The impact of interactive storytelling on enhancing the audience experience in museums Tutankhamun Immersive Exhibition in Egyptian Grand Museum (case study)

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Abstract

Nowadays, Museums are increasingly prioritizing interactive experiences over traditional heritage and art exhibitions in order to create more engaging and immersive visits for their visitors. The use of digital tools, such as interactive storytelling, has become essential in this transformation. This shift is intended to offer visitors the chance to not only acquire knowledge but also to fully enjoy their museum experience. Through the integration of interactive storytelling, museums have the potential to revolutionize the communication and experience of information, ultimately enhancing audience engagement, immersion, and emotional connection with the exhibits. **The Research problem** focuses on exploring how new technology can impact visual and multimedia communication in museums. In addition to how Interactive Storytelling can revolutionize the way information is conveyed and experienced by museum visitors. Moreover, **the Research aims** to investigate how the use of interactive storytelling techniques impacts the way information is conveyed and experienced by museum visitors, understand the importance of interactive storytelling in museums, and provide valuable insights to enhance audience engagement and create more immersive and meaningful museum visits. **Research methodology**: To achieve this goal; the research adopts a descriptive approach, gathering information to establish a theoretical framework based on previous studies and conducting an analytical study of the Tutankhamun Immersive Exhibition in Egyptian grand museum. **The Results** indicate that the integration of interactive storytelling in museums has a substantial impact on audience experience, resulting in enhanced engagement, immersion, emotional attachment to the exhibits, cultural and historical awareness. Through this research, we seek to provide practical **recommendations** on how to use this technology effectively in museums, which contributes to improving visitors' experience and increasing their cultural and historical awareness.

Keywords

الملخص

في الوقت الحاضـــر، تمنح المتاحف بشـــكل متزايد الأولوية للتجارب التفاعلية على التراث التقليدي التاريخي والمعارض الفنية من أجل خلق زيارات أكثر جاذبية وغامرة لزوارها. وقد أصـــبح اســـتخدام الأدوات الرقمية، مثل رواية القصـــص التفاعلية، ضروريًا في هذا التحول. ويهدف هذا التحول إلى إتاحة الفرصة للزوار ليس لاكتساب المعرفة فحسب، بل أيضًا للاستمتاع بتجربة المتحف بشكل كامل. من خلال دمج رواية القصص التفاعلية، تتمتع المتاحف بالقدرة على إحداث ثورة في التواصـــل وتجربة المعلومات، مما يؤدي في النهاية إلى تعزيز مشـــاركة الجمهور والانغماس والاتصـــال العاطفي مع المعروضـــات. تركز مشـــكلة البحث على اسـتكشـاف كيف يمكن للتكنولوجيا الجديدة أن تؤثر على الاتصـالات المرئية والوســـائط المتعددة في المتاحف. بالإضـــافة إلى كيف يمكن لســـرد القصـــص التفاعلية أن يُحدث ثورة في طريقة نقل المعلومات وتجربتها من قبل زوار المتحف. علاوة على ذلك، يهدف البحث إلى التحقيق في كيفية اســـتخدام تقنيات رواية القصـــص التفاعلية على طريقة نقل المعلومات وتجربتها من قبل زوار المتاحف، وفهم أهمية رواية القصـــص التفاعلية في المتاحف، وتقديم رؤى قيمة لتعزيز مشاركة الجمهور وخلق المزيد من الانغماس والمعاني لزيارات المتحف. ولتحقيق هذا الهدف كانت منهجية البحث تتبع المنهج الوصفي، وجمع المعلومات لوضع إطار نظري يعتمد على الدراسات السابقة، وإجراء دراسة تحليلية لمعرض توت عنخ آمون الغامر بالمتحف المصري الكبير. تشير النتائج إلى أن دمج رواية القصـــص التفاعلية في المتاحف له تأثير كبير على تجربة الجمهور، مما يؤدي إلى تعزيز المشـــاركة، الانغماس، الارتباط العاطفي بالمعارض، الوعي الثقافي والتاريخي .

