

DISPLAY TECHNIQUES WITHIN ARCHAEOLOGICAL MUSEUMS SPACES

تقنيات العرض داخل حيزات المتاحف الاثرية

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ABSTRACT

The recent years witnessed a growing interest in archaeological museums thus aiming to revive the Egyptian civilization, emphasize historical culture and consolidate the Egyptian identity for future generations. The museum display techniques are considered a crucial design constituent -which show the creative values of archaeological artifacts- via the concepts of hybrid spaces that connect the history of civilization and the techniques of the current era, using interactive digital tools within space. This research reviews the design techniques as a contemporary cultural mediation for effective communication between global and local communities, which supports tourist magnetism however, the economic aspects should be considered.

This research highlights the various display techniques and their relation to the interior design of the archaeological museum space, to keep the visitor interaction not just passive spectators across multi-media technologies, furthermore the design-process aims to raise the number of visitors and encourage the cultural exchange between diverse communities.

KEYWORDS

Hybrid space; multimedia; technology integration.

المخلص

شهدت السنوات القليلة الماضية الاهتمام المتزايد بالمتاحف الاثرية، بهدف احياء حضارة المجتمع المصري والتأكيد على الثقافة التاريخية بالإضافة الى ترسيخ الهوية المصرية لأجيال قادمة. تعتبر الأساليب التقنية للعرض المتحفي من أهم المقومات التصميمية -التي تعمل على إبراز القيم الإبداعية للقطع الأثرية- معبرا عنها من خلال مفاهيم الحيزات الهجينة، والتي تعمل على الوصل ما بين تاريخ الحضارة وتقنيات العصر الحالي عن طريق استخدام الأدوات الرقمية التفاعلية داخل الحيز المتحفي. يناقش البحث التقنيات التصميمية باعتبارها أساليب معاصرة للوسائط الثقافية من أجل التواصل الفعال ما بين المجتمعات العالمية والمحلية، والذي يدعم الجذب السياحي مع الأخذ في الاعتبار الجوانب الاقتصادية.

يتركز موضوع البحث في استعراض تقنيات أساليب العرض المختلفة وعلاقتها مع تصميم الحيز الداخلي في المتاحف الاثرية، للحفاظ على تفاعل الزائرين داخل الحيز وليس مشاهد فقط عبر الوسائط التقنية المتعددة، حيث ان أهداف العملية التصميمية هي جذب أكبر عدد من الزائرين وتشجيع التبادل الثقافي بين مختلف المجتمعات.

الكلمات المفتاحية

الحيز الهجين؛ الوسائط المتعددة؛ تكامل التكنولوجيا.

1 INTRODUCTION

The archaeological museums are one of the cultural institutions that have a pivotal role in knowledge and culture civilization spreading of its physical and hypothetical location. It is considered a platform for encounters among people who collect the history of the past and represent it in the future through design of interior spaces for cultural mediation. This methodology is a new vision to ensure coping with evolving communities while keeping public consciousness and continuous interactivity with life updates and social development.

Recently, in the 21st century, all life facilities move toward the digitized system. Therefore, the museum institution should study the integrated technology that expands digital content and platform, to support remote-based interaction display aided with virtual reality aspects (immersion, interaction, simulation, interactivity, artificiality, activity-passivity, telepresence) to direct a museum's spatial reality and transmogrify into a hybrid space through an automatization system that has the ability to switch between physical space and digital resources and consequently 'hybridizing' although there is presence of static interpretation of display. The research promotes cultural engineering, which consists of using the most advanced suitable visual and sensory technology to transmit the history, the tradition, and the values of civilized eras.

1.1 Problem statement:

The paper issue is about the design gap of interior spaces in the archaeological museums and the lack of a contemporary form of cultural mediation for exhibiting methods in digital and physical ways. The research shows the design techniques that support the visitor's role to become an active participant and promote remote-based interaction with local and international communities. To emphasize the State's interest to cultivate historical and cultural value and stimulates tourism with a contemporary perspective.

1.2 Aim:

One of the most important issues of a museum's interior space design strategy is to apply the ideal concepts and standards for various display methods. The research proposes to outline the archaeological museum approach in identifying, developing, and evaluating the use of integrated technologies without compromising authenticity, through the following:

- Hybridizing the museum: the interactive space to allow knowledge production and exchange.
- Mutual collaboration between the museum and different sectors such as universities, research, and development companies to set the museum's design aspects that enhance visitor experiences.
- Designing a spatial program compatible with digital and touchless technology as connectivity channels to increase the online association communication for virtual tours, student distance learning, artist interviews and etc.

1.3 Objectives:

- Explain the innovative techniques that could be creative services to create contemporary archaeological museum while preserving the culture and historical characteristics of the society.
- Focus on the importance of technical multimedia and interactive digital tools for improving museum exhibition spaces.

1.4 Methodology:

A descriptive and analytical approach to investigate new innovative techniques of archaeological museum's display method which appeared currently. That it is highlighting the term of hybrid space emphasize the significance of spatial reality and virtual, concerning the creative value of each of the historical, cultural, and aesthetic aspects of the display methods. Besides, apprehend the interior design characteristics to articulate of understanding visitors from different cultures, age-range, and people with physical disabilities. The study comprises data gathered from different resources then analyzed and interpreted in pursuit of results.

2. ARCHAEOLOGICAL MUSEUM "OVERVIEW"

The museum is one of the educational institutions building that assembles, maintains, classifies, and displays artifacts of artistic, cultural, archaeological according to the museum specialty aiming to develop and inform the recent generation, hence spreading the culture about ancient societies. The museum hosts exhibitions to publicize a specific mission about ancient discoveries and knowledge of the tangible and intangible history and civilization of this period. (Wang et al., n.d.a). The museum types are classified according to location, space dimension, exhibited object. The archaeological museum is a place that houses ancient artifacts and represents the civilization of the past to spread the knowledge to the newer generation (*Powerhouse Museum Website – Museum of Applied Arts and Sciences*, n.d.)

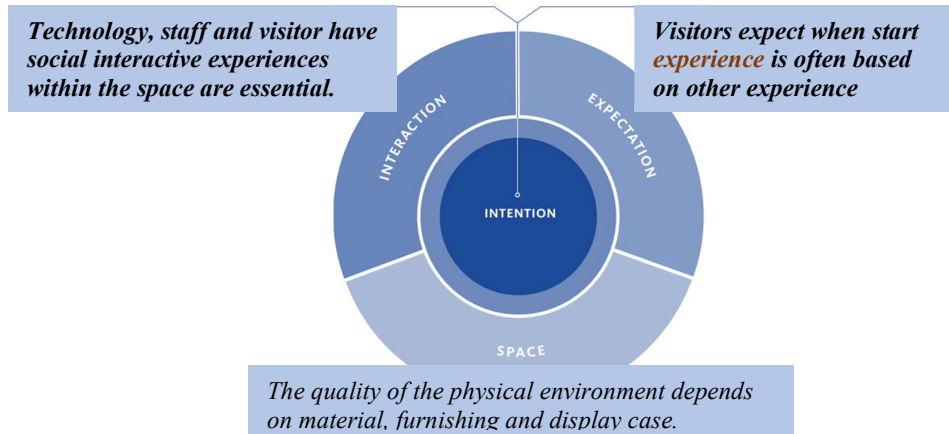
Architectural site of the Archaeological Museum classifies into (Mehroolhassani, 2015)

1. Archaeological museums equipped with historical sites.
2. Archaeological museums situated next to the archaeological sites.
3. Archaeological museums build away from the actual archaeological site.

