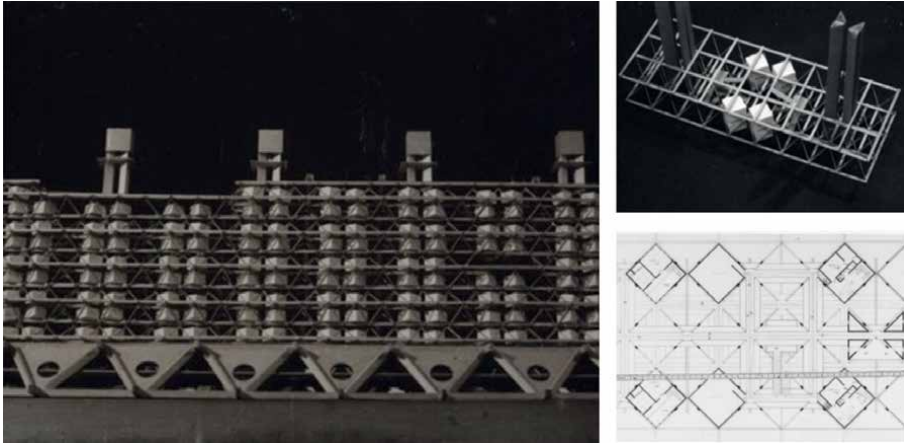


Figure 1.
1964 diploma from Tohoku University.

that its traces still remain embedded in our perceptual system. However, in contemporary society, we are surrounded by many two-dimensional media—books, films, televisions, smartphones, and personal computers. Through continuous exposure to these two-dimensional media, our ability to perceive three-dimensional space directly has gradually declined. As a result, architectural spaces created through two-dimensional representation often fail to correspond to human sensibilities. Drawings are not only indispensable for modern architecture, but they also reveal the inherent disconnect between representation and experience. Historically, people once created spaces intuitively, without relying on drawings; only since the Renaissance had the drawings become indispensable [5]. Human sensibilities, however, have not fundamentally changed, while architectural communication has shifted in ways that distort them. This helps explain why much of modern architecture lacks comfort, whereas traditional architecture often retains it: past builders used drawings minimally while trusting and embodying their direct sensibilities.

2. Manipulation of space

There are limits to creating spaces that truly appeal to human sensibility by merely reassembling planes. I believe that architectural space, which can touch human sensibility, can only be achieved through a design methodology that allows the free manipulation of space itself, including interpenetration and rotational transformation. Just as Louis Kahn explored the order of space and light through the interpenetration of geometries, I find potential in methods that involve spatial interpenetration and rotational transformation [6]. Through years of training, I have developed the ability to manipulate spatial relationships mentally, yet physical models have remained indispensable in supporting this process. For example, when designing a single house, I produced and dismantled dozens of models in pursuit of a balanced spatial composition.

In my laboratory, we use computer-based tools to explore spatial manipulations that complement and go further than physical models. This approach offers several advantages, such as reducing the number of sketch models and showing spatial forms more accurately.

(i)-(iii) in **Figure 2** show two cubes, in the ratio of 5:3, shifted and rotated to study overlapping spaces (i). Traditionally, architectural design has often relied on stacking

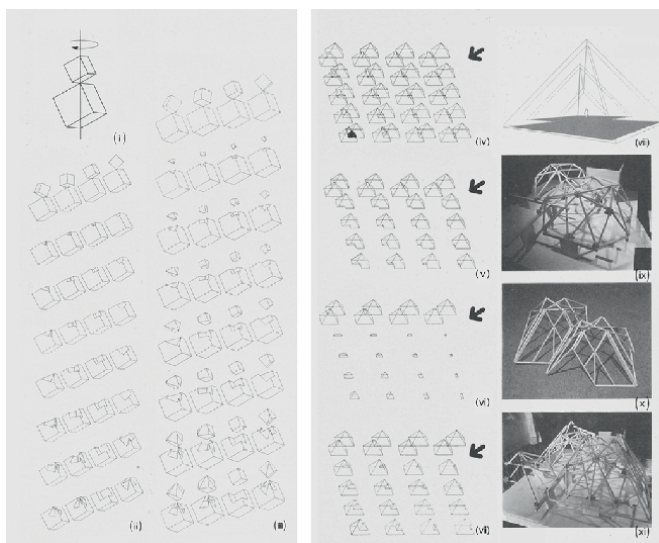


Figure 2.
Fusion of spaces. Drawn by Hideyuki Mori.

or arranging such volumes. Yet, these basic forms are no longer sufficient for today's expectations and functional needs. By shifting the smaller cube downward and rotating it by 30 degrees at each step, we can observe both the form of the subtracted parts (ii) and the shape of their overlapping volume (iii).

Using such figures as a basis, we explore the spatial possibilities created by the interpenetration of volumes and apply this idea to architectural design. For example, the larger cube may represent a three-story commercial building in a city, while the smaller cube corresponds to two floors of residential space. Simply stacking them would be ordinary. Instead, in our laboratory, we investigate new architectural spaces created by the interpenetration of these volumes. The possible architectural expressions that emerge from this method may depend on future technical development. However, drawing from my practical experience and from the unpredictable formal operations that computers can generate, I aim to establish a design methodology that combines improvisation with reproducibility.

3. Creation of space

I would like to continue the discussion of interpenetrating spaces. When two pyramids overlap—imagine a green cloud of smoke intersecting with a yellow one—the resulting shared volume appears as a light green form. While it is difficult to reproduce this effect with real smoke, computers now make such intersections easy to visualize. Points (iv) to (vii) show two pyramids gradually shifted and overlapped, viewed from a diagonal perspective. From the $\angle$ direction, where the shifts are equal, the image is easy to understand. From other angles, however, one only realizes how the green intersection is formed by looking at the diagram. By visualizing imagined spatial forms in a reproducible way, they become far more powerful in architectural design. The hatched diagram in (iv) was applied in my design for Ehime Forest Pavilion. The overlapping pyramids could be instantly visualized (viii), allowing thorough study of the space without building physical models or photographing them for the client. This ability to grasp and express space also helps in deciding what kind of structural framework

can create it. Points (ix) to (xi) show models of the structure: the primary frame, the secondary frame placed on top, and the resulting three-dimensional frame. Now, these operations can be easily done on the computer. In the future, it may become possible to design spaces beyond my imagination in a very short time.

4. Practice of 4D space

4.1 Ito House

In ancient times, people roamed freely through mountains and fields, using hollows and rocky shelters as everyday bases of life. Can we say that today's urban fabric allows us to experience such sensibilities? With its rigid zoning, monotonous block divisions, small plots tightly enclosed by concrete walls, and the lifeless uniformity of mass-produced houses, human creativity declines, instincts grow dull, and frustration accumulates. My own house stands in just such a neighborhood. Yet, even within this institutionalized and spiritless setting, I wanted to show that architecture could be freer—that it could spark creativity and leave a vivid impression on people.

I wished to live in a house where I could move freely through four-dimensional space. In this house [7] (**Figure 3**), there are no dead ends; every space connects seamlessly to another. As you walk through it, the spatial composition is so complex, making you lose your sense of position. The walls exist not to divide but to guide sightlines and movement. Large panes of glass or doors connect the interior to the surrounding landscape, softening the separation from the outside. Every part of the house, from the basement to the rooftop, becomes a space for living. Natural light comes into the basement through glass blocks set in the first-floor slab, recalling Otto Wagner's Postal Savings Bank where soft light through glass gives life to the space below [8].

On the facades, the division of floors and room layouts is not immediately legible. Conventional compositional devices have been deliberately avoided, and so the house presents a countenance quite unlike the ordinary buildings that surround my house.

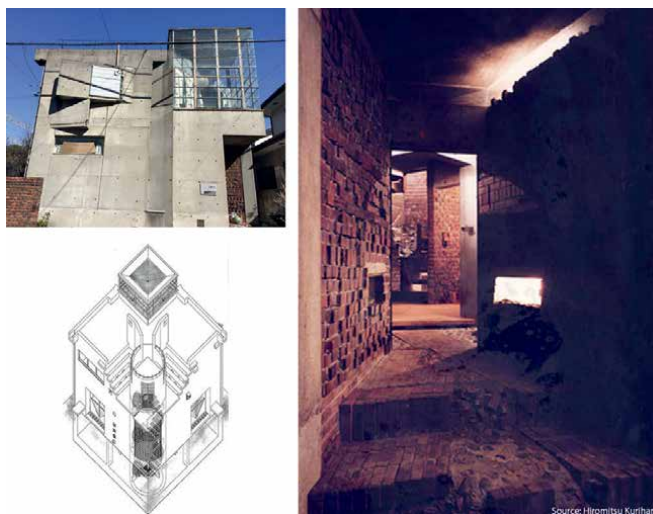


Figure 3.
Ito House.



Figure 4.
Imai House.

Many have asked to be shown inside, and in particular, the children—since the street in front is also a school route—would run up and down from basement to rooftop, gleefully exploring. Conversely, for those who could only believe in surface-level common sense, the house must have provoked a measure of rejection. But that was inevitable, for such a response was part of the design intention from the beginning.

I cut costs as much as possible. I used fixed windows set directly into the concrete due to lack of money, but also because I knew that a house that spends money on meaningless parts loses its sense of tension and becomes a shapeless mass. However, the minimal amount of carpentry, fittings, and hardware was of the highest quality, tightening the whole composition at its key points.

This house did not arise from moods or hollow abstraction, but from the urgent necessity of making a home with the smallest of means. For that reason, there are no meaningless parts; every element is supported by some rationale. In this sense, it may rightly be said that this house is spirits itself made into matter.

4.2 Imai House

This Imai House [9] (**Figure 4**) is located near Setagaya Art Museum designed by Shozo Uchii. Naturally, I was conscious of this museum and the site where there was once the golf club house designed by Architect Antonin Raymond and the wide golf course for celebrities in the past. And in the opposite direction to the museum, the NHK Broadcast Research Center occupied the wide areas.

To reflect these cultural assets, I intended to make the wary form. In that sense, it is safe to say that this work demanded an extremely challenging approach for completion of spatial integrity. The fitting and overlapping of spaces are used everywhere for my 4D space method. If I did not do that, I should not have completed to the level of anticipation of the client who anticipated a really excellent architecture.

4.3 Inoue House

From its earliest days, Inoue House (**Figure 5**) was designed with the vision of a future private museum. This stemmed from Mrs. Inoue being a master of the Sogetsu School of Ikebana, who at the time gathered students and ran gatherings.



Figure 5.
Inoue House.

The basement space held a crucial position as an exhibition area, and its atmosphere remains preserved to this day. In recent years, it has become an interesting space, with an architect occupying part of the upper floor. Its current location faces a major railway line, offering expansive views, and its proximity to a university campus makes it a prominent spot. This led to the intention of creating an interior space with a traditional Japanese sense of scale and a four-dimensional concept.

4.4 Azabu Central Point

Azabu Central Point [10] (Figures 6 and 7) was completed in 1984 at the top of the Azabu plateau, directly overlooking Tokyo Tower. The client, Mr. Isao Shimada, entrusted this project to me under the condition that it will be truly the best architecture, with the possibility of being converted into a museum in the future. The site, located at the corner of a five-way intersection, is triangular. Moreover, the two sides of the site facing the roads are inclined toward each other. Therefore, I began by inserting a triangular vertical staircase into the triangular main structure. However, this composition required special structural design skills. For this, I asked Mr. Kunio Watanabe, a respected friend, to assist. According to Japanese architectural law, it is difficult to obtain permission from the authorities when bearing walls have different reference lines in the same direction. He solved this complicated structural calculation in a short period of time. Still, this four-dimensional compositional method demanded an unusual detail design, unlike what could be found in textbooks for engineers or manuals provided by manufacturers. Our team made every effort not

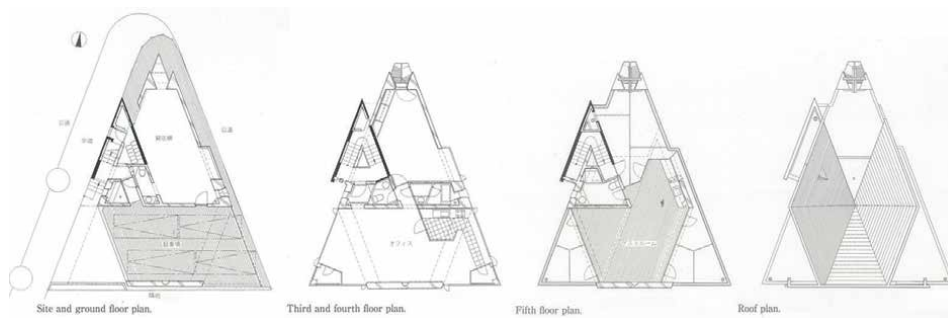


Figure 6.
Plans of Azabu Central Point.



Figure 7.
Azabu Central Point.

only to achieve consistent fit but also to realize the fundamental form, creating a space that could not be produced merely by drawings and specifications.

Much of the energy behind this building was devoted to pursuing things that cannot be captured in drawings—spaces, details marked by the touch of human hands, and the subtle effects of time. The office members who worked directly on the construction site faced a heavy burden. Takahiko Hara and Yutaka Miwa, who were on site from beginning to end, worked closely with Mr. Harasawa, the concrete formwork carpenter who had also crafted the formwork for my house. From developing special formwork to deciding panel layouts and positioning separators, Mr. Hara must have been exhausted by the endless consultations. I may have taken a forceful approach, but I believed it was the only way to build properly. Looking back now, I feel a deep sense of gratitude toward everyone at Yajima Construction company, and especially toward Mr. Harasawa again.