الكلمات المفتاحية

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1. Introduction:

Historically, museums have played a crucial role in fostering tourism and enhancing the economic prosperity of countries like Egypt (Marie, 2020), renowned for its rich and captivating historical narrative. In contemporary times, an increasing number of individuals visit museums not solely for educational purposes but also for the enjoyment of immersive experiences. The evolving expectations of visitors have driven museums to adopt innovative strategies that go beyond traditional practices of artifact collection, exhibition, and preservation. One notable strategy involves the incorporation of digital technologies, especially interactive storytelling and gaming elements, which possess significant potential for both educating and engaging museum-goers. (Booth,1998) These interactive formats effectively communicate cultural heritage and historical narratives in an engaging manner, addressing the limitations of traditional text-based presentations. Furthermore, digital technologies offer opportunities for personalization and contextually relevant information, enabling visitors to learn at their own pace while accommodating their specific interests and needs. (Danks, M., Goodchild, M., Rodriguez-Echavarria, K., Arnold, D.B., Griffiths, R. (2007) This research will investigate the role of interactive storytelling in enriching the visitor experience at the Tutankhamun exhibit within the Grand Egyptian Museum. Through this case study, the research seeks to illuminate how interactive narratives can successfully promote Egypt's cultural heritage and support the growth of the nation's tourism sector.

1.1. The Significance of Museums in contemporary society

Museums are essential institutions that have a crucial role in preserving and displaying cultural heritage, history, art, and scientific knowledge to the public. These places not only store valuable art collections but also function as educational centers and platforms for cultural exchange.

Moreover, Museums have the ability to attract visitors, stir emotions, stimulate thoughts, and spark creativity through their exhibitions and activities.

According to Lord (2007), museums serve as cultural catalysts, nurturing civil society and contributing to the growth of human capital. They offer chances for individuals to delve into and comprehend the past, present, and future, thereby enriching their knowledge and abilities. Moreover, museums provide distinctive learning opportunities that can complement formal education and boost social intelligence, as highlighted by Haas (2007). Historically, museums have been institutions of academic dedication, with a primary emphasis on exhibiting objects and ensuring the authenticity of the materials in their collections. (Baker, Istvandity, and Raphaël 2016. However, the "new museum" model endeavors to a shift away from the conventional "top-down" approach to curation, seeking to overturn the traditional hierarchy and foster a more collaborative and participatory framework. This transition not only alters the way museums present themselves, but also transforms the evolving perceptions and experiences of visitors (Baker, Istvandity, and Raphaël 2016, 370), as Contemporary museums empower communities and acknowledge the collaborative development of knowledge between the institution and its visitors (Marstine 2006), viewing them as engaged participants in their experiences rather than passive observers (Thyne and Hede 2016).

2. The Art of storytelling in Museums

Storytelling is often considered a fundamental aspect of human life, serving as a means for individuals to communicate, comprehend their environment, and construct their personality. (Moscardo 2020; Bassano et al. 2019). Stories are a form of narrative that aims to elicit emotional reactions (Beevor, Campos, and Guerreiro 2022). They typically depict a series of interconnected events for the purpose of entertainment (Moscardo 2020) and often engage the imagination by resonating with individuals' experiences and feelings (Nielsen 2017). While the study of storytelling has been extensively explored in fields such as anthropology, psychology, sociology, and more recently in museum management (Vrettakis et al. 2019), furthermore the museum's main focus is on encouraging visitors to actively engage with its narratives. The objective is to involve visitors in compelling and emotionally resonant storytelling frameworks. Storytelling is now recognized as a crucial tool for creating significance, as it fosters emotional connections among visitors and staff (Doyle and Kelliher 2023). This process is viewed as subjective, as the narrative framework evokes distinct emotions and memories for each individual (Nielsen 2017). Storytelling enriches the museum experience by supporting personal interpretation and meaning-making, allowing visitors to craft their own narratives (Wiyonoputri, Eppang, and Scott 2022). Abma (2003) discovered that sharing stories enhances group connection and promotes increased interaction. Frost et al. (2020) also concluded in their research on heritage and storytelling in tourism that storytelling effectively engages visitors and provides a competitive

edge. Additionally, Robiady, Windasari, and Nita (2020) determined that storytelling techniques positively impact customer engagement. Meanwhile, Ross and Saxena (2019) delved into the concept of storytelling, emphasizing how creative storytelling can create meaning through participative co-creation at heritage sites with lost tangible remains. Additionally, according to Pujol et al. (2012), storytelling is crucial for cultural heritage as it helps individuals connect with history on a deeper level. Coerver et al. (2022). also emphasizes the importance of storytelling over mere facts, as it allows consumers to form emotional connections and curiosity towards heritage objects. Digital storytelling stands out among other experience types in heritage settings due to its simplicity and ability to attract a broad audience, including both adults and children.