An architectural point of view, the building of the archaeological museums can be divided into two main categories as:

1. **Building originally designed as an archaeological museum**, A good example of this would be the grand Egyptian museum, National museums of civilization.
2. **Historical building adapted to be an archaeological museum**, A good example of this would be the Manial Palace and Museum, Aisha Fahmy Palace.

Archaeological sites and museums are considered the main part of developing knowledge for the coming generations. Therefore, the museum spaces should become dynamic in their design balance between developing, documenting, and preserving objects on the one hand , while sharing and accessing knowledge on the other hand, rather than taking a passive role as collector and exhibitors museums (Figure1) (Bevin Savage-Yamazaki, 2018).The research framework seeks to analyze the museum visitor's intention and mindset; therefore, the designer translates the goals inside the planning of the museum architecture and interior design, in addition to the display of the archaeological artifacts.



*Figure1, user's expectation within museums spaces,
<https://www.gensler.com/gri/museum-experience-index:2018>*

3. MUSEUM DESIGN (ARCHITECTURE AND INTERIOR)

Our lives changed due to the rapid integration of the digitization age into every innovation facet. Recently, we cannot base on past models, definitions or concepts for planning and designing the built environment significantly improved. A new digital mindset is hardly required to use advanced technology to create new design approaches and clarifications fed by innovative thinking for architecture and interior spaces. In these times, the design is not only using the geometry form but it also uses pervasive digital technologies integrated with our physical and digital behaviors, to obtain remote base work, virtual collaboration, support learning tools, sensor technology, and artificial intelligence, which enables us to measure people's practice and sense about the space, sustain the historical culture and fulfill with the design, future advancements. Museums aim to offer visitors informative knowledge, by way of the richness in archaeological artifacts, cultural material, ancient figures, painting or others. Therefore, the significant architectural spaces, shape of visitor experiences, and their reactions, all is considered an excellent setting for the technological furnishings that have an understandable interactive and enriching interpretation on exhibition display elements. (Figure2). There are a variety of distinct strategies of how to understand and utilize the technology to enhance physical environments. One of these approaches is about using the shape and dimensions of interior architecture spaces in determining the artifact arrangement within the space and with the use of interactive tools (Figure 3).

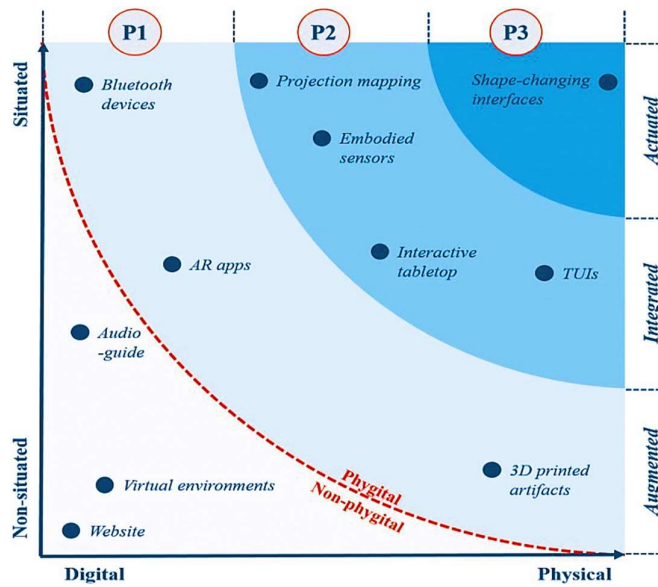


Figure2, archaeological information pass on physical & digital media, (Nofal et al., 2017b)



Figure3, Augmented Reality experience impacts the architectural contextualization of an isolated artifact. (gamer brings museums to life with augmented reality games, n.d.)

3.1 Design Factors Affecting Museum Exhibition Halls

Considerably the indoor environment rules and cultural precepts have an indirect influence on the visitor, audience circulation, and communication inside the museum, which can represent it in several points as follow:

- Visitor behavior inside the museum prevented touching the exhibit item, sitting, and leaning on surfaces, added other public activities (like eating general is not allowed), auxiliary entertainment, and educational activities might be specific. All of that is different like in any other public space.
- The human response toward obligatory rules is a sturdy factor influencing their behavior toward space and the means due to it relating to behavioral tendencies. Therefore, one pathway restriction, social distance while looking at the same exhibit object, moreover the overwhelmed sense of continuous monitoring, considered of museum guideline should follow within spaces.

To achieve design principles that correspond to the cultural context of the museum, it needs to formulate the initial design scenarios seeking a supportive connection between visitor appreciation, its interaction with each other, the spatial design, and the circulation pathway. Hence, the focus on the built environment for the museum, which contains complex activities and meaning. Therefore, it is necessary to understand visitor's physical experiences inside the museum area and their perception of diverse cultural values. (Ciolfi et al., 2007)

The design approach states series of design dimensions and definitions, specific guidelines, or requirements to interconnect the geometrical space concepts. That represents the physical and structural dimension (related to materials, structures, and environmental features) and its relationship with exhibit qualities. To highlight old historical location characteristics (for each of time and space). while considering individual experience and activities within the physical features of architectural spaces, social interaction, cultural influences. further that the museum

is oriented to visit different communities with the variable constraint that leads to countless design suggestions.

(Table 1): (Museum Exhibition Design, n.d.)

Spatial design dimension (Table 1)	
Physical / structure	Merge aesthetic values through harmonious materials and texture of interior architecture attracts visual balance, with reflective archaeological theme accessible for different age audience, welcoming and friendly entry.
Personal	Relate to positive intimation of human response and behaviors toward increase sense of identity, support welcoming and enjoyable experience, stimulate inspirational reference and informative goals.
Social	Improve abilities of communication and cooperation to accommodate others to learn ethics values.
cultural	Increase understanding empathy to other societies viewpoints by display, attitudes, beliefs, and values for their primitive history.

According to the previous design constraints, we should think of architectural space features in different vision that are appropriate advanced techniques for the archaeological museum:

- Defining innovative display methods support visual and auditory information.
- Establish a new design system to influence on the context cultural properties or even changes them to some extent.
- Provide new activities affecting visitor experience to transform ordinary existing ones into a creative opportunity for social interaction, communication, and collaboration.

4. MUSEUM OUTLINE (PLANNING INTERIOR SPACE)

The museum type, the function has a direct influence on the architectural space outline it should concern at the beginning of the design. Especially when we discover the link between architecture, archaeology disciplines, and human activity and material culture. As it considers an invisible way in which society evolves.