Mr. Yoshida was fully in charge of producing the curtain wall. Since this curtain wall was relatively small in scale and only rose to the fifth floor, we decided that overly complicated details for waterproofing were unnecessary and chose to use steel (Corten steel). We had past experience with several steel-based curtain walls, and our knowledge of the production process was very helpful in this project. The fabrication of a steel curtain wall can be compared to building a Japanese traditional timber

frame construction. From extracting each component from the drawings, assigning numbers, and producing detailed fabrication drawings, to cutting standard steel members, planing, end processing, assembling, installing, and adjusting—the work is divided among independent specialists and factories. Bringing all these separate processes together into a consistent final product is no easy task. For that reason, the design team itself had to keep track of each stage, provide the necessary instructions, and, when required, even identify and select suitable factories on the spot.

We did not achieve this because we already knew everything. Rather, there were too many uncertainties, and we felt uneasy unless we checked things directly with our own eyes. For example, we had to figure out how to ensure water-tightness at the joints between vertical columns and horizontal beams. We also had to manage the large dimensional inaccuracies of the steel members, which were much greater than common sense might suggest. It was not unusual for a web to be misaligned from the flange center by several millimeters, and twisting could also be a serious issue. These problems directly affected the success or failure of the curtain wall. By solving each of these challenges step by step, we were able to create a curtain wall that conveyed the architect's intentions in every detail. This made it quite different from standardized curtain walls.

To put it more strongly, the quality of architecture was determined not only by the building as hardware, but also by how it was used as software—usage accounted for half of it. It was impossible to regulate usage by drawings, so from the perspective of creating a truly good building, the role of drawings became much less important. In fact, even after the official completion, additional design work—practically without drawings—continued every day through discussions with the client. At that time, I was still considering whether to fill the joints or to paint the entire brick wall, planning to decide the colors after reviewing the overall balance. Many parts also remained unfinished, such as the stair handrail, and there were still many areas where I wanted to make adjustments.

To avoid misunderstanding, I must add at the end that all of the above is possible only when there are sufficiently reliable drawings. Producing such drawings alone requires an enormous amount of energy. Yet even with them, a proper building cannot be achieved. Without continuously cultivating experience, human connections, and above all one's own imagination, it is impossible to confront persistent architecture over the long term. This work received the inaugural Cornet Prize.

4.5 Forest pavilion in Ehime Prefecture

Since the beginning of twenty-first century, a boom of wooden structure by layer laminated method has been rising. But in my opinion, I have completed some wooden structure buildings even in the 1980s like Ehime Forest Pavilion [11] (**Figure 8**) or JR Iwaki-Hanawa Station. At that time, in the 1980s, more than 70% of Japan's timber was imported, and there was a growing concern that the recycling mechanisms needed for maintaining and conserving domestic forests would soon collapse due to insufficient investment. The maintenance of forests requires labor-intensive tasks such as pruning and thinning, but with the stagnation of the domestic timber market, it was impossible to generate enough funds to cover these costs. Effective use of domestic timber, including thinned wood, was therefore essential to sustaining the vitality of the forests. In the field of architecture, the year 1964 marked a symbolic turning point: various timber structures were being replaced by steel construction. No new wooden gymnasiums were built, steel prefabricated houses gained popularity, and plastic and aluminum entered interior design. And this sense of crisis gradually combined with the Japanese people's inherent sensitivity toward organic

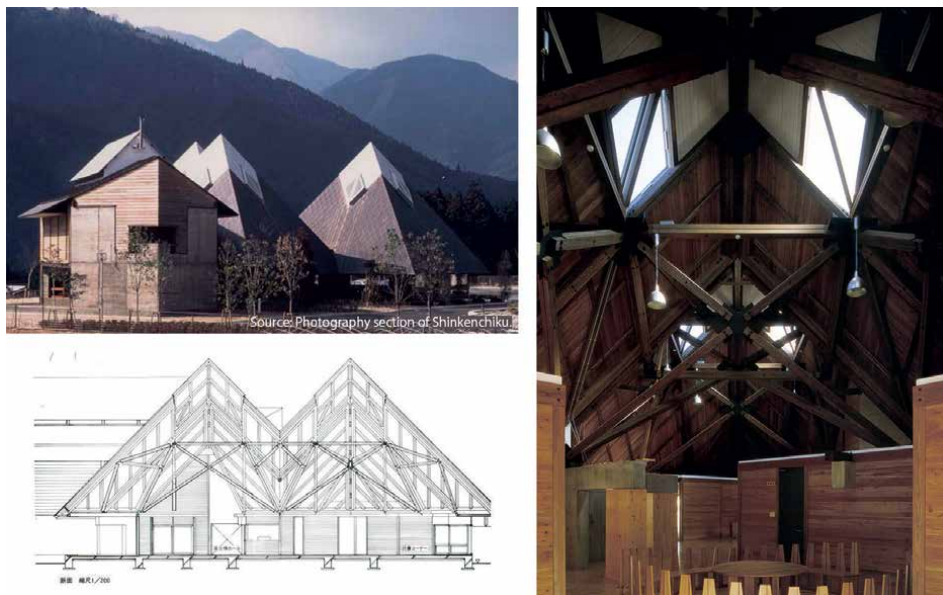


Figure 8.
Forest pavilion in Ehime prefecture.

materials, leading to a quiet yet steady reappraisal of wood products within architecture. For me as a designer, it was rather an opportunity, and I had no hesitation in taking on the challenge of exploring new possibilities for timber construction.

The Forest Pavilion in Ehime Prefecture was designed to use locally produced cedar for everything from structural members to finishing materials, making the building itself a showcase of wood utilization. As a community facility for people living in the mountains, the design also considered children's use, with a lobby and training rooms intended as places for reading under soft, filtered sunlight like that beneath a forest canopy. They are organized as a combination of pyramid-shaped spaces, and their sharp forms, together with the metallic texture of the roofs, affirm their presence within the natural environment.

The interpenetration of volumes and the fusion of spaces appear throughout the interior, realized by wood that has been given its proper place. To achieve this, a precise structural system without compromise is required. Trying to get closer, even a little, to the depth and strength of nature's order, I placed the focus of the structural design on the operation of space frames interconnecting in four dimensions. Through this process, I also aimed to express the warmth of space.

4.6 JR Iwaki-Hanawa station

The construction of the station area began in 1990 and ended in 1995 passing through four stages' addition to the building (**Figures 9 and 10**). The first stage was for library, the second was for station, the third was for exhibition pavilion, and the last was for station park from south side to north end. In 1996, this station building received Brunel Prize Commendation and I was invited for the presentation event of Utrecht Centraal Museum in 2002. In 2001, The Art Institute of Chicago published the book titled "Modern Trains and Splendid Stations" and exhibited this station's large photograph panels in a big hall where I met Curator Martha Thorne who

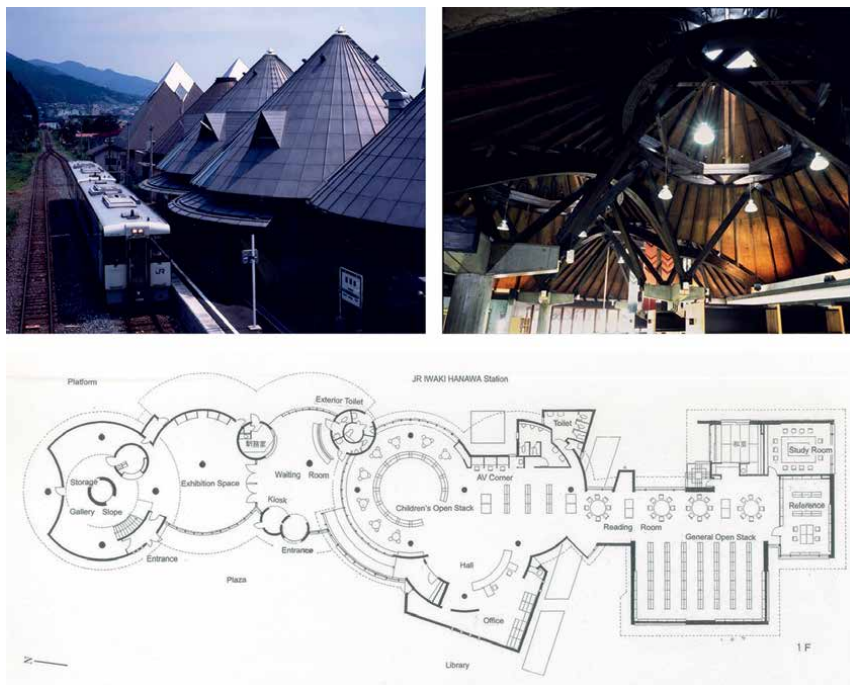


Figure 9.
JR Iwaki-Hanawa station.

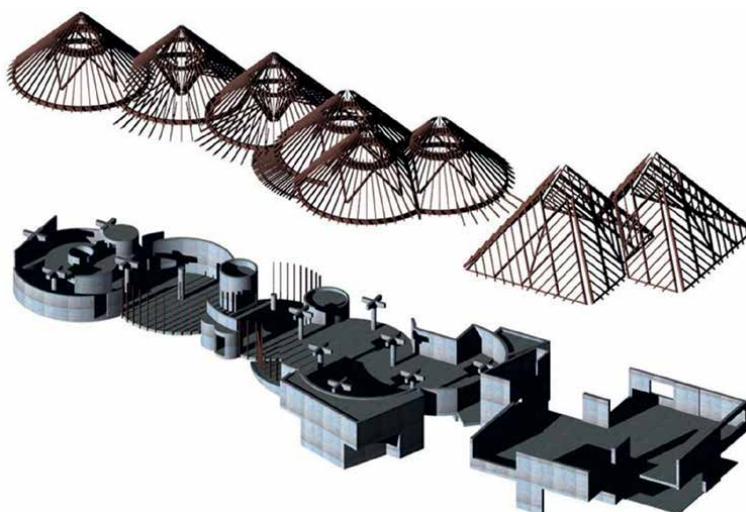


Figure 10.
Isometric of JR Iwaki-Hanawa station. Drawn by Nao Yasuda.

picked up my work. Now, I quote a more detailed explanation from the article in *The Architectural Review* [12], correcting some small misunderstandings:

Hanawa is a small, quiet country town nestled in the mountains of the Fukushima Prefecture, north-east of Tokyo, but like almost any other rural area in Japan, it has suffered from shifting of population concentration to Tokyo. In the middle of big stations,

there was a small, old unmanned railway station. By the end of the 1980s, the center of the town was decaying and as a countermove, the citizens called for a new station that could incorporate other functions as well as being a transport interchange. The East Japan Railway Company (JR-East) provided the land and part of the funding for making a building that could act as a signpost of place to people traveling on the railroad, and a new center for social life. The townsfolk chose to have a new library, tearoom, and exhibition gallery as the ingredients, which, added to the station, would initiate a revival in civic sense and start urban renewal. Kuniaki Ito was appointed as the architect, and in collaboration with Kunio Hirano, the client-side leader, he decided to design the place as a series of helmet-like structures, linked but semiautonomously reflecting the individual functions. The SAMURAI helmets have concrete columns and glass walls with pyramidal or conical metal-clad roofs. The laminated timber roof structures are exposed internally, and bear either on a circular ring beam from which loads are taken down to a central column by branch-like rafters, or four columns that similarly support ring beams. Metal-clad awnings, in effect brims of the roofs, protect passengers waiting on the platforms. The whole scenario builds up into a picturesque composition with human scale, huddled under the forested hillside, making a memorable place and punctuation mark on the train journey: so much so that more visitors are coming to the town to see its station and enjoy the knock-on effect it has had. For instance, the municipality has done up the main street and abolished the nightmarish tangle of aerial wires that bedevils the skyline of most Japanese rural settlements; now, there is a positive discussion about renewal of the commercial area, when a few years ago resignation and despair reigned in civic consciousness. Internally, there are a gallery, an exhibition room, a small waiting room with a shop, and a ticket sales counter; from the gallery, a stair leads up to a tearoom amid the rafters. The library occupies three of the interlocking circles and uses the two pyramids for the more rectilinear activities like bookstacks, the tatami room, and the regional information center. The spaces flow into each other under the dark-stained roof structure and rosy timber ceilings; in the library, a wooden floor soothingly relates all parts, reading room, children's hut, and stacks under the dark branches of the roof. Both inside and out, the station is a powerful argument for the powers of the picturesque (Veronica Pease, 1997, *The Architectural Review*, May).



Figure 11.
Ogatsu Inkstone Museum.

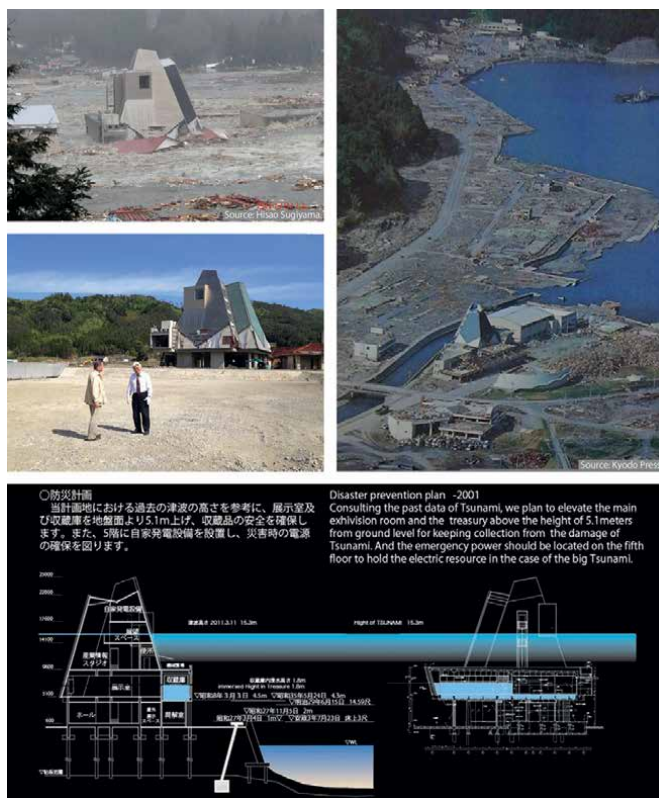


Figure 12.
At the height and after the Tsunami.