2.1 Museum Interactive Storytelling: Integrating Storytelling and Interactivity

The term "interactive" is frequently employed in the context of digital storytelling applications, often suggesting a level of user engagement that is not fully realized. Specifically, these applications typically provide users with options to navigate the site and choose informational content, rather than offering a truly interactive experience Katifori A. et al. (2018). Although Defining interactivity and interactive storytelling is intricate, as scholars have investigated numerous frameworks, including immersive storytelling, emergent storytelling, interactive authoring, plot-centric systems, and character-driven systems (Cavazza et al., 2002). Charles et al. (2003) identifies several fundamental issues in interactive storytelling, such as the balance between interactivity and narrative, the relationship between character and plot, narrative causality, the question of narrative control, and the dynamics of story generation versus presentation. It is noteworthy that much of the emphasis has been placed on technological aspects, including artificial intelligence methodologies, planning frameworks, and narrative representations, rather than on the actual processes of computer-mediated communication (Rafaeli, 1988). In the realm of designing interactive digital storytelling within museum environments, these factors hold particular significance. Museums ought to aim for a "responsive" form of interactivity, wherein the narrative and content evolve in real-time according to the visitor's choices, preferences, and engagement style (Rafaeli, 1988; Sundar, 2007). This approach facilitates a highly individualized outcome and enhances the visitor's sense of agency over their experience. Designers are tasked with the challenge of harmonizing an engaging and coherent narrative with substantial interactive control for visitors. A narrative that is too rigid may restrict interactivity, while excessive freedom could detract from the narrative experience (Charles et al., 2003). The relationship between characters, their objectives and motivations, and the progression of the plot must be meticulously crafted to foster an engaging and cohesive interactive experience (Charles et al., 2003).

Furthermore, it is essential for designers to maintain narrative coherence and logical causality amidst visitor interactions, thereby ensuring that the experience remains both immersive and credible (Charles et al., 2003). The interactive digital storytelling framework should also possess the capability to adapt the content and structure of the experience according to the unique preferences, interests, and playstyles of individual visitors, thereby facilitating a highly personalized engagement (Sundar, 2007). Instances of such interactive digital storytelling within museum environments may encompass augmented reality experiences that enable

visitors to engage with virtual characters and affect the storyline, or interactive displays where the decisions made by visitors influence the unfolding of a historical narrative.

2.2. Interactive Storytelling Architecture

The framework of interactive storytelling systems typically comprises a "**Drama Manager**" (also referred to as a story engine, narrative generator, narrative logic, narrative sequencer, or plot manager), a "User Model" (known as a player analyzer or player profiler), and an "Agent Model" (which may be termed an actor engine, knowledge base, or behavior engine). The drama manager plays a crucial role in identifying and executing sequences of narrative plots (Bates, 1992; Kelso et al., 1993), organizing story beats based on declarative knowledge (Mateas, 1997; Mateas, 2000; Mateas and Stern, 2001), and generating narratives that arise from the interactions between virtual characters with dramatic objectives and the user (Cavazza et al., 2002). It is also responsible for selecting, specifying, and refining story events (Thue et al., 2007), choosing story beats informed by the user model (El-Nasr, 2007), linking dilemmas as interaction points within a cohesive narrative (Barber and Kudenko, 2008), partially ordering abstract plot elements (Magerko, 2005), and ranking character actions from most to least significant (Szilas, 2003). **The agent model** emphasizes the creation of believable characters that exhibit autonomy, including virtual actors with dramatic goals or semi-autonomous intelligent agents. **The user model,** or player analyzer, is the component that monitors user interactions or choices, reflecting the diversity within the field in terms of how researchers categorize players or define player types.

2.3. The fundamental Interactive Storytelling design in Museum Settings

I. **Research and collecting information for Content Development:** Effective storytelling requires collecting information regarding historical figures, as well as relevant historical sites and structures, from museum professionals. Utilizing this information, narratives must be created and specifically designed for interactive experiences, necessitating the expertise of skilled authors capable of creating compelling stories. (Dal Falco & Vassos, 2017). These stories should be engaging, informative, and designed to captivate the audience's attention (Weng, Liang, & Bao, 2020).