While each of them has opposite utility, the archaeologists document the archaeological artifacts of ancient civilizations, while architectural and interior designers formulate historical, cultural, and human concepts within an architectural design. That serves the quality and function of the museum alike. Therefore, the purpose of cultural documentation is a better understanding of human relationships and exchange (architizer.com - Architizer Journal, n.d.). The museum interior space must have a harmonious overall look to bind the exhibition. It may facilitate the visitor to focus and enjoy seen the exhibit content. Therefore, the interior space planning for exhibition halls and facilities depends on a group of design elements that explore the meaning and visual appeal through space sequences (Figure 4).

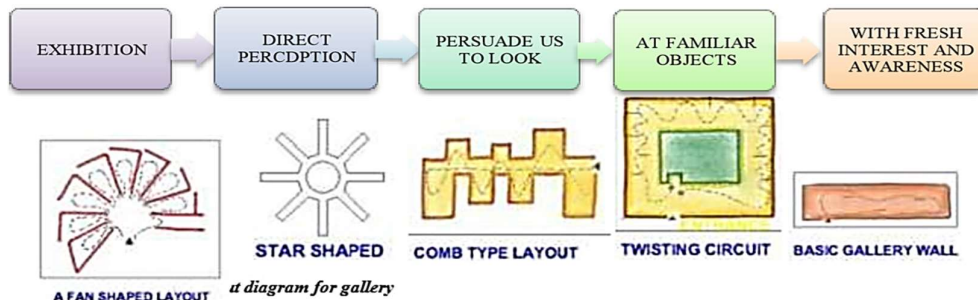


Figure4, museum space sequences and types of circulation (Museum – Day Arch, n.d.)

The museum interior design considers as a background for the displayed material and artifacts, thus the ideal one-act is a channel for visitor communication and to express the museum theme. Therefore, the design is not a simple decision to leave it by chance, but it demands principles to follow. Firstly, the layout planning works on identifying where you will need to accumulate items or any gaps that need addressing, number of the display object inside the exhibition in certain areas. Secondly, configure the space dimension and interior space surfaces (vertically & horizontally) to furnishing. It needs to assume distant inquiries about the choices, elements, graphics, lighting, and all design elements to handle with technical equipment installing that improve the efficiency of the archaeological spaces. Finally, the mock-up of the exhibition before installation is recommended for the designed elements to create simple layouts by different design disciplines participation using technological computer-aided software (5. *Exhibition basics - Museums Victoria*, n.d.) (Figure 5).

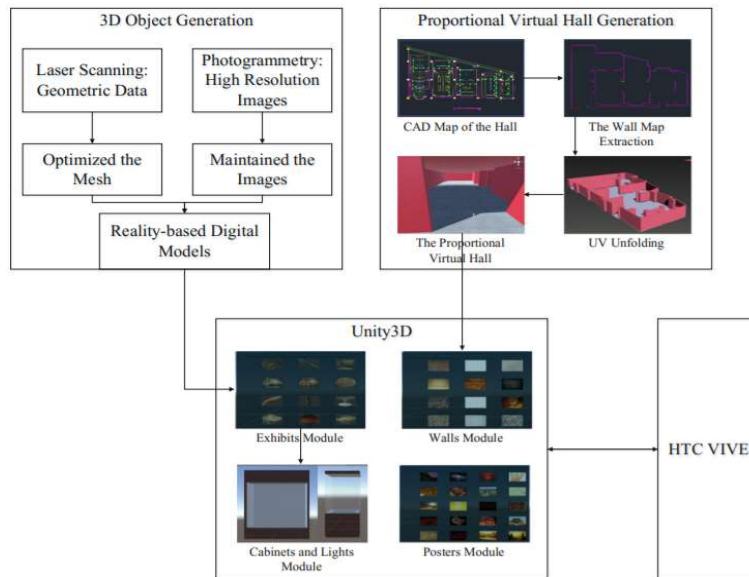


Figure 5, Museum interior design sequences on software
(Wang et al., n.d.-b)

Museums are combined organizations of artists, exhibition designers, conservationists, creative companies, and researchers who should collaborate in interior space planning to enhance (the exhibited sculpture, painting, artifacts, etc.) presentation and interpretation to achieve the optimum museum goals. In the meantime, they should utilize innovative display case and equipment to guard the artwork and highlight it aesthetically, according to the nature of the material and its position within the museum context.(*Museum – Day Arch*, n.d.)

5. DISPLAY SYSTEM DESIGN PRINCIPLE

Recently, the museum design concept involved various display techniques, considering the object characteristic, exhibition interpretation and presentation set-up, as its physical interaction of placing collections on public view. The crucial contestation to be achieved in designing a museum is to keep the visitor's attentiveness inward the exhibition, through the communication of knowledge transfer and subject matter in order not to lose the visitor attention in the display after twice of galleries tour. That depends on categorized by object arrangement and exhibit theme. (Figure 6). For example, sculptures exhibit varies between freestanding item that may need a platform while another would need glass unit for sculptures

in the round or vertical display. Other items such as paintings, scripts, books, or other similar exhibit forms, can be shown on display tables or frames. (Figure 7). Thus, each section in the museum theme plan can represent a period of ancient culture, which requires the comprehension of its varied properties, historical effects, to serve archaeological objectives besides keeping a typological model for the sequential interior design that continuously assumed circulation of the exhibition method.(Mehroolhassani, n.d.)

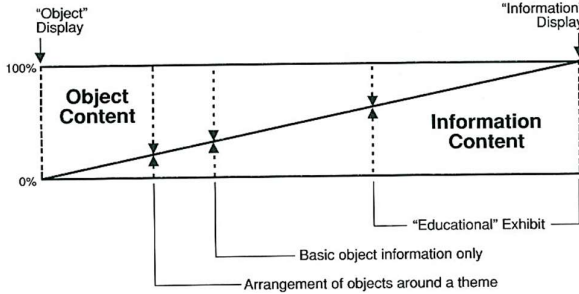


Figure 6, Relation Interpretation and presentation for exhibit item (Kapukotuwa et al., n.d.)



Figure 7, Exhibit display methods(ArchDaily.com/2020)

Obviously, the design of the display unit is one of the influencing factors on the museum mission, which must be in line with the museum context and highlight the aesthetic and philosophical values of the artwork and museum interior design. Therefore, in deciding a glass unit, wooden or metal frame the designer should take into consideration the design aspects such as frame thickness, consistency, and stability of the display method among the rest of the museum theme to enhance visitor circulation in addition of its suitability for the exhibit item features and dimension, support sensitive display items with inert plastic underneath to protect them from any distortion for dyes, fabrics, or even painted surfaces. A display case can be lined with treated fabrics while avoiding woolen or painted with environmentally sustainable materials like low VOC water-based paints, it should also use protect ingredient from insect and rodent, lighting system suited for displayed object beside avoid drop shadows as its obligatory application (*Museum – Day Arch*, n.d.).