4.7 Ogatsu Inkstone Museum

On March 11th, 2011, the devastating big Tsunami attacked the north-eastern seashore area of Japan. Around this building, Ogatsu town had spread up to the end of Ogatsu Bay. Then, a lot of people died and almost all wooden housings were swept away by the strong currents of the Tsunami to the Pacific Ocean. But this building [13] (Figures 11 and 12) has stood as it has been like no structural damages. I designed the first floor in piloti-type style, only surrounded by glass panes, which assisted to decrease the current pressure of passing currents by breaking themselves. And the figure of building was composed by a combination of a little bit slender pyramid style, which is useful for Tsunami to slide by without giving strong pressure to the building. The special storage room was placed 5 meters above the ground level. The emergency electric room was planned on the 5th floor, which was the topmost floor having an escaping hatch for help, different from Fukushima Daiichi Nuclear Power Station. These ideas are all coming from the principle of 4D space Design method.

In 1999, newly planned Ogatsu Inkstone Museum was selected as the for its working plan by in the competition for exhibition and storage of precious Inkstones, China Ink Stick, Calligraphy, and Writing Brush. The leader of this competition committee was Prof. Saburo Yamashita at that time. The most important Design concepts were it could become the symbol of this harbor town and could survive big Tsunamis almost every 50 years had Tsunamis attacked this area.

Ogatsu has been known as the place of producing slate stone, which is used mainly for roof tiles and Inkstones for calligraphy. This Ogatsu stone had been an important industry to sustain people's lives together with fishery in Ogatsu Bay where a lot of nursing rafts were used for farming oysters or scallops. But the wharf of ships sank by about 1 m in the earthquake and Tsunami since before.

The roof facing the mountains was covered by Ogatsu slate stone as a symbol of the Ogatsu products and in contrast to it, the opposite side of roof facing the bay was covered by Titanium as the easily recognized landmark like a lighthouse. Even after more than 10 years since its completion, Ogatsu Inkstone Museum had been looked as clean and beautiful as it was opened until the devastated earthquake. On March 11, 2011, the great Tsunami attacked Ogatsu town and this building.

The site of this building close to the sea was prepared by putting up a 5 m high sea wall from sea level between the site and the sea. This height had been decided based on the experience of Chile Earthquake Tsunami in 1960. But the great Tsunami exceeded this wall easily to the height of 15.3 m from the ground level, which reclaimed 3 m from sea level. Then, the height of Tsunami at this place was 18.3 m above sea level. However, the highest point of Tsunami running up to the mountain was almost 42 m above sea level.

The author confirmed that sharpened pyramid-type polyhedra were effective to keep their figures by structural check after getting permission to enter. As being shown in the bottom figure in **Figure 12**, the emergency generator space had been planned on the fifth floor. From this space, people who want to escape to the top could

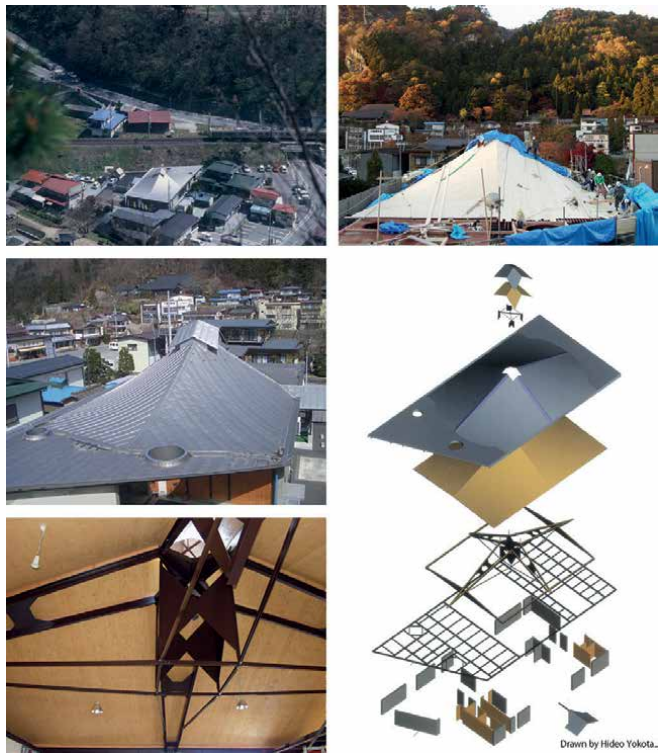


Figure 13.
Yamadera post office.

climb up there using a ladder for the help of a helicopter. Opening of skylight was designed like petals open.

4.8 Yamadera Post Office

The design theme of the Yamadera Post Office [14] (**Figure 13**) was to create a large space beneath the roof, which was achieved using four wooden hyperbolic paraboloid (HP) shells. The roof was constructed from crossed stripe flooring, with each intersection fastened by two screws—a very simple yet effective method. The exterior form of the roof harmonizes with the surrounding mountains. Just as Frank Lloyd Wright integrated his houses into the landscape [15], this building likewise aims to achieve harmony with its natural surroundings.

I believe that this simple construction method and the clear spatial quality of the roof can be further developed for urban housing, for example, by placing such a roof on top of two or three-storey buildings. In this sense, the project served as a prototype, and this idea leads to the extension project of the Ito House, which will be discussed in the next chapter.

5. Colored timescale for next museum

5.1 Expressing “Time” through color

So far, we have discussed 4D space as a combination of solids. However, when considering “four dimensions,” one cannot do so without referring to the concept of “time.” In this section, therefore, we focus on time. Although time is intangible, humans perceive its flow through various senses in everyday life. Among these, changes in color are closely tied to the experience of time. The sky, for instance, shifts

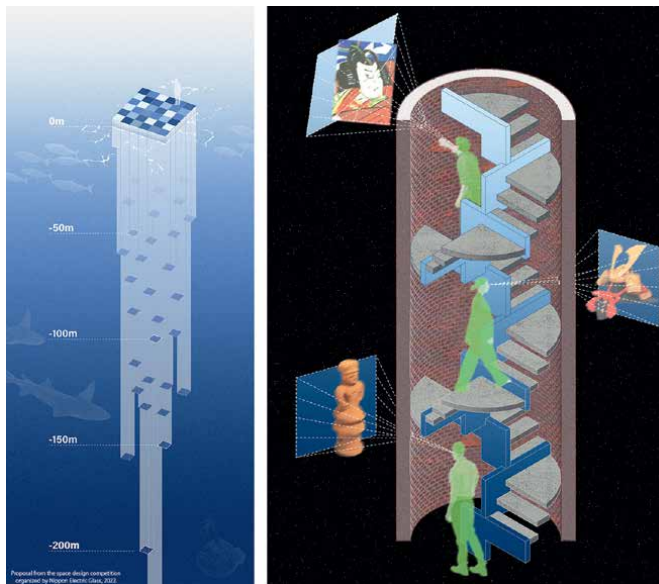


Figure 14.
Expressing time through color.

from the pale red of dawn to the clear blue of day, the orange of sunset, and finally the deep blue of night. Color can effectively represent the concept of time without relying on language or numerical expression.

As an example of bringing this relationship between time and color into architecture, we would like to introduce a competition proposal by Tatsuya Ide (Left of **Figure 14**). His project seeks to express the layers of time by introducing the colors of the sea into architecture. Though it requires a bit of poetic imagination, the depth of the sea can also be perceived as a layer of time. This transition—from the bright blue of shallow waters to the deep indigo of the ocean depths, and finally to the darkness where light cannot reach—becomes an image of the layering of time.

To put this idea into practice, Ide designed a floor made of glass cylinders in different lengths. Each cylinder uses total reflection to carry the colors of the deep sea up to the surface. By the principle of total reflection, the cylinders create a striking visual effect when seen from above: brighter and deeper blues appear side by side on a single floor. In this way, time, which usually builds up vertically, is rearranged into a horizontal sequence, allowing different moments to be experienced at once. Here, color is not just decoration, but a medium that calls up memory and imagination, reshaping time in both vertical and horizontal dimensions.

5.2 The transformation of spatial and time concepts by digital devices

As discussed thus far, our focus has been on how higher-dimensional space and multilayered time might be realized in architecture. Yet in the contemporary era, the framework of space and time is being fundamentally transformed by technological development. Recent digital technologies do not merely function as aids to perception, they unsettle the foundations on which architecture has long relied.

Technologies known collectively as XR (Extended Reality)—VR (Virtual Reality), AR (Augmented Reality), MR (Mixed Reality), and SR (Substitutional Reality)—are fundamentally altering our recognition of space and time. MR adds virtual objects into the real world, so people can experience different realities at the same time. SR brings recorded scenes into what we see now, making past events feel as if they are happening in the present. In this way, space and time no longer seem fixed, but become things that can be reshaped through choices and editing.

As one example, I propose the idea of a “Vertical Digital Archive (Right of **Figure 14**).” In this project, the cylindrical staircase running from basement to rooftop becomes an exhibition space shaped by digital devices. The building’s vertical height is treated as a timeline: the basement stands for the past, the rooftop for the future, and holographic displays make the exhibits visible. Digital devices set into the brick walls project three-dimensional holograms that appear from certain viewpoints. Climbing the stairs itself turns into an experience of moving back and forth through time. The background color of the holograms changes gradually—from deep blue on the lower levels to light blue at the top—so that bodily movement and visual experience are linked to the flow of time.

5.3 Extension project for Ito House: Integrating 4D space, time, and digital technology

We are currently engaged in a project to extend the Ito House and transform it into a family museum. In this project, we aim to integrate the concept of “four-dimensional space” with digital technology to create an environment where time, information, and the body intersect.



Figure 15.
Exterior view of Ito House in 2025.

The act of converting a private residence into a museum holds significant meaning. We would like to suggest for each family line to have a small-scale museum for family unity to be continued. Once in Japan, people who were ranked to some extent high-class used to have “KURA” as a storage house in their sites. Traditional KURA was protected by a thick soil wall and pottery roof tiles against fire and severe weather, in addition to warding off attack from thieves. Nowadays, Japan has come to hold a lot of empty houses; they say almost 15% of the total housing, namely 9 million. I think if it is small, some part of these houses could be changeable to small museums, not only private but also open to the public at large.

As mentioned earlier, the Ito House (**Figure 15**) is a reinforced-concrete residence and office building completed in 1979. Its architecture is characterized by a composition, in which glass boxes and cylindrical stairwells penetrate the main concrete volume, forming a multilayered and dynamic space through the intersection of distinct three-dimensional elements. This house is the starting point of my architectural practice and the first step in the ongoing exploration of 4D space.

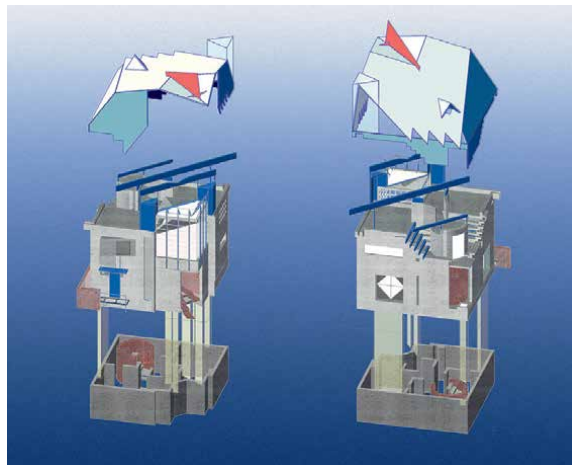


Figure 16.
Isometrics.

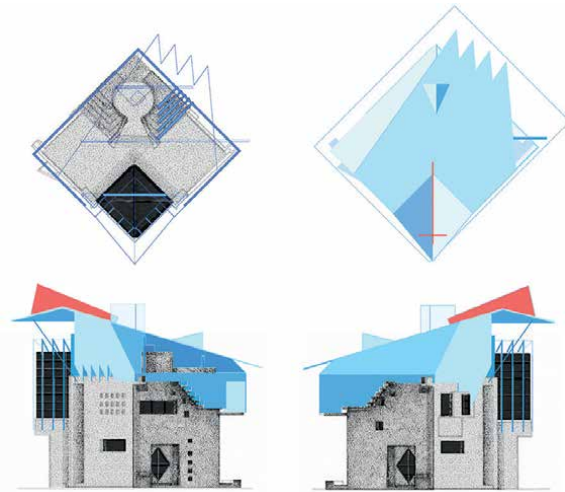


Figure 17.
Plans and elevations.