II. Storytelling design (Narrative structure)

Stories intended for interactive experiences should be meticulously crafted and customized, drawing upon information about historical figures and pertinent historical locations and structures. The participation of skilled authors, who possess a deep understanding of both narrative construction and interactive design, is essential for developing immersive, responsive, and captivating narrative experiences for users. Their proficiency is vital in unlocking the complete potential of interactive storytelling to produce engaging narratives. (Dal Falco & Vassos, 2017).
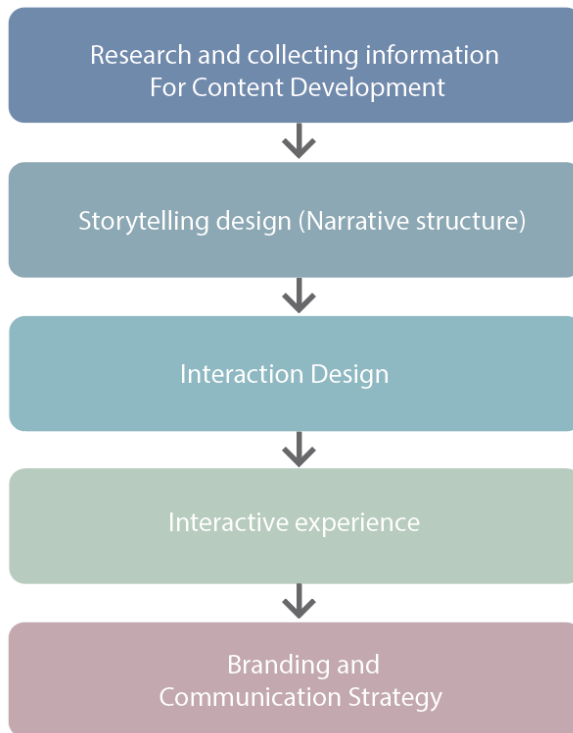
III. Interaction Design:

Museums should focus on developing experiences that foster active participation, enabling visitors to explore narratives in an engaging and dynamic manner. This could involve the integration of interactive exhibits, touch-responsive displays, and mobile applications that facilitate exploration and education (Weng, Liang, & Bao, 2020).

Diagram 1 (The fundamental Interactive Storytelling design in Museum Settings) (Designed by the Author)

- **Incorporating game design elements**: It can significantly enhance the interactivity of storytelling experiences. This may entail the creation of games or challenges that encourage visitors to interact with the content in a fun and immersive way (Dal Falco & Vassos, 2017). This stage necessitates collaboration with game designers, experts in interaction design, and application developers. Museums should also evaluate how to convey narratives through various mediums, whether in physical environments, digital platforms, or a hybrid approach. This adaptability enables a wider reach and engagement with a diverse audience (O'Keefe et al., 2014).

IV. Interactive experience:

- Interactive storytelling should be adaptable to the choices and actions of visitors, thereby creating tailored narratives that resonate with their individual experiences. This approach greatly enhances emotional engagement and makes the storytelling experience more relevant to each person.
- **Personalized Interactive Storytelling and User Decisions**: Allowing visitors to make choices that influence the direction of the narrative enables museums to create a more engaging and memorable experience. This may involve branching storylines or alternatives that lead to different outcomes based on visitor decisions (O'Keefe et al., 2014).

- **Artificial Intelligence (AI) Integration**:
- Conversational Interfaces: The use of AI can support the creation of conversational interfaces, allowing visitors to ask questions and receive personalized answers. This method can significantly enhance the educational experience by providing immediate access to information and fostering an interactive dialogue between the visitor and the museum (Dal Falco & Vassos, 2017).
- **Machine Learning Applications:** The integration of machine learning technologies can continuously improve the storytelling experience by examining visitor interactions, thereby enhancing the relevance and engagement of the narratives presented (O'Keefe et al., 2014).

V. **Branding and Communication Strategy:** The museum's branding identity and communication strategy should align with the interactive storytelling experience. This involves captivating the target audience and effectively promoting the museum's offerings to attract visitors (Dal Falco & Vassos, 2017).