The design of the museum exhibition is a combination of science and art for visual arrangement, design interior space, and finishing material selection according to acquainting exhibit item specification. The presentation of exhibitions in museums should never be a random chance. But it needs design standards that could serve the public properly and achieve the optimum design within space and apply the fundamentals of visual arts for each of the display system design such as, self-standing, wall-mounted, platforms and basses and the last one the interactive techniques.

- **Visual Communication:**

The visual communication within museum space can define various design elements corresponding to the archaeological museum, which can summarize the impact value of color, texture, balance for vertical and horizontal surface treatments. Consequently, all of these are influenced by the presence of other physical characteristics (Kapukotuwa et al., n.d.).

Infographics (information graphic) is “a visual representation of information or data, e.g. as a chart or diagram”(Oxford Dictionary on Lexico.com, n.d.) are a valuable tool for visual communication that gives a quickly and clearly understood overview of an archaeological

context through different design categories such as, informational, statistical, timeline, process, geographic, hierarchical infographics.

• **Spatial Ergonomic**

The successful technological display system depends on design standard of spatial dimension and visitor circulation within smoothly, attractive, and discoverable insight design. Otherwise, museum interior design reflects its type and exhibition halls to the visitors and target audience, through the following consideration (*Museum – Day Arch*, n.d.):

- permanent exhibition hall dimension, Width is not more than 22’ – 0” , Length 65’ – 0” to 80’ – 0” , Height 12’ – 0” to 18’ – 0”.
- Visual angle starts 27° up from eye level, most of galleries position the ‘eye level’ 155cm above finishing floor level for hanging pictures.
- Wall-mounted exhibit item, from the finishing floor 70 cm & away from the top ceiling 10m not more than 4.9m above eye level (Figure 8).
- Allowed areas for vertical surfaces about 3-5m² hanging & horizontal surfaces 6-10m² per sculpture. The desired space for painting and pictures 2.13m height & 3-3.65 m for sculptures items (Figure 9).
- For signs and text noted to be not less than 90cm or more than 200cm from finishing floor level.
- Pathway should allow visitors to exclude from the objects they already seen, while adequate for visitor’s variable speed movement.

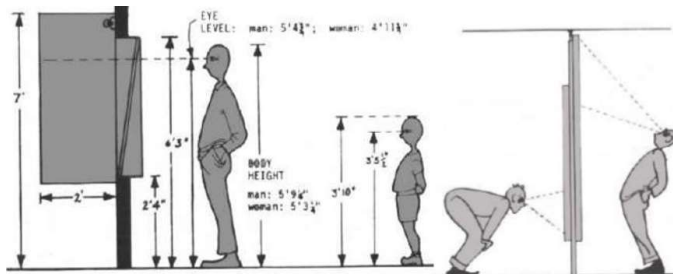


Figure 8, visual heights for standalone display

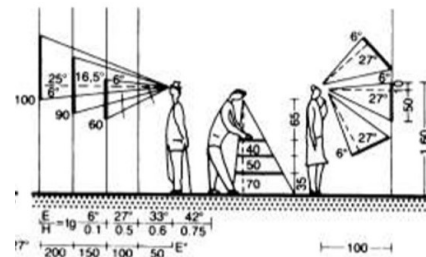


Figure9, visual range for surfaces

• **Environmental quality**

Exhibition display properly is not the only issue to take into consideration. while the environmental impact such as physical and chemical protection is a radical concern in the archaeological design process. Regarding physical factors related to the object like age, material, and all surrounded condition of the built environment and frequency of visitors within the museum. knowing, that there is a freestanding object without a display unit. So, the air quality should calculate and accurate to avoid spoilage over time. On the other side, the control system of the display unit that protects the exhibit item inside as is one of the designer's tasks must provide. The following point highlights environmental guidelines Which relate to the preservation of artifacts within the archaeological museum.

- The variable temperature has a direct effect on the museum exhibit object. For example, increases in the chemical reaction of cellulose nitrate film when the temperature level is the rise causes fire breakouts. (Mehroolhassani, n.d.) As well as the air conditioning levels recommended average is 18 to 20 centigrade degrees, the maximum degree is 24 to maintain cooling level as much as possible.

- The biological effects of insect growth should be limit by Spoiling the vital auxiliary factors. That helps to produce contaminated media of dirt, moisture, etc.
- Humidity level directly changes when the air temperature inside the museum changed due to cooling down the temperatures during the closing time in the evening. It is occurring inside the exhibition hall and storage areas, So the moisture level ruins dyes pigments, wood fiber, metal corrosion whether the organic and inorganic materials damage it. That is solves by monitoring and controlling techniques of the display case (Figure 10).

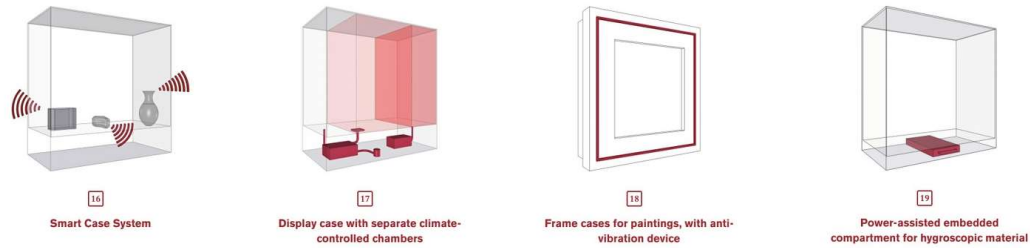


Figure10, display case & conversion (ArchDaily, n.d.-b)

(How to Design Museum Interiors: Display Cases to Protect & Highlight the Art | ArchDaily, n.d.-b)

• **Lighting:**

Museums and exhibition lighting system is the design key for the rest of the interior design element. That focuses on the cultural and architectural values, moreover its archaeological content. The crucial issue that faces the designer to fulfill different requirements of the ideal light system according to standards meanwhile follows sustainable facilities for economic, environmental, and audience Expectations in one single context inside the museum spaces. Therefore, the ideal lighting for the museum should realize in the following.

- The ambient light level should be indirect and a low intensity. which offers an ultimate chance for the direct light fixture to focus on the exhibit object. In addition, to reduce the harmful influence on artifacts, furnishing, etc.
- The natural and artificial light system must control to keep a moderate ambient light level.
- The window treatment should consider conserving exhibited artifacts from Harmful ultraviolet rays to avoid permanent damage on exhibit significance features. Furthermore, the window placement preferred to be in the top wall side or ceiling skylight to produce an artistic light reflection.

On that basis, design a museum light system is not a simple context due to complex function, so creating a mock-up model (computer aid programs) while applying the design constraint and values. That facilitates the designer to evaluate light quality, assume quantitative criteria of illumination, study light utilization for spatial characteristics (*Light for museums and galleries* | ERCO, n.d.), while noticing the lighting strategy and methods optimize its display of cultural assets for functional museum areas, and focus on cultural, architectural dominance (Figure 11).