The ongoing renovation plan (Figures 16 and 17) seeks to expand the interior by constructing a new wooden roof over the existing rooftop. Since regulations on the floor-area ratio changed after the house was first built, it has become possible to extend habitable space upward. The added structure consists of a shell of 75 mm thick cross-laminated timber (CLT), supported by wooden beams laid across the existing reinforced-concrete frame, upon which a folded-plate roof is assembled. This too is a structure made possible through recent advances in technology. The sharply folded planes evoke the image of a bird's wings in motion, imparting rhythm and lightness to the exterior.

This addition functions not merely as a roof but as a device that renews the spatial and temporal experience of the entire house. In the future, the Ito House is envisioned as a venue for exhibiting my models and drawings, positioned as a “digital museum”



Figure 18.
Digital archive space utilizing glass curtain walls.

in conjunction with a digital archive. In the exhibition space, physical materials will be kept to a minimum, while a flexible spatial configuration will allow coexistence with the residential functions of the house. In this way, the design of a place where living and exhibition, privacy and publicness, and the material and the digital intersect inherently carries the potential to reconfigure the relationship between space and information.

This project attempts to integrate four-dimensional space, color, and technology. The stairwell, mentioned earlier, is one such example. In addition, the southern curtain wall becomes a projection interface for exhibitions (**Figure 18**). By employing new materials such as curved displays and micro-LEDs (light-emitting diodes), holograms of birds in flight appear to float within the interior. On the same surface, glass and imagery overlap, dissolving the boundary between inside and outside and intensifying immersion. In this space, the glass volume itself behaves like a device that handles information, integrating space and technology to produce new experiences. Furthermore, information is embedded into each individual glass panel. Once again, the shifting colors of the imagery bring a sense of time into the space, imparting rhythm and flow to what would otherwise be a static structure.

Thus, by incorporating color into “4D space” and further inserting and integrating virtual realities, this museum emerges not as a container for storing and displaying information, but as a dynamic spatial device that provokes bodily movement, cognitive processes, and sensory reactions in its visitors (**Figure 19**). Whereas traditional architecture has understood “space” as a three-dimensional composition, the museum space of the future must be reconstructed as a multi-layered and mutable structure, in which space and time mutually penetrate and interfere with one another. In this sense, the Ito House serves as an experimental site for exploring the potential of the next-generation museum, holding significance as its prototype.



Figure 19.
As you climb the stairs, you encounter the exhibits.

Appendix

See **Figure A1**.

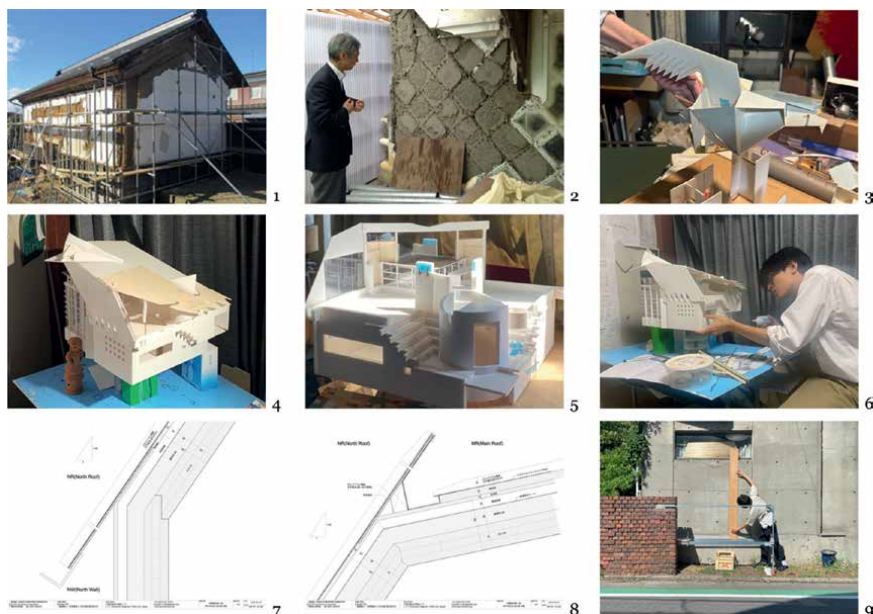


Figure A1. KURA storage: Craftsmen used bamboo keys and split bamboos, which were buried in the clay walls for reinforcement. Photographs were taken just after the 2011 Great East Japan Earthquake (1–2); Model for a bird sculpture made of a folded plate: The idea for a bird-shaped roof came from here (3); Models and details currently being produced for the Ito House (4–8); New entrance for the museum under construction (9).

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Seeing me at Night: Visualizing the M+ Façade in Hong Kong

Yu Weiyang

Abstract

M+, opened to the public on 12 November 2021, located in the West Kowloon Cultural District of Hong Kong, is “Asia’s global museum of contemporary visual culture”. It not only establishes its leading role from Hong Kong to Asia and global discourse but also creates a dramatic nighttime cityscape through its LED screen facade—an architectural digital media display facing Victoria Harbor. This chapter explores the M+ Façade within the conceptual framework of urban culture, visual experience, and media environment. Specifically, this interdisciplinary research analyses how the façade’s visual spectacles, through curatorial strategies, architectural design, and interactive cultural experiences, reflect museum practices connecting Asia to the global art world in the digital age.

Keywords: M+ Museum, Hong Kong, media facade, digital and screen display, visual culture

1. Introduction: The making of M+ in Hong Kong

M+ Museum’s architectural form features a mega-digital media facade that showcases Hong Kong’s spectacular urban landscape:

Facing Victoria Harbor, the M+ façade lights up nightly as one of the largest media facades in the world. At 65 metres tall by 110 metres wide, it is visible up to 1.5 kilometers away when viewed on Hong Kong Island. This enormous light-powered canvas, embedded with thousands of LEDs, enlivens the Hong Kong skyline as a key point of connection with our audiences.¹ (Figure 1).

The official description of M+ façade captures its significant establishment as one of the world’s largest night media displays. But more importantly, it acknowledges visual art as the museum’s identity—“seeing me at night” in the digital age. In its spatial location, the M+ façade faces Victoria Harbor and Hong Kong Island, where the financial centre and hillside luxury houses reside. In other words, Hong Kong Island offers distinct experiences from the Kowloon Peninsula, which is densely populated with street life and traditional markets. M+, located in the West Kowloon Cultural

¹ See the website: <https://www.mplus.org.hk/en/mplus-facade/> [Accessed: June 17, 2025].



Figure 1.

The view of M+ facade, featuring the moving image work The Shape of Light by Ellen Pau (Photo taken by the author).

District (together with the Palace Museum among others), can be regarded as an enclave of arts and culture positioned between Hong Kong Island and the Kowloon Peninsula. Yet the development of M+ embodies various tensions, uncertainties, and complex dynamics—spatial, cultural, and visual.

M+ was built on the West Kowloon Cultural District (WKCD) reclamation area, which has been part of Hong Kong's urban planning since 1995, comprising a complex infrastructure of transportation, public spaces, and commercial and residential buildings. The architectural competition for M+ launched in 2012, stating: "M+ also aims to complement the 'white cubes' and 'black boxes' of the contemporary art museum with 'third spaces'—new formats of interactive space and new interfaces between public space and back-of-house where learning is prioritized." (*The Making of M+* 2021, 63) [1]. Beyond its traditional interior exhibition space, the museum's architectural vision emphasizes the innovative screen facade, creating these "third spaces" or "new interfaces" for public interaction. According to Victor Lo (Convenor of Museums Advisory Group) on 23 November 2006, M+ stands for "Museum plus", designed to "study and showcase visual culture in an unorthodox manner, encourage interaction, and actively establish a platform for dialogue with audiences" (*The Making of M+* 2021, 118–119) [1]. In this context, M+'s mission is to serve as a visual art museum rooted in Hong Kong's global context, cultivating visual culture through its collections for diverse audiences—locals, tourists, and researchers alike. As M+'s director Suhanya Raffel states:

"I would state that the future of the museum will have significant developments as it builds infrastructure in Asia, and M+ is key to that story. As such, I want M+ to be a critical cultural platform for fostering exchange between Hong Kong and the rest of the world and be part of a global conversation." (Art Monthly Australasia, [2], p. 56)

On the other hand, many museums emphasize visual culture in their collections. M+'s collection, established in 2012, contains over 7000 pieces from 1895 to the present, with a focus on moving images, design and architecture, visual art, and Hong

Kong's visual culture.² The Sigg Collection, comprising 1510 pieces from 1972 to 2012, is acclaimed as “one of the largest and most comprehensive collections of contemporary Chinese art in the world”.³ Other sectors include the M+ Library Special Collection and the M+ Collection Archives. Whether digitized or in physical form, M+'s collection is the core value and asset showcasing its identity as a visual art and visual culture museum. In other words, the collection requires articulation and circulation—one of the best ways is through its media façade.

This chapter particularly concerns the M+ façade as visual representation and articulation to complicate and cultivate its museum identity of visual art connecting Asia to the global art world. First, I lay out the M+ Façade's screen in its architectural dimension to explore how visual culture is embodied and visualized in media infrastructure. Second, by analysing the museum's curatorial strategies, I provide concrete cases to understand the choices and outcomes of its screen visualization. Finally, I conclude with the poetics and esthetics of “Seeing M+ at Night” in Hong Kong's urban spectacle and visual cultural experiences.

2. M+ facade: Screen architecture as media infrastructure

The M+ façade is a media infrastructure of contemporary art—LED for digitalization, visibility for visualization, and conceptualization for artistic expressions. The scale of the entire side of M+'s architectural form is essential for its screen visibility. Even so, the temporality of M+'s façade showtime period is comparatively limited from dusk (approximately 6 pm daily) to 10 pm. The façade is significant but can also overshadow M+'s broader vision. As the museum director of M+, Suhanya Raffel addresses the museum's dedication to institutional operation and constitution (as well as engagement with local and international audiences): “Focusing on the building alone, however, has its limitations. As we open our permanent home in the West Kowloon Cultural District, it is important to remember that we have in fact been open for years.” (*The Making of M+* 2021) [1]. The intentional emphasis on the institution's history and its “permanent” status represents the cultural identity of WKCD through visual arts. Thus, a more concrete understanding of the M+ façade must be considered within its architectural design and concept as a whole story.⁴

Compared to other world-class modern art museums (such as the Guggenheim Museum in New York designed by Frank Lloyd Wright and its counterpart in Bilbao, Spain designed by Frank Gehry), Li [3] describes M+ as a “Bilbao Effect 2.0” with its “revised starchitecture”:

In the case of M+, this revised interpretation of architecture is encapsulated in the design of the M+ Façade, the prominent light-emitting diode (LED) screen that has

² See the website :<https://www.mplus.org.hk/en/about-the-collection/m-collection/>
[Accessed : June 17, 2025].

³ See the website :<https://www.mplus.org.hk/en/about-the-collection/m-sigg-collection/>
[Accessed : June 17, 2025].

⁴ The making of M+ undergone delays in the timeline “Plans for M+ were officially approved in 2011 The museum started its collection in 2012 and the construction of the building began 3 years later. Initially scheduled to open in 2017, M+'s launch was delayed several times due to construction issues.” M+ Museum of Visual Culture Opens in Hong Kong, *Art Asia Pacific*, issue 126, Nov/Dec 2021, p. 18.

become a signature feature of the museum. This design reinterprets the allure of starchitecture by not only enhancing the museum's esthetic appeal, but also serving as a crucial medium for conveying the urban importance of the museum and amplifying the cultural stature of the city itself ... M+'s LED screen became the largest billboard in Hong Kong, yet the institution deliberately avoids the term 'billboard' when referring to its distinctive LED facade. This screen displays digital art from the museum's collection, alongside the M+ logo and visitor information ... The façade design of M+ testifies to the museum's ambition to command global attention and be recognized as one of the world's pre-eminent art institutions. (p. 23, 24)

Unlike the more traditional architecture of The Palace Museum of Hong Kong next to M+, M+'s LED screen differs from the billboards that promote public or commercial-oriented high-rise buildings such as the International Commerce Center (ICC) (**Figure 2**). The ICC, a 188-floor structure with a mega-digital façade spanning 77,000 square meters of LEDs, is specifically part of "A Symphony of Lights"⁵ (light and music shows) to celebrate holidays or present welcome phrases. While the ICC represents part of the traditional visual effects of Hong Kong's nightly skyline architecture, M+'s façade demonstrates new ambitions in moving images as the city's emerging visual landmark. The M+ facade, awarded "the best Animated Media Architecture project at the 2023 Media Architecture Awards", highlights that "Not only does it showcase the possibilities of digital light, but it also plays a significant role in understanding the politics and poetics of the Hong Kong urban space and experience".⁶

On one side, it diversifies the visualization of arts and cultural dimensions. On the other side, it faces constraints from sustainable development policies and requirements. For instance, M+ Museum has committed to environmental sustainability by joining the Hong Kong Environment and Ecology Bureau's Outdoor Lighting Charter. Under this initiative, the museum turns off its facade lighting at 10 PM daily to reduce light pollution and conserve energy. M+'s facade thus functions as a media infrastructure that both consumes energy and delivers curated messages through moving images. These LED displays and artistic articulations, free to the public, distinctively shape the future narrative of Hong Kong's contemporary art scene. However, the high visibility masks the challenges facing M+, one of the world's largest visual cultural museums, with four key barriers to accessibility: insufficient promotion, high costs,⁷ cultural knowledge gaps, and limited social engagement opportunities (Chen and Chiu, [4], p. 83). While these gaps may not improve quickly due to institutional size and administrative and financial constraints, they significantly impact the complexity of M+'s visual culture vision and meaning—raising questions about its intended audience: locals, international tourists, or the potential futures of contemporary museums in Asian spatial and cultural discourse?