- **Awareness and Accessibility:** Ensuring that storytelling experiences are accessible and well-communicated is crucial for maximizing visitor participation and enjoyment (O'Keefe et al.'s (2014).
- **2.4 Interactive digital storytelling elements:**
- **Narrative structure**: The narrative structure serves as the foundation of every story. In the realm of interactive storytelling, it frequently adopts non-linear or interactive formats. The sequence of events or experiences crafted by the storyteller can vary from straightforward, linear arrangements to intricate, branching narratives commonly found in interactive media.
- **Character development:** Narratives extend beyond mere textual descriptions of characters. The incorporation of visuals, voiceovers, and interactive components can significantly enrich the storytelling experience, fostering a deeper engagement with the audience. These characters frequently serve as the central element of the narrative, contributing to a more immersive atmosphere.
- **Visual Design***:* This component employs graphics, videos, and images to establish an ambiance that enhances the narrative. In digital storytelling, visual design serves a purpose beyond mere aesthetics; it plays a crucial role in setting the tone and eliciting emotional responses. (Tenh et. al., 2012)

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- **Sound and music:** Sound effects and music play a crucial role in establishing the atmosphere and enriching the narrative experience. In digital formats, audio can be interactive, and adapting in response to user actions and choices

- **Interactivity:** Interactivity serves as a fundamental component of digital storytelling. It allows the audience to engage with the narrative in a more significant manner, often enabling them to affect the story's progression or conclusion.

Diagram 2 (Interactive Storytelling elements) (Designed by the Author)
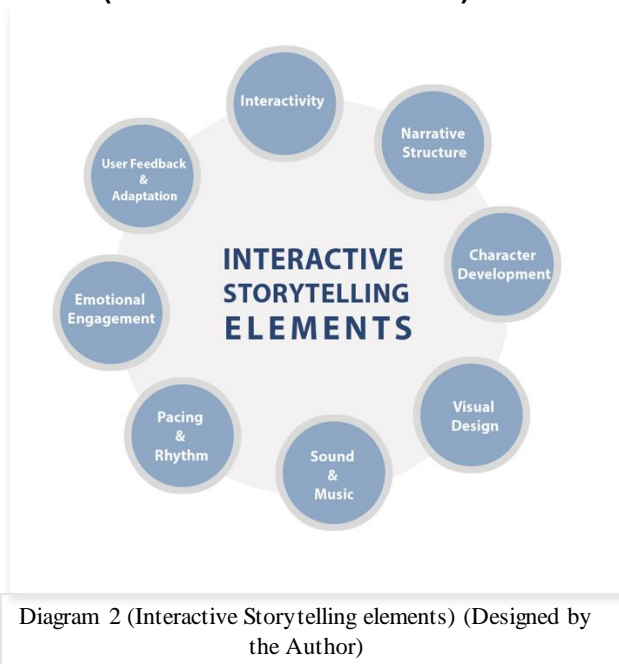
- **Pacing & Rhythm**: The pacing of a narrative in digital media plays a crucial role in regulating its progression. It dictates the tempo at which the story develops, which is vital for sustaining the audience's engagement. Additionally, user interactions can influence the narrative's rhythm, introducing a dynamic aspect to digital storytelling. (Rosli, & Kamaruddin, 2020)

- **Emotional Engagement:** Successful interactive storytelling cultivates emotional ties by presenting characters and scenarios that resonate with the audience. When individuals experience emotional investment, they are more inclined to engage thoroughly with the narrative, thereby enriching their overall experience.

- **User Feedback and Adaptation:** Interactive storytelling frequently integrates audience feedback to modify the narrative dynamically. This adaptability fosters a more tailored experience, as the storyline shifts in response to the users' decisions and inclinations. The opportunity to navigate various paths and conclusions motivates users to return to the story. This journey of exploration enhances the narrative's depth and intricacy, resulting in a more profound storytelling experience that evolves with each interaction. (https://blog.emb.global/elements-of-digital-storytelling.)

2.4. Interactive storytelling design applications

Interactive storytelling within museums serves as an effective mechanism for boosting visitor involvement and enriching educational experiences. A variety of applications and software solutions are employed to develop interactive narratives, each presenting unique features.

Storytelling tools are software applications dedicated to the creation and development of interactive storytelling.

Interactive storytelling concept tools

These tools assist users in planning, writing, and testing their stories, while also enabling the export of narratives to various formats and platforms. Notable examples of such tools include: Articy, Draft, Chat Mapper, and StoryStylus. They provide functionalities for crafting intricate and branching narratives, incorporating elements such as flowcharts, maps, characters, dialogue, and variables.

Articy: Draft serves as a comprehensive narrative design tool that enables users to structure and visualize intricate narratives using a node-based framework. Its primary features encompass branching dialogue, character management, global variables, localization support, and the ability to export projects for Unity and Unreal Engine.