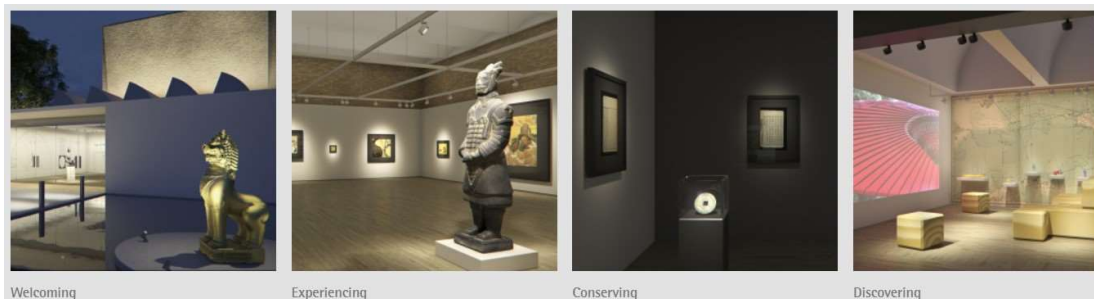


Figure11, various lighting methods in museum spaces, - <https://www.gensler.com/gri/museum-experience-index:2018>

6. HYBRID SPACE (APPROACHE FOR INTEGRATED TECHNOLOGY WITHIN ARCHAEOLOGICAL MUSEUM)

The innovative design key for museum space is to re-think the ongoing spatial features to be more efficient and sustainable. However, it influences the exhibition to undertake an interactive concept merging physicality (gestures, actions) and digital interaction (on-screen). Meanwhile, in collaboration of the designer with Archeology institutions developer and visitor feedback to create integrated design solution handle 3D programming, electronics, mechanics, and connectivity. It is about offering immersive and interactive hybrid space to attract the new generation efficiently and moving with time, that is connected age demands and future aspiration.

Hybrid spaces depend on (collection of control systems) diverse design theories practicing metaphor, embodiment, a consciousness with maps of information for digital resources and delivery systems to help the designer create electronic communication as well as physical space describe “environmental perception” underlie pervasive computing methods in the presence of both continuous and discrete.(Advocating a Hybrid Design Approach for Interconnected Environments [Book], n.d.-a)

Museum hybrid space approaches spatial and societal aspects and understands the ways of constructing participative solutions through which the museum may be an active mediator towards the audience through Interactive display technology suitable for the subjects of archaeological exhibition display method. For example, in western countries, heritage museums use the interactive display method depends on visual three-dimension information and virtual reality exhibits. Thus, the visitors react in physical space while experimenting with the exhibit with virtual reality and immersive space in getting the information that has a positive impact emotionally and sensory. Considers the cultural impact of intellectual constituents that reflect on the features and details of architectural design generally and interior design particularly. so, our cultural institutions can take advantage of it with preservation our identity shape to rebuilding our sense of community and belonging toward innovative cultural mediation.(The Hybrid Museum Experience, AMT Lab @ CMU, n.d.) Hybrid architectural spaces described the interconnected exhibition which links visitors or users, developed machine and architectural areas with emerging systems within interior design and the influencing factors.

We should realize a new environmental element to respect within architectural space expresses development and investment application for the archaeological museum hybrid design theory. That keeps us on track with the advanced technologies used around the world.



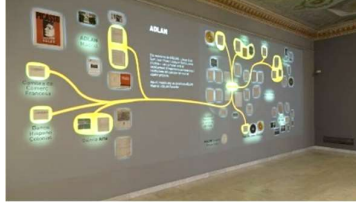
Prosperous hybrid space requires intelligent insight to understanding digital interface technology and be aware of people's (visitor or audience) interactions within the interior space. Therefore, hybrid architectural challenges necessitate the designers to know technological conceptual design, which gives them the ability to create a creative model that could simulate the digital and spatial environment. In addition, the anticipation of the influences of humans (individual visitors), usage of technologies such (Layers of information, virtual geometry, and relevant data, augmented reality devices), and design contexts (archaeological museum).

For that, the designers will immerse the architectural design with programmable communication tools (exhibit case) and apply knowledge, explanation, and exploration that makes meaningful physical and digital interaction in a museum context, through sophisticated systems of information inherent networks are integrated into physical spaces, so, Space itself will become malleable, capable of reconfiguring to suit our interior architectural design.

7. INTERACTIVE DISPLAYS TECHNIQUES (TECHNOLOGICAL SYSTEM)

The technique in the archaeological museum is combining the interior design guidelines and innovative technology of the interactive digital tools, which can embed it within exhibit display to give the visitors a possibility to immerse and interacts in a group or individually with the exhibit spaces. And they can connect to online platforms that are considered extensive opportunities for global interconnection and navigate virtually within museum spaces this is showing historical and futuristic values.(axiell.com /2017)

The modern archaeological museum basic idea should design with Brilliantly vision. To represent the history of the past through contemporary exhibition halls (*The ideal archaeological museum - Engaging with the past is key to making museums relevant - Ancient World Magazine*, n.d.) and new civilized spaces considered a social practice vitally important. To enhance cultural facilities in developing a mission for visitors, learners, and researchers and offers a valuable opportunity for institutions to continue digitizing their collections, deliver a seamless and enjoyable across interactive tools reflect the progress around the world.

EXAMPLES OF INTERNATIONAL MUSEUMS			
EXAMPLE (1)	<p>The exhibition halls are provided with interactive multimedia, which shows the combination of new media technologies and historical documentation.</p>		
TRACES OF AN EXHIBITION	<p style="text-align: center;">Design highlights</p>		
PICASSO	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> <ul style="list-style-type: none"> Interactive audiovisual mapping, (figure 12) Two large touch screens with customized software for lighting and image control </td> <td style="width: 50%; padding: 5px;"> <ul style="list-style-type: none"> Interactive & tactile interfaces, (figure 13) Data visualization (sensor solution & interactive projection, figure 14) </td> </tr> </table>	<ul style="list-style-type: none"> Interactive audiovisual mapping, (figure 12) Two large touch screens with customized software for lighting and image control 	<ul style="list-style-type: none"> Interactive & tactile interfaces, (figure 13) Data visualization (sensor solution & interactive projection, figure 14)
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<p style="text-align: center;"> <i>Figure 12, blogmuseupicassobcn.org</i> <i>Figure 13, mid.studio/projects/picasso</i> <i>Figure 14, bcn.cat/museupicasso</i> </p>			
EXAMPLE (2)	<p>The project will introduce contemporary display techniques that emphasize storytelling and have a comprehensive narrative that will make the museum visit enjoyable for the archeological artifacts and exhibition space.(<i>ISTANBUL ARCHAEOLOGICAL MUSEUM. TURKEY</i>, n.d.)</p>		
ISTANBUL ARCHAEOLOGICAL MUSEUM.	<p style="text-align: center;">Design highlights</p>		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> <ul style="list-style-type: none"> Audiovisual & interactive integration (figure 15). Large-format graphics integration. </td> <td style="width: 50%; padding: 5px;"> <ul style="list-style-type: none"> Artifact treatment (figure 16). Large-format scenography </td> </tr> </table>	<ul style="list-style-type: none"> Audiovisual & interactive integration (figure 15). Large-format graphics integration. 	<ul style="list-style-type: none"> Artifact treatment (figure 16). Large-format scenography
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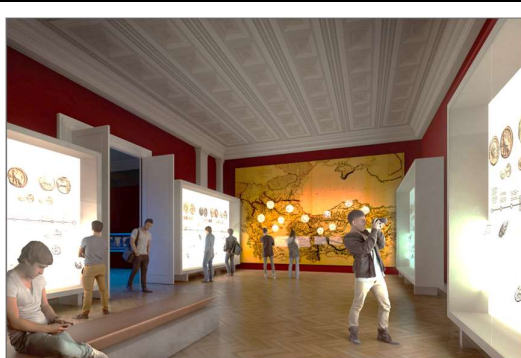