As a media infrastructure of a contemporary museum, the M+ facade extends beyond mere physical walls. It interweaves relationships between time, space, and

⁵ See the website: <https://www.tourism.gov.hk/symphony/english/details/details.html> [Accessed : June 18, 2025].

⁶ See the website: <https://www.mplus.org.hk/en/magazine/mplus-building-hong-kong-showcases-art-on-led-facade/> [Accessed: June 18, 2025].

⁷ See the website : Standard ticket : HKD 120 and Concessions : HKD 60, more details seen in the website <https://www.mplus.org.hk/en/get-tickets/> [Accessed: June 18, 2025].



Figure 2.
The view of M+ façade and International Commerce Center (ICC) on the Victoria Harbor (Photo taken by the author).

techno-cultural elements: temporal effects (Volmar and Stine, [5]), digital platforms in the “infrastructural turn” (Plantine and Punathambekar, [6]), and the “deep time of media infrastructure” [7, 8]. Recognizing modern digital technologies in its interactivity and interface, this “public urban screen” embodies the media environment as contemporary screened spatial and cultural visual experiences. As Stephanie DeBoer [7] comments:

The screen problems from which many of these essays depart are of the city that most readily announces itself to any urban inhabitant who might encounter it – the commercial city, the spectacular city, the global city, the city of enchantment [8].

The power consumption, [9] temporality of display, and critical analysis of M+’s facade must be understood through both its surface appearance and underlying media infrastructure as a “public urban screen.” Beyond its architectural form as a contemporary art museum, the screen architecture establishes its identity as media infrastructure—functioning both as a micro-screen within the museum context and as part of Hong Kong’s macro-screen media cityscape.

3. Curatorial strategies for screen programming and beyond

The M+ facade curates digital art exhibitions that explore how art can be visualized, remembered, and interpreted. The rotating curatorial content serves as a critical strategy for screening digital art exhibitions, featuring both collection pieces and “facade commissions”. The M+ facade exhibitions primarily showcase diverse video works by artists from Hong Kong, mainland China, and international creators, reflecting a clear curatorial vision for visual language.

Esthetically, the digital art exhibition evokes science fiction through subtle distortions on the large-scale screen and conceptual artistic vision. From May 20 to July 31, 2022, the co-commissioned moving image work (by M+ and Art Basel)—*The Shape of Light*—by Ellen Pau echoes an iconic scene from *Blade Runner* (1982). Hong Kong's cyberpunk esthetics are embedded in its streets and high rises, particularly in the neon-lit nightlife. While cyberpunk represents the contrast between high technology and low life in near-future urban experiences, it has become an esthetically imposed cinematic narrative of Hong Kong. As Hugh Davies (2019) notes, “cyberpunk's genre-defining feature is not its Hong Kong-ness, but the Western projection of it”. The commissioned moving images reinforce these esthetic and visual interpretations [10]. The exhibition features several conceptual pieces, including *Legible City Hong Kong* by Jeffrey Shaw and Hong Kong fiction writer Dung Kai-cheung, and Yang Fudong's black-and-white film *Sparrow on the Sea* exploring Hong Kong's temporal dimensions. While the commissioned works purposefully present Hong Kong through contemporary art, their reception on M+'s facade screen remains contentious. As a “public urban screen” [7], these conceptual moving images may be too abstract for general audiences (though perhaps not for art enthusiasts or those versed in contemporary art). The visual complexity risks reducing the works to mere backdrops in visitors' photos. Though the exhibition remains impactful, M+'s visual culture identity becomes diluted amid these shifting visual displays.

Before dawn, the M+ facade stands as an 18-story grey cuboid, resembling an unfinished building awaiting its final coat of paint. However, from the upper floors of M+—above the exhibition halls—you can see the facade's architectural details: blackish-green terracotta tiles crafted in Florence, Italy:

*Unlike the glass and steel exteriors of many Hong Kong buildings, the M+ facade features corrugated ceramic tile, which serves the important function of protecting our building and our collections from the elements. Natural variations in the textures and minerals of the glaze make the tiles highly responsive to the environment—like the water in the harbor, they might shimmer in direct sunlight or deepen into darker hues under the shade.*⁸

Between manufacturing and digital display, the M+ facade serves as a gateway to its hidden perceptions both locally and internationally. The facade's global journey spans from tiles made in Florence, Italy, to assembly in mainland China, and finally to its narrative presence in Hong Kong. Thus, the M+ facade transcends mere commissioned screen programming—it reveals how media infrastructure maintains physical connections across globalization.

4. Seeing M+ at night: Urban spectacle of Hong Kong and visual cultural experiences

Hong Kong's night urban landscape is one of the most visually striking and dazzling aspects of this international metropolis's spatial and cultural identity. M+, connected to Kowloon Peninsula and Hong Kong Island through Western Harbor Crossing,

⁸ See the website: <https://www.mplus.org.hk/en/magazine/the-beauty-and-craft-of-terracotta-manufacturing/> [Accessed: June 18, 2025].

stands prominently in the skyline. In *Hong Kong: Culture and the Politics of Disappearance* (1997), Ackbar Abbas [11] writes that the cultural forms of Hong Kong (architecture, cinema, and literature) reflect a sense of disappearance in between the historical transition from British colonial regime to reunification with mainland China. The cultural identity of Hong Kong is spatially and culturally uncertain for its future as history and memories are altered, displaced, and detached. The forces of postcolonialism, modernity, and globalization all shape and reshape Hong Kong politically and culturally. In one of the M+ collections, the ink and colour painting by Hong Kong painter Lui Shou-kwan (1919–1975, best known for abstract and gestural *Zen* paintings), *Hong Kong at Night* (1961), metaphorically visualizes the urban landscape in its poetics and flux in the night urbanscape [12] (**Figure 3**). The high-rising buildings with yellow neon lights, lost in the grey foggy mist, and stand on Hong Kong Island in front of Victoria Harbor. M+ museum could be one of these architectures, a part of Hong Kong's cultural identity spatially and culturally in the passing of time.

Before 1997, the Kowloon Walled City embodied “a sense of disappearance” in architectural form—a largely ungoverned, densely populated settlement in Kowloon City, Hong Kong”. Originally a Chinese military fort, it became a British-controlled enclave in 1898. The settlement gained notoriety between the 1950s and 1970s for illegal activities under triad control. The Hong Kong government began its demolition in 1987, completing it in 1994, and transformed the site into the Kowloon Walled City Park in 1995. Despite its unplanned and chaotic development, the City's organizational and functional systems maintained their own flexible order. The concept of entropy helps illuminate the structure and dynamism of this unconventional urban space [13]. The Walled City's demolition signified more than just the political and historical forces of British colonization and the 1997 handover—its architecture and façade embodied a disappearing spatial, cultural, and visual world. Its exterior powerfully captured iconic elements of Hong Kong's urban history through its density, visual complexity, and vibrant business signage. In contrast, today's M+ façade displays contemporary art on digital screens, highlighting tensions of globalization.

Second, the political unrest and uncertainty extends beyond the latent censorship at the M+ museum to how the intricate and subtle political environment impacts Hong Kong's cultural identity. The mission and vision of M+ 's contributions to Hong Kong's cultural identity are expected and speculated upon, including its engagement with



Figure 3.
Lui Shou-kwan, Hong Kong at Night (1961), ink and colour. M+ 香港 © Helen C. Ting.

various stakeholders and embrace of radical change (Poposki and Leung, [14]). As the “one country, two systems” framework will end in 2047, M+ represents one of the last opportunities for Hong Kong to create a cultural icon for future generations. However, making this project a reality is not an easy task (Ho and Aggeklint, [15], p. 17). Besides, the WKCD is still under development with unfinished buildings and construction sites. The speculation, both financial and political, continues as:

The funding comes from the Hong Kong Special Administrative Region and the decision to move ahead came in 2008—but it took until 2010 until Lars Nittve, at the time director of Moderna Museet in Stockholm, was contacted and asked to become its visionary leader. M+ is a distinct Hong Kong project, looked upon with skepticism from Beijing. (Ho and Aggeklint, [15], p. 18, 19)

As Yeewan Koon notes, “The change in Hong Kong’s political landscape has placed M+ under more intense scrutiny regarding its position than any other institution in Hong Kong” (Koon, [16], p. 155). The complex relationship between WKCD’s government position and M+’s conservative stance maintains a delicate balance in the visual arts sector, particularly in light of the 2014 Umbrella Movement protests (Vigneron, [17]). Additionally, issues such as “grand cultural spectacles” in capitalization, “inadequate infrastructure”, “(post)colonial legacy”, and “the fallacy of ‘global is local’” (Ho, [18]) have left the Hong Kong perspective unfulfilled while challenging M+’s cultural identity (Ho and Aggeklint, [19, 20]).

5. Conclusion

M+’s architecture is the foundational element of its permanent identity, particularly through its extensive architecture-oriented collection. This architectural focus was prominently displayed in the groundbreaking exhibition “Building M+: The Museum and Architecture Collection” (January 10 — February 2014) [21], which established the institution’s commitment to architectural discourse. The M+ facade, with its distinctive design and scale, stands as the most prominent and visible representation of visual art in the museum’s physical presence, creating a powerful dialog between the building itself and its cultural mission.

Several significant challenges have influenced and shaped M+’s evolving cultural identity over time: multiple delays in its official opening that affected public perception, the social and political impact of the Umbrella Movement, the far-reaching effects of the COVID-19 pandemic on the global art market and institutional operations (Poposki and Leung, [14]), and the growing tensions of counter-globalization movements that have reshaped cultural institutions worldwide.

In articulating the museum’s unique position, M+’s artistic director and chief curator Doryun Chong provides a nuanced perspective: “It is not a contemporary art museum and it is not a modern art museum. We call ourselves, museum of 20th/21st century visual culture” [22]. This carefully crafted institutional identity finds its most complete expression through the museum’s sophisticated media infrastructure, particularly evident in the dynamic M+ facade, which serves as a monumental canvas reflecting and engaging with contemporary visual culture in our digital age.

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Chapter 6

On Some Healing Bowls from Anatolian Museums and their Visibility

Şerife Tali

Abstract

Six healing bowls, five of which are made of metal and one of which is made of seashells, were scientifically introduced and evaluated for the first time in some museums Anatolia. It has been observed that digital (augmented reality (AR)) technology has not yet been used in museums related to artifacts. People will be able to see the healing bowls, all of which are handcrafted and original, only when they go to museums within their own means. With this publication, various solutions have been offered for the diversity and richness of the healing bowls introduced to the scientific community and for them to be more visible. Accordingly, thanks to digital (AR) technologies, it will be possible to open the healing bowls, which are not well known and produced by a certain culture to get rid of diseases, overcome their fears and meet their different expectations and wishes, to visitors all over the world. By constructing the healing bowls with AR technology, the interest and attention of the visitors in the museums, where to pay attention when using this bowl, and the rituals according to the diseases made and used will be transferred to the digital environment and an interactive experience will be provided to the visitors. The use of these technologies in museums will also significantly enrich the way healing bowls are made accessible to a wider audience. The importance of using technologies and keeping up with the times in order to make the healing bowls, which are invisible outside the museums, visible, was emphasized.

Keywords: Anatolian museums, healing bowls, manuscripts, digital technologies, visibility of artifacts

1. Introduction

Starting from the most primitive societies in history to the most advanced societies, human beings have sought various healings to cure their physical and mental diseases. They tried to get rid of their problems by including different applications such as magic, magic and enchantment in the treatment methods they developed based on faith and religion [1]. The search for healing through religion and magic began in B.C. In the 2000s, it was traced back to the Arameans. Among the old tomb structures, the bowls with the inner faces written entirely in Aramaic were called “magic

bowls” [2]. In the Roman and Byzantine periods, liturgical vessels adorned with religious contents, in which holy wine and bread similar to these bowls were placed, were used for healing [3]. Shamanism has had strong effects on healing practices in Turks [4]. In particular, it is known that shamans have the power to heal the patient’s body by washing them with holy water called “han water” by performing magic and spells [5]. With the acceptance of Islam by the Turks, it is seen that they have further enriched their practices by basing their traditions and customs, which were fed by their previous beliefs, on their religion [1]. In the twelfth century, the bowl prepared for Sultan Al-Maliq al-Adil Mahmud bin Zengi and in which it was written as follows: “This blessed vessel is for all kinds of poisons. Proven uses are brought together in it” is considered to be one of the earliest examples of healing bowls to the best of our knowledge [6]. It is thought that during the Anatolian Seljuk period, bowls adorned with natural or mythical animal depictions, planets, zodiac signs and prayers were used for the same purpose as healing bowls. The largest and most well known of the “April bowl” healing bowls, which was gifted by the Ilkhanid Ruler Ebu Said Bahadır Han during the Anatolian Principalities period in 734 H./1333 A.D., is displayed in the Konya Mevlana Museum [7]. The search for healing was continued in the Ottoman period and rich examples of healing bowls were given according to the periods in the art of mining [8]. Healing bowls have found a wide place in both folk medicine and palace medicine. Unlike metal samples, porcelain healing vessels were also made in China for the healing of dynastic members. This is shown as evidence that healing bowls were widely used in Islamic geography [9]. Healing bowls are talismans that symbolize people’s search for health, security and luck against nature, evil spirits and life [10]. Bowls are made from various materials, such as earth, copper and especially their alloys. In every period, there have been surahs, prayers, talismans, names of religious elders, symbolic figures, vows arranged according to the stars, and objects for healing with celestial elements [11]. Healing bowls from Iran are works that provide important information about art and the folk medicine practices it serves, with their material, decoration and especially content [12]. Healing bowls, which are made to get rid of many diseases and mental problems, have become less used with the developing technology. Some changes have emerged over time in the content and workmanship of the healing bowls, whose names vary according to the regions and are applied with various rituals [13].