Chat Mapper is tailored for the creation and management of game dialogue, featuring visual dialogue trees and scripting functionalities. It allows for the export of dialogue in various formats that are compatible with game development engines, making it ideal for projects that require detailed dialogue management and complex narrative branching.

StoryStylus is a platform dedicated to crafting interactive stories for games and other media, providing modular story components, interactive choices, and export options. Together, these tools offer a powerful suite of capabilities for creators aiming to build engaging interactive storytelling experiences, especially within gaming and educational environments. (https://www.linkedin.com/advice/1/what-best-tools-software-creating-interactive-game-r8gmf)

Interactive storytelling software:

- **TouchDesigner** is a node-based visual programming language designed for crafting immersive installations, projections, and exhibitions.
- **Unity** functions as a flexible game engine utilized for developing interactive 2D and 3D applications, frequently applied in virtual reality (VR) and augmented reality (AR) experiences within museum settings.
- **Articulate Storyline** is an e-learning authoring tool that facilitates the creation of interactive presentations and courses, thereby enhancing visitor engagement.
- **SketchUp** is a 3D modeling software that assists in the development of detailed exhibit models and spatial planning. (**Hürst, W., Tan, X. J., & de Coninck, F. (2016).**
- **Zappar** is an augmented reality platform that empowers users to design interactive AR experiences, augmenting physical exhibits with digital elements.
- QR code generators produce codes that connect to digital content, enabling seamless integration into marketing materials and physical displays.
- **Museum software platforms such as PastPerfect and Omeka** aid institutions in managing collections, developing digital exhibitions, and engaging audiences online. These tools offer extensive collection management capabilities, resources for constructing interactive exhibits, and compelling narratives. By leveraging these technologies, museums can strengthen visitor connections with their exhibits, rendering education to be more immersive and enjoyable. **Karmakar, Dr. (2021**

3. **Digital Interactive Technologies in museums:** The integration of digital technologies within museums has become standard practice following significant technological

advancements over the past decade. The digital tools employed in modern museums can be categorized into two main types: **'passive' digital technologies** and **'active' interactive digital technologies**.

• **Passive technologies**: Encompass projection mapping systems, audio systems, digital displays, and sensors as in recent exhibitions such as "The Klimt's Nights," "Dreamed Japan, Images of "Van Gogh, Starry Night" at the Atelier des Lumières exemplify the innovative application of projection mapping (Figures1,2). Where utilizing a single projection device to display images at a specific point, a notable trend observed in museums in recent years is the use of projection mapping, which involves projecting images onto all surfaces within a designated area through the deployment of multiple projectors. This technique

Figure 1 (Projection mapping, "The Klimt's Nights" at Atelier des Lumieres, Paris) Karayılanğlu, G., & Arabacıoğlu, B. C. (2020)

can significantly transform the perception of space, resulting in immersive digital museum experiences that incorporate a variety of visuals, lighting, and soundscapes.

• **Active' interactive digital technologies:**

In contrast, active interactive systems necessitate user engagement and include touch screens, QR code applications, virtual reality, augmented reality, mixed reality, and artificial intelligence solutions. The simultaneous use of various interactive technologies can foster a captivating environment. Karayılanğlu, G., & Arabacıoğlu, B. C. (2020) as in figure 3 that pertains to the Aboca Experience, the innovative digital extension of the Aboca Museum located in Sansepolcro, the objective of this initiative is to highlight the multifaceted nature of Aboca's endeavors,

Figure 2("Van Gogh, Starry Night"at the Atelier des Lumières) https://www.atelier-lumieres.com/en/van-gogh-dreamed-japan

encompassing research on botanical elements and activities related to territorial stewardship, thereby creating a rich and interconnected narrative alongside the corporate museum.