Figure 15. borismicka.com



Figure 16. borismicka.com

EXAMPLE (3) ARCHAEOLOGY SWITZERLAND – SWISS NATIONAL MUSEUM (ZURICH)	The exhibition locates in the new building extension. The interior architecture designs bases on dynamic shadows that drift over walls and floors to reflect a topographic model for the Swiss landscape. Visitors discover different geographical and geological sites and become part of the exhibition by sitting inside the display unit as it is considered enjoyable display techniques for the objects. (figure 17).	
	Design highlights	
	<ul style="list-style-type: none"> • Moveable interactive screen: offer detailed information for display object & context (figure 18). • Floor graphic: visually connected the highlight artifacts 	<ul style="list-style-type: none"> • Film projections • Large scale projection



Figure 17. e-architect.com



Figure 18. atelier-brueckner.com

EXAMPLES OF INTERACTIVE DIGITAL TECHNIQUES

AUDIO VISUAL INTEGRATION (AV)	Immersive digital interactivity technology for creative visualization of information, interactive wayfinding, and engagement with artifacts/exhibits, video playback systems, interactive audio installations. Moreover, it helps to envelop a visitor and interlace them on tactile and intellectual levels concurrently. Such an impact is achievable with interactive tools, such as touchscreens, beam speakers that perform extremely focused audio, and the Internet of Things (IoT). (Figure 19)
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Figure 19, AV and AR shows artifacts & statues of Terracotta Warriors at the World Museum

Digital and interactive artefacts

An innovative method of cultural mediation enabled the museum to introduce new informative content which would have been impossible to exhibit in material or physical form (Figure 20) (figure 21)(Paliokas et al., 2020).(The Anet Castle - Tactile Studio, n.d.)

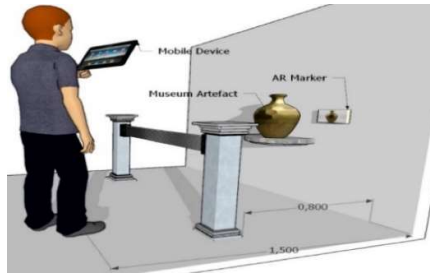


Figure 20, augment display artifacts



Figure 21, digital library appears in HD visualization for archeological material & artifacts.

RFID technology (radio frequency identification)

It is a way of saving and retrieving information remotely, design a model equipped with an illumination system and interactive cards, allowing visitors to discover the purposes of the buildings (Figure 22). They can completely immerse themselves in the space of this historic architecture and understand its history. Around this model are 25 cards, captioned and organized by color, which help to understand the functions of the buildings and to light up the room in question.

Figure 22, interactive model, <https://www.gensler.com/gri/museum-experience-index:2018>.



For example, by placing a green plaque on the lectern of the model, there is an instant luminous interaction, indicating the room shown on the card (Figure 23). (*The Anet Castle - Tactile Studio*, n.d.).

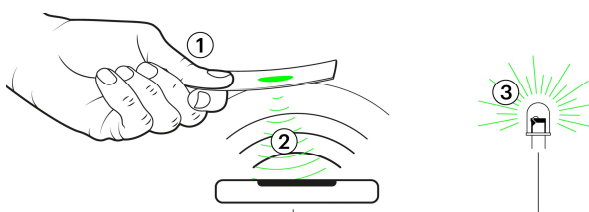


Figure 23, interactive cards, gensler.com/gri/museum-experience-index:2018.

Museum audio guide (Bone conduction technology)

Voice navigation is an important guiding tool while visiting the museum, but for some people with congenital hearing impairment and elder, whose hearing loss is hard to hear it. The tool can help most hearing-impaired people to enjoy the museum's voice guide to enjoy the tour service effectively as same as ordinary people. (This navigation system will not spread sounds into the air which can keep the museum quite effective) allows greater inclusion and independence for this audience through audio-description functions, visual and textual adaptations of dialogues, and commentaries (figure24)(*Museum Audio Guide | iF WORLD DESIGN GUIDE*, n.d.).

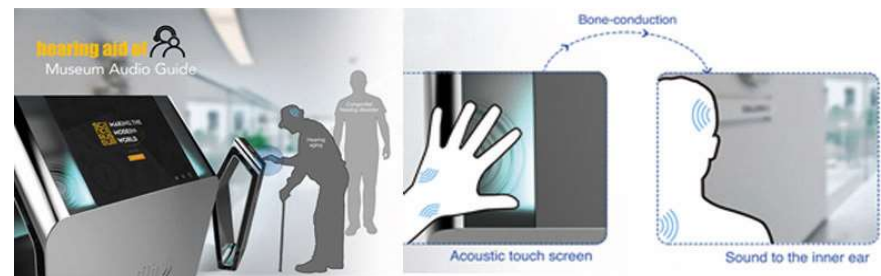


Figure 24, navigation audio tools (bone conduction tech.). Ifworlddesignguide.com

museography

the techniques which have been developed interior design installation through the multi-media table. When the object is detected, an interactive explanation appears on the interactive screens, interior surfaces, and recounts in detail the story or the symbolic significance of the object (figure25)(*Museum: Museography Concept | EVE Museology*, n.d.).




Figure 25, architectural Features in display scenario and museography (archdaily.com).

The innovative technologies in the context of the interactive hybrid museum are limitless tools of used application in the developed museums, which included a collection of controlling system.

Interactive Physicality	relate to (gesture and action) spatial system supports visitor within contemporary museum spaces applying for digital guidance, informative multimedia, and interactive display case and etc.
Digital interaction	relate to (sensors and touch screen) virtual of the museum through online visiting, activities, learning, etc.