2. Catalogue

2.1 Work No: 1, Tokat museum, Env. No: 76.28.1/2873, d.: 15.2 × 4.5 cm, Brass, place in the museum: Exhibition

Description: Healing bowl is considered in the type with a quarter-spherical body, without a belly, with a flat wide mouth and oval bottom (bowl-shaped ones). The inside of the healing bowl (**Figure 1**) is bounded at the top by two narrow borders, while its body is arranged in the form of four medallions connected in a double-contoured circular form, and symmetrical panels that lie between the medallions. Under this large area, the middle of the bowl is divided into two narrow borders, and the double-contoured six-armed Seal of Suleiman motif is placed in the center. While the first border is left blank in the upper part of the healing bowl, the second border is filled with Surah al-Baqarah 255, *which begins with Basmala in the calligrapher’s own handwriting. The verse (Ayat-al Kürsi) is written and completed on the first border*



Figure 1.
2.1. Inside the healing bowl.

in the middle of the bowl. The insides of the four circular medallions that determine the design of the inner body of the healing bowl are divided into square amulets of $3 \times 3 = 9$, and numbers are engraved in letters “betadin-zehecin-vahin” [14] and numbers are engraved on the corners of the squares.

د	ط	ب
ج	ه	ز
ح	ا	و

In the rectangular panels between the medallions, the content consisting mainly of *erkam-ı* and *hurûf-ı mukâtaa* is engraved. In the other two panels, the same verse is written in *Surah al-Hashr* 23 without *Basmala*. The verse (in part) is repeated: “Huwallahullazî lâ ilâhe illâ huwa, almalikul quddûsus salâmul mû'minul muheymî-nul azîzul jabbarul mutaqabbir al-Khaliq”. On the first of the two narrow borders that run around the center under the body of the healing bowl, seven seal symbols and numbers are inscribed with ۛۛۛۛۛۛۛۛ with the *Basmala*, and it is also completed with *Ayat al-Kursi* “and huwa'l-'aliyyu'l-'azim”. In the same border, *Surah Saff* 13 without *Basmala*, the verse (in part) reads: “Nâsrûn minallâhi wa fethun karîb”. The other second border is left blank. The inside of the Mühr-i Süleyman motif in the center of the bowl and the arms of the star are filled with ancient abjad symbols, *erkam-ı* and *hurûf-ı mukâta*.

In the outer body of the healing bowl (Figure 2), the order in the bowl has been continued in the same way and no changes have been made. On the border that wraps around the outer mouth of the healing bowl, *Surah al-Fatiha*, which starts with *Basmala*, is recited. On the four circular medallions outside the body of the bowl, $3 \times 3 = 9$ square amulets, two of them are written “betadin-zehecin-vahin” amulets, and the other two are written amulets consisting of numbers and symbols, and the content is differentiated.



Figure 2.
2.1. Outside the healing bowl.

4	9	2
3	5	7
8	1	6

Outside the healing bowl, the circular medallions are divided into rectangular panels between them in *Surah Saff* 13. The verse (in part) is: “*Nasrun minallâhi wa fathun karîb wa bashiril mu’minin*” and “O Muhammad” in the bottom line, *Surah al-Tawbah* Verse 111. The verse is written (in part): “*bi enne lehumul jannah*”. On the outer bottom border of the healing bowl, *Surah Falaq* is recited, which continues with Basmala. The inner center of the bowl is engraved with the motif of the Seal of Suleiman. The outer bottom is engraved with an eight-pointed star, unlike the inside. In the center of the eight-pointed star motif, $3 \times 3 = 9$ “*betadin-zehecin-vahin*” amulet has been largely erased and *Erkam-i Mukâtaa* is engraved around it. The healing bowl, in which very rich amulets are processed, is in good condition.

2.2 Work No: 2, Trabzon museum, Env. No: 10, d.: 19.5 × 5 cm, Brass, place in the museum: Exhibition

Description: Healing bowl is considered as a type with a hemispherical body, a wide spherical belly, a flat wide mouth and a flat bottom (similar to bath bowls). The inner and outer sides of the healing bowl are arranged similarly to each other. The inside of the bowl (**Figure 3**) is divided by a border bordered by a double contour in the middle, and its body is arranged in the form of two wide borders. Eight cartridges, four small and four large, in the form of double-contoured sliced clover leaves, connected by braided interlaces, were placed at the lower bottom of the body of the healing bowl. On the mouth of the bowl, which curves outward, the *Erkam-ı Mukâtaas* are engraved. Under the mouth of the healing bowl, the first wide border is engraved in an order that is divided into straight rows and connected to each other by segmented arches. The inside of the border in the body is written consecutively, in the first one, in the



Figure 3.
2.2. Inside the healing bowl.

squares of $2 \times 2 = 4$, “Beduh بدوح” and in three straight lines on the other arches, Erkam-i Mukâtaas are written.

د	ب
ح	و

Inside the narrow border under the border bordered by arches at the top of the healing bowl, Erkam-i Mukâtaas and ancient abjad symbols are engraved in between. On four small cartouches in a wide border around the core of the bowl, with letters in squares of $2 \times 2 = 4$ “Beduh بدوح” amulets were formed. In other interludes, the Erkam-i Mukâtaas were repeated consecutively in straight lines on four large cartridges. The top of the hemispherical curved belly of the bowl has been repaired. With this restoration, the writing belt on the belly, which was half destroyed, could not be read due to deterioration.

On the outer face of the healing bowl (**Figure 4**), the order on the inner face is maintained similarly. A different distinction is the prescription written in Rayhani script within a wide border around the mouth. *The summary of the prescription’s meaning: With God’s permission, there is benefit in relieving the deep restlessness, pain and sadness experienced during pregnancy. Spiritual support and assistance are available to ease pain, prevent premature birth and eliminate postpartum hemorrhage (for an easy birth). May it be blessed, and congratulations (the text is entirely about women’s easy childbirth).*

On the outer body of the bowl, *Surah al-Fatiha* is engraved (partially) in the narrow border under the frieze. Under the curb, as on the inside, interconnected cartridges are processed. Differently, the number of cartridges was increased to 13 and all of them were evaluated in the same measure. The insides of the cartridges are divided into squares of $2 \times 2 = 4$, and in the form of a four-leaf clover, the numbers “2, 4, 6, 8” are arranged differently in the center to give “Beduh” by swapping the numbers “2, 4, 6, 8” in the quadruple amulets. Numbers were written on each square, including the slices on the side, with the verses consisting of quadruple numbers, and they *were not written in letters* “Beduh” different from the squares in the bowl. The outer interior of the curved belly, which is evaluated with a writing belt on the inside, is divided vertically and completely filled with number verses. In all of the $3 \times 3 = 9$ number amulets, the “Beduh” amulets, which give a total number of 15 in each line, are repeated 13 times as follows.



Figure 4.
2.2. Outside the healing bowl.

4	9	2
3	5	7
8	1	6

Especially with the “*Beduh Amulet*” layout, the top of the navel part of the healing bowl has been restored due to melting and corrosion. The outer part of the bowl (except for the erasures at the bottom) has survived to the present day as stronger than the inner part.

2.3 Work No: 3, Erzurum TİEM, Env. No: 169/10, d.: 21x6 cm, Brass, place in the museum: Exhibition

Description: Healing bowl is handled in a deep type with a spherical body, conical belly, collapsed bottom, protruding rim and a ring base. There is a connection point inside the bowl above the conical core, indicating the presence of the small bowl. There is a hole above the mouth of the healing bowl, indicating that 40 locks may be found. The inner and outer faces of the bowl are designed similarly to each other. The inside of the healing bowl (**Figure 5**) is divided into three sections wide in the middle, with two borders with double contours at the top and bottom of the trunk. Twelve double-contoured medallions in a circular form are placed side by side in the middle wide part of the body of the bowl. Verses 16–28 of the Surah Yasin, which begins with Basmala in the calligrapher’s own handwriting on top of the wide mouth of the healing bowl, have been written. On the first border under the mouth in the bowl, Surah Yasin’s Verses 16–28 have been resumed. On the body of the healing bowl, in the wide border, the floors are bounded by a double contour, the floors of which are animated by zigzags, with a thulus calligraphy, these names of God are recited: “*O Qadir, O Merciful, O Merciful, O Nazîr, O Qayyûm, O Sâbit, O Dâim, O Hannân, O Dâfi, O Sadîk, O Ganîyy, O Riza*”. In the body part of the healing bowl, in the lower



Figure 5.
2.3. *Inside the healing bowl.*

and upper parts of the medallions, in between, Surah Yasin's Verse 28 from the middle of the verse (min jundin) is written down to the verse until Verse 45. In the narrow border under the body of the healing bowl, around the navel, Surah Yasin's Verse 50 can be traced to the end (halfeküm lealleküm). The circumference of the navel, which collapsed in the healing bowl, was corroded and *the Basmala* and *Surah Ihlas* were stacked freely in large numbers. The conical core of the bowl, which is divided into three horizontally, is filled with erkam-ı mukâtaas.

The outer face of the healing bowl (**Figure 6**) is divided into three, bordered by two double-contoured borders at the top and bottom, similar to the interior. While the bottom of the outer mouth is engraved with erkam-ı mukâtaas, the names of *Salavat-ı Sharifa* and *the Twelve Imams* are read in large Rayhani calligraphy on the wide border. In the middle wide part of the body of the bowl, 12 medallions of circular form are placed, adjacent to each other, unlike from the inside. Inside the six



Figure 6.
2.3. *Outside the healing bowl.*

medallions that are not contoured “*yâ Kâfi, yâ Muâfi, yâ Shafî, yâ Râzî, yâ Ghazi, yâ Dâfi*” Asmâ-i Husnâs were written. The insides of the six medallions in between are divided into unequal squares and filled as talismans consisting of disconnected letters and numerals. Between the medallions on the outer body of the healing bowl, *Surah Ihlas* continues with *Basmala*, *Surah Nas*, *Surah Basmala* and *Surah Kalem’s Verses 51 and 52*, known as the verses of the evil eye, were stacked as: “*Ve in yekâdullezîne keferû le yuzlikûneke bi ebsârihim lemmâ semîûz zikra ve yekûlûne innehu le mecnûn ve mâ huve illâ zikrun lil âlemin*”.

On the lowest narrow border in the body of the bowl, *Salawat*, thus invocation of peace upon the Prophet Muhammad can be read as: “*Muhammed sallallahu aleyhi ve ilahi? ve sellim ..rasulü rabbil alemin ..fe haimun nebiyyine ilel azim*”. The content was completed by engraving disconnected letters and numerals on the face of the ring base of the healing bowl and the numbers in three lines in eight circular medallions at the bottom of the bowl. Talismanic healing bowl, which has a rich content in terms of measurement, workmanship and calligraphy, is solid, except for corrosion in the central part.

2.4 Work No: 4, Elaziğ museum, Env. No: 74/F-12-53, d.: 16.1x6.2 cm, Brass, place in the museum: Exhibition

Description: Healing bowl is handled in a spherical body, a conical belly, a collapsed bottom, an outwardly slanted rim and a ring base type. There are 40 locks on the mouth of the bowl, and the locks have not survived to the present day. The inside of the healing bowl (**Figure 7**) is bounded by two double-contoured borders at the top and bottom, and its body is divided into three parts. The bottom of the body is arranged in four sections, with a wide border around the belly. Sixteen cypress motifs with oval bodies and heads tilted to the right are placed on double-contoured bases on the middle wide belly of the bowl. The fourth border around the belly at the bottom of the body is again divided by two small and four large asymmetrical cartridges in between, which are connected to each other in between. Verses 1–10 of *Surah Yasin*, which begins with *Basmala*, can be read above the wide mouth of the healing bowl. *Surah’s Verse 10* on the first border under the mouth continues to Verse 15. The cypress



Figure 7.
2.4. Inside the healing bowl.



Figure 8.
 2.4. Outside the healing bowl.

motifs that surround the body and are divided into straight lines are separated between them and the interiors of Surah Yasin's Verse 15 till the end of its Verse 72's beginning. It is read up to the beginning of the verse. On the narrow border under the cypress motifs in the bowl, Surah Yasin's Verses 72–79th exist, whereas Verses 79–81 are mentioned in the cartridges around the belly. It is completed down to the verse. In the line above the conical navel, which is divided horizontally into two, the healing verse Surah Isra Verse 82 is engraved: “*Ve nunezzilu minel kur’âni mâ huve şifâun ve rahmetun lil mu’minîne ve lâ yezîduz zâlimîne illâ hasârâ*”.

On the outer face of the healing bowl (**Figure 8**) the order on the inner face is maintained. On the other hand, 10 circular medallions with wavy edges with double contours are placed, connected to each other in the middle wide part. Below the mouth of the bowl *Surah al-Baqarah's* Verse 255 (*Ayat al-Kursi*) is recited. On the first border on the body, the names of the Twelve Imams were written with the mouth on the top: “Allahumma salli alel Mustafa wal Murtaza ie..”. Between the top and bottom of the medallions in the body of the bowl, which are divided into straight rows; all starting with Basmala, *Surah al-Fatiha*, *Surah al-Nas*, *Surah al-Falaq*, *Surah al-Ihlas*, *Surah al-Kafirun*, *Surah al-Qadr* and *Surah al-Baqarah's* Verses 255–256 are engraved. On the narrow border under the wide border on the body, there is *Surah al-Baqarah's* Verse 257 without Basmala. While the verse was being written, the face of the ring base of the bowl was engraved with the words. On the lowest ground of the healing bowl, the content was completed by writing the phrases “*Surah al-Gulezü, Surah al-Gulezu, Surah al-Gulhuwall, Surah al-Kafirun, Surah al-Alhamd, Surah al-Yasin, Ayat-el Kürsi, Devazede Imam, Ayat-i Shifa, Ayat-i Muhabbet(i), Esmâ-i Allah, Nâd-ı Ali*” in pieces. The healing bowl has a quality workmanship and rich content and is in solid condition.