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Immersive technology encompasses a variety of tools designed to create an engaging, sensory-rich environment. Notable examples include Virtual Reality (VR), which immerses users in a fully digital environment, effectively substituting the physical world through the use of headsets. Augmented Reality (AR) enhances the real world by superimposing digital information, typically accessed via smartphones or smart glasses. Mixed Reality (MR) integrates both VR and AR, enabling interaction between real and virtual objects in real time. VR provides complete immersion in a digital realm, AR enriches the physical environment with digital components, and MR combines both realms for a more interactive experience. VR necessitates the use of headsets and sensors, AR relies on

Figure 3 (A view of the new digital wing of Aboca Museum .
https://dotdotdot-it.medium.com/corporate-museum-future-digital-scenarios-f93ffdf3dd57

smartphones or tablets, while MR frequently employs sophisticated headsets, 360-degree videos and interactive installations and projections. These innovations hold the promise of significantly enriching the visitor experience in museums, enabling individuals to engage with artworks in ways that were previously unattainable. Nevertheless, the application of immersive technology within museum settings is still nascent, and its full capabilities remain to be explored. The integration of such technologies also prompts discussions regarding their effects on the authenticity and preservation of art, as well as issues of accessibility and equity in the museum experience. For instance, some critics contend that employing VR in museums may diminish the authentic experience of viewing art in its physical form. Barteit, S., Lanfermann, L., Bärnighausen, T., Neuhann, F., Beiersmann, C.(2021). As in **figure 4** Frida Kahlo: The Life of an Icon (Various Locations): The engaging exhibition, scheduled for a worldwide tour, will utilize projection mapping, interactive installations, and virtual reality experiences to delve into the life and artistic contributions of Frida Kahlo. Attendees will have the opportunity to immerse themselves in reconstructed environments from Kahlo's life and engage with digital renditions of her artwork and personal artifacts.

Figure 4 (Frida Kahlo: The Life of an Icon) https://immersivefridakahlo.com/

4. The impact of interactive storytelling on the audience experience:

There are three primary themes emerged: Emotional Engagement, Imagination, and Memorability regarding the influence of storytelling on the heritage experience from the perspective of tourists.

4.1 Emotional Engagement:

Narratives play a crucial role in shaping the connections that visitors establish with museum displays or heritage sites. The emotional engagement fostered by storytelling can stem from two key sources**: Human empathy**, which involves the capacity to 'experience the feelings or emotions of others' or to 'connect with fundamental human values,' and) **personal connections**, which allow individuals to relate the stories to their own lives, identities, or cultural backgrounds. (Little et al. 2022)

4.2. Imagination:

In discussions surrounding storytelling, participants frequently emphasized the role of imagination. This imaginative engagement often facilitated a deeper reflection on historical narratives shared by the tour guide.

The participant underscored that the narrative enabled them to visualize these characters in a historical context, fostering a sense of engagement. By employing their imagination, participants endeavored to speculate on the identity of the absent figurine. Given that conventional museum experiences often deliver information in unidirectional and authoritative manner, this observation suggests that storytelling enhances engagement by transforming visitors into active participants who can shape their own heritage experiences. (Falk, J. H. & Dierking, L. D. (2000).)

4.3 Memorability:

In exploring the most significant moments from the storytelling tour, numerous participants associated their recollections of specific exhibits with the narratives connected to them. This suggests that the elements deemed memorable by the majority were not solely the heritage artifacts or locations, but rather the cognitive processes of meaning-making stimulated by the stories conveyed—both from the 'provider' to the 'listener' and from the 'listener' to themselves or their peers. Consequently, these interactions contributed to the perception of memorability. This observation implies potential connections among the themes of Emotional Engagement, Imagination, and Memorability. Specifically, a synergy of emotional involvement and imaginative engagement may enhance the perceived memorability from the tourist's viewpoint. The sense of memorability may inspire participants to communicate their experiences with others, however, collective storytelling within a group can also foster moments that are regarded as memorable. In essence, genuine inter-visitor storytelling and learning experiences can culminate in significant moments for individual visitors. These interactions are viewed as authentic exchanges among attendees. Thus, visitors engage in their personal meaning-making processes, which may lead to modifications or adaptations in their understanding of heritage

artifacts based on the insights shared by fellow group members. (Campos, A. C., Guerreiro, M. M., & Beevor, M. C. (2023).

5. Case Study: Tutankhamun: The Immersive Exhibition: Museums have traditionally served as custodians of cultural heritage, providing visitors with insights into history through the exhibition of artifacts and fixed displays. In the contemporary digital era, however, museums are progressively adopting interactive storytelling techniques to captivate audiences and improve their overall experience. This analytical study seeks to examine the effects of interactive digital storytelling on audience engagement, comprehension, and emotional resonance within the framework of the "Tutankhamun: The Immersive Exhibition."