8. DISCUSSION AND ANALYSIS

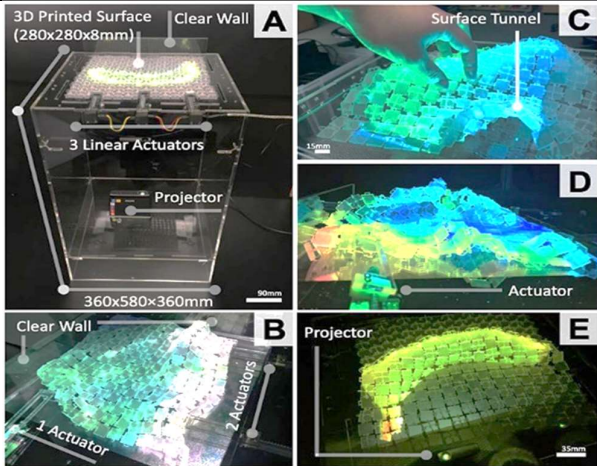
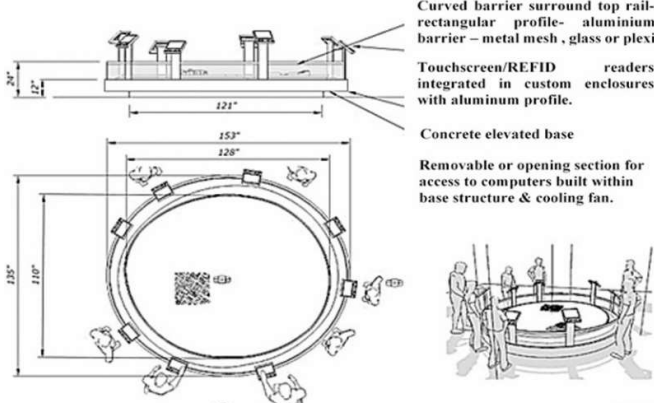
The archaeological museum considered a civilization and culture icon of society for hundreds of past years. The ancient civilization raised on the technical progress of which the ancient designer excelled. The research highlighted the historical culture in a contemporary perspective by using different digital technology media on the one hand and its relation to the design of interior space on the other hand. Aiming to represent digital mediation able to transfer and exchange knowledge within immersive and interactive hybrid space (physically and virtually). Therefore, the role of interior designer is to create (hybrid interior museum spaces), which is supported by a variant of digital and interactive tools, as design concept helps in spatial communication suitable for a diverse condition such as an epidemic, different societies communications, and...others. In a way that does not conflict with the historical authenticity of the building and the archaeological exhibits.

The museum interior space fundamental principle and guideline depend on multidisciplinary functional and design aspects. Therefore, the context of integrating digital and physical technology requires advanced installation in spatial structure and space design as Louvre Abu Dhabi. Hence, the “physical, the integration of digital technology ‘into’ physical reality” Demands technical installations of various sensors and operators within interior architecture invisibly. For example, shape-changing surfaces, projection tools, have significant, contemplative, easy to understand, and use for the museum context (Nofal et al., 2017a). As it is considered a distinctive opportunity for narration (tour guidance) for variable fields such as learners, foreign visitors of different languages, disabilities, etc. achieve interpreting display. By abbreviated the western country archaeological museums identifying, developing, and evaluating its digital engagement solutions for interior space features approaches to associate the tangible items through an online platform to display with the world of virtual media that create a strong emotional and sensory impact afforded by interactive digital by touchscreens, mobile apps, or location-based audio guides. The previous analysis shows the technology to create a hybrid museum, facilitate physical and digital application that transforms and enriches the visitor.

Egyptian archaeological museums will need to rethink digital engagement by developing more Innovative technologies to be woven through exhibits without compromising the authenticity and intimacy of the visitor experience, as it a challenge and limitations should the interior designer consider which allows an actual and interaction with the artifacts displayed to grasp the information of historical and also enjoy his presence inside the museum on the one hand and on the other hand, can visit the exhibition by default and interact with the space exhibition through the site and application electronics, allows visits and exchange of knowledge from all

over the world and also the tourism activity continued even in periods of downtime as happened to reduce the spread of epidemics.

This research identifies the following finding aspects

Spatial Hybrid archaeological museum design	
Innovative techniques	
Interactive Physicality (Interior architectural surfaces)	<div style="display: flex;"> <div style="flex: 1; padding-right: 10px;"> <ul style="list-style-type: none"> Spatial surfaces: supported information and visualizing theme through shape-changing surfaces using digital lighting system & 3d printed panels. (figure 26) Furnishing: innovative display case Active spaces program: space dimensions allow variable interactive techniques, Availability civilized area for visitor communications. </div> <div style="flex: 2;">  </div> </div> <p style="text-align: center; margin-top: 10px;">Figure 26, Shape-Changing display surfaces, (Althoefer et al., 2019)</p>
	<div style="width: 45%; padding: 5px;"> <p style="text-align: center; background-color: #fff9c4; margin-bottom: 5px;">Quality</p> <ul style="list-style-type: none"> architectural building designed for archaeological museum applying contemporary interior design accommodate for society changing needs for integrated technology. Employment of adaptive historical spaces design that blends with the exhibit collections without overshadowing the significance of each other. </div> <div style="width: 45%; padding: 5px;"> <p style="text-align: center; background-color: #fff9c4; margin-bottom: 5px;">Accessibility</p> <ul style="list-style-type: none"> Allowing visitors to interact with museum collections and space through interactive visualization of its history. The enhancement of inclusive personalized systems for disabled individuals to interact with different museum spaces and collections using integrated technology. </div>
Spatial Hybrid archaeological museum design	
Innovative techniques	
Digital interaction (Computer & Mechanical installation, Online services)	<div style="display: flex;"> <div style="flex: 1; padding-right: 10px;"> <p>Gesture and action with projection mapping museum through implanted invisible mechanical actuators. (Figure 27)</p>  </div> </div> <p style="text-align: center; margin-top: 10px;">Figure 27, Projection mapping, (The Biosphere – NGX Interactive, n.d.)</p>

- users within museum space have virtual simulation museum tour based on **interactive tools** (spatial holographic Head-mounted Displays -HMD) offers interactive visualizations with actual artefacts and display object and connect online for remote based interaction (web-based) which can union at the same time.



Figure 28, Different interactivity suggested for archaeological museum,
(Tools for making MR-Mixed Reality | Download Scientific Diagram, n.d.)

Quality	Accessibility
<ul style="list-style-type: none"> • Utilization of highly immersive virtual engagement interactions in both physical spaces and online platforms to connect with diverse communities. 	<ul style="list-style-type: none"> • Targeting wide audience of different backgrounds, age groups, disabilities through an inclusive individualized experience.

9. STUDY RESULTS AND RECOMMENDATION:

The study aims to use the advanced technology of interactive design, which is important for the success of interior architecture design and contribute the artistic creativity within museums spaces, and to take consideration of the future innovations that pave the way to keep up with the times, this paper recommended the following:

1. Interconnecting the physical & digital experiences can help the audiences on online platforms to virtually engage with visitor tours and museum events, also allowing remote-based interactions such as distance learning programs to better deliver to their objective virtually to the visitors.
2. Offering improved museum wide Wi-Fi access to visitors for indoors and outdoors areas to improve their digital experience and promote outdoor programming.
3. Emphasizing on accessibility and inclusivity in the museum to meet the needs of people with disabilities, also offering a welcoming environment for people of all age groups and different backgrounds.
4. The new knowledge era demands updating the outdated planning theories. Zoning-based and functional segregating planning are no longer valid for contemporary design.
5. Many institutional considerations should be taken care of when it comes to promoting digital experiences in museums. Starting from staff training programs, space requirements and cost, not to mention the need of continuous maintenance and revisioning of these technologies so they do not go obsolete. Also, the implementation of such digital technologies should be designed to maintain a good balance with the physical experience of the museum to enhance it without being distracting or overshadowing.
6. Museum exhibition designers should create an engaging and friendly environment through integration and visualization of exhibition information through combining different physical and digital techniques with consider environmental aspects for archaeological museums.
7. The wide variety of museum audience and visitors of different interests makes it challenging to offer an enticing experience for everyone. while visitors ranging from researchers and

enthusiasts to causal visitors, designers should be aiming for inclusivity of the environment through presenting the educational value of museum exhibits in an approachable and comprehensive way by utilizing new technology advances.