2.5 Work No: 5, Edirne museum, Env. No: 5495, d.: 13.5x4.5 cm, Brass, place in the museum: Warehouse

Description: Healing bowl is dealt with in a type with a quarter-spherical body, without a belly, with a flat wide mouth and a flat bottom. The interior of the healing bowl (**Figure 9**) is divided into five sections by four double-contoured borders that



Figure 9.
2.5. *Inside the healing bowl.*

vary in width. On the second border, which is held wide in the middle, eight inter-connected cartridges, four large and four small, are placed. Surah al-Baqarah's Verse 255, which begins with the first border on the inner rim of the healing bowl without Basmala (*Ayat al-Kursi*), has been written. In the four large cartridges in the inner body of the bowl, Surah Basmala and Surah Ihlas are recited in full, while in four small cartridges in between; "yâ Hannân, yâ Mennân, yâ Deyyân, yâ Subhân" Esmâ-i Husnâs have been repeated. On the third narrow border under the wide cartouches of the healing bowl, Surah al-Basmala and Surah al-Fatiha are engraved. On the fourth wide border around the center of the bowl, the Nâd-ı Âliyyen Prayer is recited: "Nâd-ı Âliyyen mazhar-ül ajâib tecidhü avnen leke fin-nawaib kulli hemm-in ve gamm-in seyencelî bi-velayetike yâ (Ali)". The center of the healing bowl is bordered by zigzags and divided into two horizons, and the names of the Ahl al-Bayt "upon them peace be are stacked as "Allah, Muhammad, Ali, Fatima, Hasan, and Hussein". On the narrow border at the outer mouth of the healing bowl (Figure 10) Surah Nas was written with Basmala. The healing bowl is intact.



Figure 10.
2.5. *Outside the healing bowl.*

2.6 Work No: 6, Tokat museum, Env. No: 1.2.69, d.: 12.5x0.4 cm, mother-of-pearl, place in museum: Exhibition

Description: The healing bowl has a form close to a circle, the natural form of which is selected from the oyster shell. The corner part that curves the circular form outwards is deep and the symmetry is broken (**Figure 11**). The back of the shell, which is white and shiny inside, has rainbow colors consisting of brown, yellow, cream and pink colors (**Figure 12**). The lined inner surface of the healing bowl is arranged in such a way as to form a six-petaled flower with double contours that intersect each other in the middle. In the area arranged symmetrically in nine lines inside the leaves, starting from the center, only the talismans consisting of disconnected letters were written. The circularly completed rows of the shell are bordered by a narrow erasure at the outermost. The outermost edge of the healing bowl is framed by a double-contoured molding and placed in five pieces: “*minel mü'minine Rasulin; yağfirü aliiyyün bihakki ila Rasuli; Vestei'nü şerabten keffe Aliyyen?, Seyyid-i'l evla zu(v)ric nebiyyün*” and Surah Saff Verse 13 in part is written, “*Nasrun minallâhi*



Figure 11.
2.6. Inside the healing bowl.



Figure 12.
2.6. Outside the healing bowl.

ve fethun karibun.” While the geometric layouts dividing the inner part of the bowl are quite symmetrical, the quality of the line is unsuccessful. The bowl is intact, except for some erasures in the writing belts of the healing bowl.

3. Assessment

In this study, six healing bowls selected from Anatolian museums, such as Erzurum Turkish and Islamic Arts Museum (Yakutiye Madrasa), Elazığ Archaeology and Ethnography Museum, Edirne Museum, Tokat Museum and Trabzon Museum (Kostaki Mansion), are evaluated. All of the healing bowls are original pieces that are inventoried and handcrafted in museums. Of the healing bowls, all of which were brought to the museums through purchase, Work No. 5 is kept in storage, whereas the other five specimens are on display. One of the bowls, all intact, was made of natural shells, which are rare in museums, and the others were made of brass. Brass material has been used in bowls. It has been preferred more because it is easy to find and does not rust. The healing bowl in Work No. 6; In its natural form, it is different and made of seashell (mother-of-pearl). The choice of mother-of-pearl material, examples of which can be seen in the museums of the world [15] and Turkey [16], should be related to healing in bowls. In Verses 22–23 of the *Vakia* surah in the Qur‘an, the pearl and coral that come out of the sea are mentioned as the grace of Allah [17]. In this direction, psoriasis; When combined with April rain, which is considered healing, it becomes a pearl. The shells in which the pearl was formed were probably considered healing and thought to have been transformed into healing vessels as a means for people to heal. Casting technique was applied in the production of healing bowls. As decoration, the inner and outer surfaces of the bowls were mostly engraved and to a lesser extent, relief technique was used in the cartridges. It has also been determined from the museum inventory records that the healing bowls selected from museums in different regions were given local names such as “flower bowl” in Erzurum and “inscribed prayer bowl and forty-key prayer bowl” in Elazığ. The presence of healing bowls, whose numbers and characteristics vary in almost every museum in Anatolia, also reveals the prevalence of the use of bowls culturally. While it is called by this name “*because it is good for smallpox*” in Erzurum and its surroundings [8], it is stated that the people in Elazığ use the water they drink from the healing bowls to “*break the spell, to be good for malaria and jaundice, and to give birth easily to women*” [18]. Work in No. 2, a different recipe, was found on the wide border that wraps around the outer face of the bowl, indicating which diseases it is good for. ... Healing bowls are not only used to treat bodily diseases, but also to meet various expectations, *cancelation of magic (about easy childbirth for women...?)*, etc. It has been understood that it is evaluated on a much wider scope. Eser; It is noteworthy that the healing bowl in No. 4 is engraved on the outer bottom as “*Twelve Imams deva zade Imam*”. Deva zade means “*remedy, or deva ed/held*”. It can be explained that the names of the Twelve Imams take their place in the healing bowls because they are a cure for the afflicted, and that they are written concretely.

There is no date inscription on any of the healing bowls examined. Healing bowls without dates; They were dated by comparing them with the specimens found in other museums, as well as including details, such as materials, decorations and techniques. Accordingly, the healing bowl in Work No. 1 is the earliest of the examples. Work No.1; ISUM (Istanbul Water Museum), which is similar in typology,

material and especially content. No: 2021–2060 fourteenth century. It is similar to the healing bowl [16] dating back to the Mamluk period. With this example, the date of bowl No. 1 can be dated to the fourteenth century in general, especially in line with technical details such as knot motifs. The healing bowl in Work No. 2 draws attention to the types of bowls similar to bath bowls. In the British Museum, according to the same type and similar contents, as the Islamic Period; OA. 2603 Env. The undated bowl No¹. 1689, the undated bowl No. 1853.0528.14² and the single specimen No. 1878.1230.734 are dated to the seventeenth century, although they do not have an inscription³. FBQ at the Sheikh Faisal Bin Qassim Al Thani Museum (FBQ) Museum in Qatar. HH.362 Env. A similar healing bowl is given to the Ottoman Period and the nineteenth century as a date⁴. In one source, it is stated that the same type of healing bowl No. 33 may belong to either Syria or Egypt in the seventeenth–eighteenth century [19]. The inventory in the Haluk Perk Collection is of the same type. Seven healing bowls numbered 56–62 are dated to the seventeenth and eighteenth centuries [6]. In the thesis titled *Mineral Healing Bowls in Istanbul Museums and Private Collections* [11], healing bowls in metalworks in the Istanbul Tombs Museum [20], Malatya Museum healing bowls [21] and many works of the same type were examined as part of scientific thesis studies. Since there was no inscription on any of the bowls in the studies, the researchers dated the bowls across different date ranges. In scientific researches, private collections or auctions, it has been determined that these types have been dated to a very wide range of dates (without showing any data or sources) from the fifteenth to the nineteenth century. The bowl in Work No. 3 differs from other examples in a remarkable way with its large size, depth, quality workmanship and especially its rich decoration program such as religious talismans. Typologically, on a ring base, due to the similarities of their deep spherical bodies with a belly and wide mouthparts, the Khalili Collection with the healing bowl with the inscription number 30 (1044 H./1634–35 M.) and the healing bowl with the inscription number 33 in the same source (1050 H./1640–1641 M.) [10] shows similar features with the inscription bowl layout dated 9.4 No. 1066 H./1655–1656 M., which is stated to have been made in Shiraz in a different publication of the same author [22]. Although there are some differences in the decoration programs of Work No. 3 in line with these data, it seems possible that it can be dated to the seventeenth century in general when compared with the examples with inscriptions that can be found in various collections. The bowl in Work No. 4 is similar to the examples of previous Works: Khalili Collection Indian Work (1249/1833 M.) dated bowl [19], Erzurum Museum Env. No.: 1(4)9-81 (Year 1313 H./1895–1896 M.) and Elazığ Museum Env. No.: 74-F38-3 (Year 1281 H./1864–1865 M.) [13]; Haluk Perk Collection Inventory No.: 65 (1270 H./1853-54 M.), Inventory No.: 71 (1285 H./1868 M.), Inventory No.: 81 (1272/1855-56) and Inventory No.: 91 (1285 H./1868 M.) [6]. Work No. 4 is generally dated to the nineteenth century, accordingly. The healing bowl in Work No. 5 is similar to the conical body of the bowl cut with a flat bottom, without a base and with the mouth expanding towards the top, especially in the Kars Museum, which has the same typology and contents, 98/E-25-1 inv. and inscription 1327 H./1909–1910 M. tasa

¹ magic bowl (British Museum, number OA+.2603)

² magic bowl (British Museum, number 1853,0528.14)

³ magic bowl (divination) (British Museum, number 1878,1230.734)

⁴ Magic Bowl (Museum With No Frontiers, number QT2 22)

[13], as well as examples similar to the healing bowls in Inventory Nos.: 30, 32 and 37 in the Haluk Perk Collection [6] can be dated to the end of the nineteenth century and the beginning of the twentieth century. For the healing bowl from mother-of-pearl in Work No. 6, it is possible to date the specimen found in the Istanbul Water Museum (ISUM) [16], the sample in AKM00665 the world collections, one of which is displayed in the Aga Khan Museum, with the inventory number [15], and the other mother-of-pearl healing bowls, whose location is not specified and both of which are given as either Iranian or Indian work, show similar features to the eighteenth–nineteenth century range [19].

Healing bowls are typologically discussed in four different types. Work No. 1 is considered to be of the type with a spherical body, without a belly, with a flat wide mouth and with an oval bottom; Work No. 2 is considered to be of the type with a hemispherical body, a wide spherical belly, a flat wide rim and a flat bottom; Work Nos. 3 and 4 are considered to be of the type with a spherical body, conical core, retracted rim and a ring base; Work No. 5 is considered to be of the type with a hemispherical body, without a belly, flat wide mouth, flat bottom, and Work No. 6 is considered in its natural form (without type). The bowls in Work Nos.: 2–3–4 were evaluated as the first with a spherical core and the other two with a conical belly. None of the bowls examined have small second bowls located above the bellies. The bellies of the bowls are loaded with important meanings with the central phenomenon [23], which is thought to represent God and His existence. Forty keys, which are one of the indispensable components of healing bowls and evaluated by positioning them in two different places, have not survived to the present day, although they have places on the lips in Work Nos.: 3–4. The calligraphy that adorns the inside and outside of the healing bowls is written in the calligrapher's own handwriting. In terms of technique and workmanship, the bowls numbered 1–4 are very successful and in good condition. The workmanship of the bowls numbered 5 and 6 is simpler. It is understood that geometric decoration is actually preferred as a layout in the decorated bowls and this may be woven with symbolic contents. The inner or outer bodies of the bowls are animated with different stacks in the form of arches, borders, medallions or cartouches arranged in different ways.

When we look at the writing and decoration programs of the bowls, it is seen that verses or prayers are written only on the inner part of the bowls numbered 5–6, and the outer sides are left plain. It is understood that the inner and outer sides of the Work Nos.: 1–2–3 and 6 are woven with religious phrases, such as verses, prayers, etc., related to healing, as well as with more obscure contents. In the text content of the bowls, Surah Yasin and Surah al-Baqarah 255 (Ayat al-Kursi)–256–257 are recited. Its verses are Surah Al-Qalam 51–52, known as the verse of the evil eye. Verses, healing verses such as Surah Isra Verse 82, Surah al-Hashr Verse 23, Surah al-Tawbah Verse 111 (in part) and Surah Saff 13. The verse (partially), Surah al-Qadr, Surah Ihlas, Surah al-Falaq, Surah Nas and Surah Kafirun are recited. All or some verses of the Surahs are repeated one or more times. For Surah *Yasin*, which is recited on bowls, Everything has a heart, and the heart of the Qur'an is Surah Yasin. The person who recites this surah; *"If he reads hungry, he will be satisfied, if he reads thirsty, his thirst will be quenched, if he reads naked, he will be dressed, if he is single, he will get married, if he reads afraidly, he will be cured, if he reads sick, he will be healed, if he reads a prisoner, he will become halas, if he reads a guest, he will reach his destination in peace, if he reads troubled, Allah Almighty will alleviate his trouble, if he reads who has lost his way, he will find his way, if he reads whose belongings are lost or stolen, he will find*

his loss, if he reads with affairs attached to the door of the state, his affairs will be in order, He who fears the evil of an oppressor or for any wish to have any wish, for a long and healthy life, for all calamities and for all calamities, and without being dependent on anyone but Allah” [24]. Surah al-Baqarah 255 is written on bowls. Ayat al-Kursi has also stated that it is acceptable to read it 7 times and that the verse is healing when given to patients with water. The verse, which is revealed from under the feet of the throne, also protects the person from the fear and horror of all kinds of ins and jinn [25]. Ayat al-Kursi, as the greatest verse after Surah al-Fatiha, is shown as a gate of infinite power, unlimited power and endless wealth. In particular, it is said that very soon after the recitation of the honorable and glorious verse, in which the glorious names of Allah are mentioned, it brought about tremendous changes in the state, status, existence and entourage of the reciter [26]. Regarding the healing verses written on the healing bowls, “For the treatment of all kinds of material and spiritual diseases, if the Surahs Fatiha, Ayat-al-Kursi, Ihlas, Muavvizeteyn and healing verses are written on a clean paper and put in a jug, and then the patient and the water in the jug are read and given to the patient to drink for a week after breathing by reciting the same surahs, the patient will be healed and the soul will be at peace” [27]. In all of the healing bowls, after the surahs, Esmâ-i Husna (the beautiful names of Allah) occupies an important place. It was believed that the Qur’an could cure bodily diseases. It has been accepted that Asma-i Husna, the majority of which are abjad equivalents in the Qur’an, can be used for this purpose, and it is believed that some names may have special effects [28]. In the healing bowls, after the verses and Asma-ul Husna, various prayers to Allah come. When the contents of the prayers are examined, it is understood that Allah’s help is expected to get rid of troubles, to find healing and to meet various pilgrimages. It is woven with various religious contents as Basmala, Salavat-ı Sharifeler, Nâd-i Ali Duası, Ahl al-Bayt names (Âl-i Âbâ, Ahl al-Âbâ) and Twelve Imams. Each of the religious figures close to the Prophet has their own important characteristics; They possess knowledge, justice, righteousness, generosity, etc. That is why they must have been written in bowls as important intermediaries for wishes and expectations.

The content of the healing bowl in Work No. 2 is mainly written in “Beduh” (in the form of letters and numbers). Beduh is seen in square vefks with single or multiple layouts as letter or number values. In Work No. 2, the phrase “Beduh” was written in circular medallions inside and outside the bowl with four square religious talismans. Baduh is not included in the Bible and the Qur’an in any way, nor is it found in the hadiths in which the names of Allah are mentioned. In fact, the word Badûh بدوح (whose meaning is not fully known) consists of the letters in various numbers of talismans being broken down and arranged. According to the belief that prevails in the Islamic literature after al-Ghazzâlî, there is a relationship between this wafk and Hazrat Adam, and it is also claimed that this wafk is the seal of Hazrat Suleiman (tenth century B.C.) [29]. It is accepted that the use of this talisman began to become widespread after it was given by al-Ghazzâlî in al-Munķız mine’đ-đalâl as “a sure method for solving difficult problems” [30]. It is frequently applied in talismans and amulets, which are prepared and evaluated for different purposes. It is considered appropriate to write the word Badûh or its numerical values with the letters that make it up or the triple vefkin from which its name is taken in various numbers or to draw it in figures according to the need [31]. It differs from other healing bowls with the talismans consisting of “betadin-zehecin-vahin” [14] in Work No. 1, disconnected letters and numbers in Work No.3 and disconnected numbers in Work No. 6.

In this respect, the rich contents of the healing bowls, especially with the talismanic sequences in Work Nos. 1, 2, 3 and 6, reveal that the bowls may have been used not only for the healing of physical diseases, but also for the solution of mental problems or the realization of different wishes and expectations. The effect of cosmic forces has also been used to make these bowls with vefk content more powerful in healing [32].

The figure was not included in the healing bowls examined. In addition, some symbols with various meanings were used. The first of these symbols is the Mühr-i Süleyman motif engraved in the center of the bowl numbered Work No. 1. In addition, some symbols with various meanings were used. The first of these symbols is the Mühr-i Süleyman motif engraved in the center of the bowl numbered Work No. 1 [33]. The motif, which acts as a protective armor, is a talisman worn by Mühr-i Süleyman to protect himself from evil forces. *The six-pointed star* as a religious symbol is more commonly associated with witchcraft [34]. While a six-armed star motif is engraved inside the same healing bowl, an eight-armed star motif is also embroidered on the outer bottom. *The eight-pointed star* is a sign of luck in Judaism and Christianity, and a symbol of the creator of the universe in Islam [35]. Each corner of the motif [36], also referred to as the heavenly stamp (sky/God floor), has different meanings, such as mercy, gratitude, compassion, generosity, patience, loyalty, truthfulness and keeping secrets. It is thought that the eight-pointed star motif is drawn to the center of the bowls, and with its star shape, it has taken its place in the healing bowls as the equivalent of the sky and God. In Work No. 1, seven seal symbols, *which cover the supreme majestic name of Allah and are also accepted as the seal of charity*, are engraved. The seven seal symbols are also among the most powerful talisman symbols [37]. The seven seal symbols, which have variations as good (positive) and evil (negative) seals, have a very rich variety and content [37]. The khatami of charity was often used to protect against the harm of enemies [14]. There are also versions with different names and contents for the healing of diseases, such as stroke, paralysis, etc. [38]. Work No: 4 “the interior of the healing bowl is made of stylized cypress trees with heads bowed on their roots”. It is divided by motifs. The cypress motif, whose evergreen leaves are a symbol of life and death, has a strong symbolism. It is seen that the motif, whose head is tilted to the right in favor of the wind, is depicted in a way that respects the God [39].

In the study on healing bowls in Anatolian museums, due to the rarity of the artifacts, no digital analysis (e.g., X-ray fluorescence or metallurgical studies) was allowed, other than photography and measurements. A typology was created with all the research done on healing bowls and the bowls were grouped according to their “body-mouth and base” arrangement. It would be correct to note that the calligraphy on metal healing bowls, which is generally understood to be a single-handed work, is the calligrapher’s own handwriting style. However, the calligraphy, written in various characters, is stacked on the metal in a highly successful and generally legible manner. It is unknown what ritual was followed when the healing bowls were inscribed, or how long it took to complete them. Examples indicate that the healing bowls were created as variations of a single model and followed similar inscription patterns. Although the bowls were likely made in different times and places, it is clear that, despite all their differences, similar and common patterns and models were preferred. (Within the art of metalworking, healing bowls appear to have been produced, or at least marketed, in a wide range of styles and designs, including Egypt, Saudi Arabia, Turkey/(Ottoman), Qajar Iran and Afghanistan. However, it is noted that the examples found in these areas are almost indistinguishable in design [22].

4. Conclusions

Healing bowls made of different materials to get rid of many diseases and mental problems have become less used with the developing medical technology over time. In the historical process, it is clearly understood that healing bowls, known as folk medicine works and practices, have a widespread use in the form of psychological solutions in the social sense. The preference for concrete, long-lasting materials such as metal in the production of healing bowls, which are accepted by all segments of the society, has caused the bowls to carry their existence to the present day (in museums). It is clearly understood that the material selection was made consciously, taking into account the effects of the mine and its interaction with water. There is no doubt that everything written or drawn on the bowls has a meaning, and the healing bowls are fed by religious content, such as talisman shirts and talisman seals. It is also highly probable that the astral or celestial elements were started by calculating certain special hours according to the stars in order to cure a disease, as in talismanic objects, and to accept an expected wish. The only center where healing is expected and desired in bowls adorned with religious content can be none other than Allah. In bowls where traditions and customs are integrated with religion, healing verses and talismanic symbols, which are believed to contain various powers and secrets, are often repeated. It is known that healing bowls are widely used in periods when medicine is not developed or in places where medicine is not accessible. Today, those who believe in the positive effects of the bowls are healed by the water poured into the bowls, whose benefits may even be questioned. It is very difficult to explain or explain the miraculous effects of healing bowls to people, especially in the face of advanced medicine. Considering that the source of most physical diseases is caused by mental problems, it is an important data that bowls are used as a tool to get rid of them. At this point, the existence of healing bowls in museums and their transfer from the past to the future have been proved, thanks to museums. Museums play a very important role as the memory of society. The six healing bowls, each of which we work with by going to museums in different provinces, can be seen when people go to the museums where they are located, within their own means. However, with augmented reality (AR) technology, it will be possible for visitors to look at the bowls from every angle and understand the artifacts with the fictions to be made about the production and usage rituals of the healing bowls (SG). These technologies will significantly enrich the healing bowls to become accessible to a wider audience. It will allow for the exploration of all the details of the bowls, their textual content and their strong symbolism. In today's world where the usefulness of healing bowl is questioned, explaining to the visitors that the presence of bowls is good for physical and mental illnesses will deepen the emotional bond with the bowls and create an interesting experience. It has been observed that this technology has not yet been used digitally in the museums we have researched. There is no doubt that the use of these technologies in museums will make significant contributions to those interested in the content, awareness and use of the bowls.

Museums play a very important role as the memory of society. With augmented reality (AR), museums are not only exhibition areas, but also the interaction of visitors with the works that has increased and the processes of obtaining information are facilitated. When examined in terms of the purposes of use in museums, the aim is to discover and interact with the works, to find the positioning of the works more easily among the galleries during the visit, to increase the number and participation of visitors, and to comprehend and watch the works in the digital environment. It is seen that augmented reality is applied in different ways in museums. For example, in the Topkapı Palace Carpet Museum in Istanbul, the virtual carpet is interacted

with through the interactive floor using AR and the carpet is patterned. All kinds of information about the artifacts exhibited with AR technology in the Ankara Museum of Anatolian Civilizations can be accessed in audio and written forms. The exhibition of rare manuscripts at the Sakıp Sabancı Museum in Istanbul can be examined in detail via iPad. It is possible to interact with the interactive touch table clock at Bursa Clock Museum [40]. In our research, it has been seen that digital (AR) technology has not yet been used in the aforementioned museums.

Six healing bowls, each of which we work with by personally going to museums in different provinces in Anatolia, are exhibited in the museums where they are located, while one is kept in storage. When the visitors go to the museums within their own means, they will only be able to see what is on display. The healing bowl numbered 701 Inv. in the Ordu Museum was designed with AR technology (video in the “Additional information” section) and presented to the attention of readers, aiming to provide an interactive experience. This unique artifact, little known today, will allow visitors with limited interaction to view the bowls from all perspectives and understand the artifacts. This technology has significantly enriched the way healing bowls are made accessible to a wider audience. It will also allow for interactive exploration of the healing bowl’s textual content and powerful symbolism. Now, in today’s world, where even the usefulness of healing bowls is questioned, the existence of bowls and the fact that they are good for physical and mental diseases will be able to create an interesting experience that deepens the emotional bond with the bowls for the visitors. From now on, there is no doubt that the use of these technologies will make significant contributions to those interested in the content, awareness and use of the works.

Conflict of interest

The author declares no conflict of interest.

Additional information

British Museum: Magic bowl (museum number OA+.2603): https://www.britishmuseum.org/collection/object/W_OA-2603 (accessed 23.06.2025). Magic bowl (museum number 1853,0528.14): https://www.britishmuseum.org/collection/object/W_1853-0528-14?selectedImageId=1399278001 (accessed 23.06.2025). Magic bowl (divination) (museum number 1878,1230.734): https://www.britishmuseum.org/collection/object/W_1878-1230-734; (accessed 26.04.2024).

Museum With No Frontiers: Magic bowl (museum number QT2 22): https://islamicart.museumwnf.org/database_item.php?id=object;EPM;qt;Mus22;22;en (accessed 23.07.2024).

Ordu Museum: Healing bowl (museum number 701) designed with AR technology: <https://bit.ly/47ue2BP>.

Additional Youtube resources: Carpet Museum 3D Animation: <https://www.youtube.com/watch?v=yfuQFXgngqM>. Argela - Anatolian Civilizations Museum Mobile Application: https://www.youtube.com/watch?v=P3EmG_xOnZ8. Sakıp Sabancı Museum - Augmented Reality: <https://www.youtube.com/watch?v=IDtdGwiL0t0>. Arox Bilisim - Bursa Time Machines Exhibition: <https://www.youtube.com/watch?v=KkkK0UjbL94>.

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This volume, *Digital Horizons of Museums – Crossing Boundaries of Education and Practice*, examines how museums are redefining their roles in an era marked by digital transformation and societal change. No longer confined to the preservation of collections, museums are increasingly dynamic institutions where education, practice, and innovation converge. This book offers readers a critical overview of how digital technologies expand access, enhance learning, and foster participation among diverse audiences. By examining the intersections of museology, pedagogy, and cultural practice, it highlights both the opportunities and challenges of integrating digital tools into institutional strategies. Key themes include the creation of inclusive learning environments, the redefinition of audience engagement, and the development of new professional competencies within the museum sector. The book emphasizes the advantages of bridging theory and practice, offering conceptual clarity for scholars, practical insights for professionals, and inspiration for policymakers who aim to support sustainable cultural development. With its interdisciplinary approach and global relevance, this book serves as a valuable resource for understanding the future of museums as responsive, innovative, and socially engaged organizations.

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