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10. REFERENCES

- Archaeology Museums That Combine Modern Architecture with the Ancient Past - Architizer Journal.* (n.d.). Retrieved from <https://architizer.com/blog/inspiration/collections/archaeology-museums/>
- Architecture as Interface: Advocating a Hybrid Design Approach for Interconnected Environments - Designing for the Internet of Things [Book].* (n.d.). Retrieved from <https://www.oreilly.com/library/view/designing-for-the/9781491971468/ch02.html>
- Exhibition basics - Museums Victoria.* (n.d.). Retrieved from <https://museums victoria.com.au/learning/small-object-big-story/5-exhibition-basics/>
- Althoefer, K., Mastrangeli, M., Everitt, A., & Alexander, J. (2019). 3D Printed Deformable Surfaces for Shape-Changing Displays. *Frontiers in Robotics and AI* | *Www.Frontiersin.Org*.
- Bevin Savage-Yamazaki, C. B. (2018). *Museum Experience IndexSM | Research & Insight | Gensler.* Retrieved from <https://www.gensler.com/gri/museum-experience-index>
- Ciolfi, L., & Bannon, L. J. (2007). Designing hybrid places: merging interaction design, ubiquitous technologies and geographies of the museum space. *CoDesign.*
- Gallery of Danish National Maritime Museum Permanent Exhibition / Kossmann.dejong - 9.* (n.d.). Retrieved from <https://www.archdaily.com/445543/danish-national-maritime-museum-bjarke-ingels-group/52785452e8e44e82b000059-danish-national-maritime-museum-bjarke-ingels-group-photo>
- Gamar Brings Museums To Life With Augmented Reality Games | Innovation Warehouse.* (n.d.). Retrieved from <https://innovationwarehouse.org/gamar-brings-museums-life-augmented-reality-games/>
- How to Design Museum Interiors: Display Cases to Protect & Highlight the Art | ArchDaily.* (n.d.-b). Retrieved from <https://www.archdaily.com/935917/how-to-design-museum-interiors-display-cases-to-protect-and-highlight-the-art>
- Infographic | Definition of Infographic by Oxford Dictionary on Lexico.com also meaning of INFOGRAPHIC.* (n.d.). Retrieved from <https://www.lexico.com/definition/infographic>
- Istanbul Archaeological Museum. Turkey.* (n.d.). Retrieved from <http://www.borismicka.com/iam/>
- Kapukotuwa, A., Alex, O., & Anedo, A. (n.d.). *Museum Exhibition Techniques IGBO Traditional Education View Project Trans Continental Novel Involving Igbo, Chinese And Philippine Cultures View project.* Retrieved from <https://www.researchgate.net/publication/342788591>
- Light for museums and galleries | ERCO.* (n.d.). Retrieved from <https://www.erco.com/en/designing-with-light/culture/culture-6493/>
- Mehroolhassani, M. (2015). *Archaeological museum design in re-used historical Buildings. September. Museum – Day Arch.* (n.d.). Retrieved from <https://www.dayarch.com/educational-building/museum/>
- Museum Audio Guide | iF WORLD DESIGN GUIDE.* (n.d.). Retrieved from <https://ifworlddesignguide.com/entry/228543-museum-audio-guide>
- Museum Exhibition Design: Communication of Meaning and the Shaping of Knowledge | Elsevier Enhanced Reader.* (n.d.). Retrieved from <https://reader.elsevier.com/reader/sd/pii/S1877042814055013?token=B475ED0FB977208A8D>

- [1E7B0741CF4CD11B6FAB10FFD10377D354EED20DDA9388B2FA05D15754EB0ECFC86DE92C1930B2&originRegion=eu-west-1&originCreation=20210607004110](https://doi.org/10.21608/jaars.2021.3.3.110)
- Museum: Museography Concept | EVE Museology.* (n.d.). Retrieved from <https://evmuseography.wordpress.com/2015/04/05/museum-museography-concept/>
- Museums accelerate implementation of digital strategies, making more content available online and on-site to improve visitor experiences - Axiell.* (n.d.). Retrieved from <https://www.axiell.com/axiell-news/museums-accelerate-implementation-of-digital-strategies-making-more-content-available-online-and-on-site-to-improve-visitor-experiences-2/>
- Nofal, E., Reffat, R. M., Vande, A., & Ku Leuven, M. (2017b). *Phygital Heritage: an Approach for Heritage Communication Towards Interactive Robotic Fabrication View project An Effective Utilization Approach of Daylighting Systems for Energy Efficiency and Users' Comfort in Office Buildings in Egypt View project.*
- Paliokas, I., Patenidis, A. T., Mitsopoulou, E. E., Tsita, C., Pehlivanides, G., Karyati, E., Tsafaras, S., Stathopoulos, E. A., Kokkalas, A., Diplaris, S., Meditskos, G., Vrochidis, S., Tasiopoulou, E., Riggas, C., Votis, K., Kompatsiaris, I., & Tzovaras, D. (2020). A gamified augmented reality application for digital heritage and tourism. *Applied Sciences (Switzerland)*.
- Powerhouse Museum Website – Museum of Applied Arts and Sciences.* (n.d.). Retrieved from <https://maas.museum/powerhouse-museum-website/>
- The Anet Castle - Tactile Studio.* (n.d.). Retrieved from <https://tactilestudio.co/achievements/anet-castle-interactive-model-hybrid-device-museum-for-all/>
- The Biosphere – NGX Interactive.* (n.d.). Retrieved from <https://ngxinteractive.com/work/the-biosphere/>
- The Hybrid Museum Experience: Case Studies in Digital Engagement and Experience Design — AMT Lab @ CMU.* (n.d.). Retrieved from <https://amt-lab.org/blog/2019/9/the-hybrid-museum-experience-case-studies-in-digital-engagement-and-experience-design-in-the-museum-space>
- The ideal archaeological museum - Engaging with the past is key to making museums relevant - Ancient World Magazine.* (n.d.). Retrieved from <https://www.ancientworldmagazine.com/articles/ideal-archaeological-museum/>
- Tools for making MR-Mixed Reality | Download Scientific Diagram.* (n.d.). Retrieved from https://www.researchgate.net/figure/Tools-for-making-MR-Mixed-Reality_fig1_281165550
- Wang, Y., Wang, S., Liu, Y., Yang, J., Yuan, X., Ran, , Henry, H., & Duh, B.-L. (n.d.-a). *Advances in Image and Graphics Technologies Communications in Computer and Information Science* 757. Retrieved from <http://www.springer.com/series/7899>