5.1 Overview:

"Tutankhamun: The Immersive Exhibition" represents a pioneering digital showcase that employs advanced technology to vividly portray the narrative of the ancient Egyptian pharaoh. Initiated by Madrid Artes Digitales (MAD) in 2022, the exhibition rapidly garnered acclaim, drawing over 300,000 attendees within its first eight months and averaging 38,000 visitors monthly. After its successful debut in Madrid, the exhibition made its way to various cultural venues, including those in Vienna and Barcelona, culminating in a significant presentation at the Grand Egyptian Museum in Cairo, Egypt, which commenced on November 21, 2023. Interactive Narrative Visualization: At the heart of the exhibition lies an interactive narrative visualization that fully engages visitors in the era of Tutankhamun, who ruled ancient Egypt from 1333 BC to 1323 BC. Guests enter a dimly illuminated space where vibrant images are projected across the walls and floor, complemented by an immersive sound system that enriches the experience. Within this environment, a digital avatar of Tutankhamun recounts his own story, leading visitors through six unique chapters that delve into the history, culture, and significant findings related to the young pharaoh. The Exhibition" at the Grand Egyptian Museum is offered in various languages (Arabic and English) while the "Wien" exhibition offers a multilingual presentation, with panels in German and English, and an audio tour in multiple languages, ensuring accessibility for local and international visitors, enhancing their experience.

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تحت عنوان (رؤية مستقبلية للصناعة المصرية)

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- **The "Tutankhamun" exhibition narration voice**:
The Tutankhamun exhibition features narration through the voice of **Howard Carter** , the archaeologist renowned for the discovery of Tutankhamun's tomb. This immersive experience integrates multiple forms of narration, including: First-Person Narration: The original voice of Howard Carter recounts the discovery of the tomb, offering a personal connection that links visitors directly to this significant historical event. **This first-person** viewpoint enhances the authenticity of the experience, allowing attendees to feel as if they are hearing the account from someone who witnessed it firsthand. **Interactive Narration**: The exhibition incorporates interactive components that enable visitors to engage with displays, interpret hieroglyphs,

Figure 5 (Tutankhamun: Exhibition (A fully immersive room featuring 360° projections that vividly recreate ancient temples and majestic pyramids) https://www.wien-tickets.com/tutanchamun/about/

and examine replicas of Tutankhamun's treasures. This form of narration fosters a dialogue-like experience, encouraging active participation in the educational journey.

Augmented and Virtual Reality Experiences

These features may include guided narration that elucidates the importance of various artifacts and the context of ancient Egyptian culture, thereby enriching the overall visitor experience. The narration is thoughtfully crafted to appeal to a diverse audience, including children, adults, and families, delivering educational content in an engaging manner. The exhibition's methodology harmonizes historical narration with contemporary technology, ensuring accessibility and attraction for individuals of all ages.

-**Technological Interactive Innovations:** The exhibition features an array of advanced digital technologies designed to create an immersive and informative experience for attendees. These innovations include:

- **Cutting-edge digital projections**: Attendees are taken back 3,400 years to experience the splendor and magnificence of ancient Egypt.

- **Virtual reality (VR) experiences**: Attendees have the opportunity to navigate Tutankhamun's tomb in the Valley of the Kings, following the pathways outlined in the Book of the Dead.

Figure 6 (Tutankhamun Exhibition (the interactive experience room https://www.wien-tickets.com/tutanchamun/about/

Figure 7 (Tutankhamun Exhibition (virtual reality quest through the ancient Book of the Dead) https://www.wien-tickets.com/tutanchamun/about/

- **Augmented reality (AR)** tours: Attendees can deepen their comprehension of hieroglyphics, archaeology, and the ancient Egyptian civilization by integrating digital components with the physical environment.

- **Interactive archaeological exploration:** Attendees can embody the role of the esteemed archaeologist Howard Carter, reliving the thrill and discovery associated with the excavation of the tomb.

Figure 8 (Tutankhamun Exhibition (Experience an augmented reality journey through the burial chamber located in the Valley of the Kings, where you can admire the opulent gold-adorned sarcophagi and the renowned golden funerary mask. https://www.wien-tickets.com/tutanchamun/about/

- **3D mapping projection system**: A captivating blend of visual and auditory elements transports attendees to the golden era of ancient Egypt.

5.1. Research Methodology

This research employed a survey as the primary instrument for data collection from attendees of the "Tutankhamun: The Immersive Exhibition." In the Egyptian grand museum, the study included 50 participants, whose ages varied from 22 to 56 years. The demographic breakdown
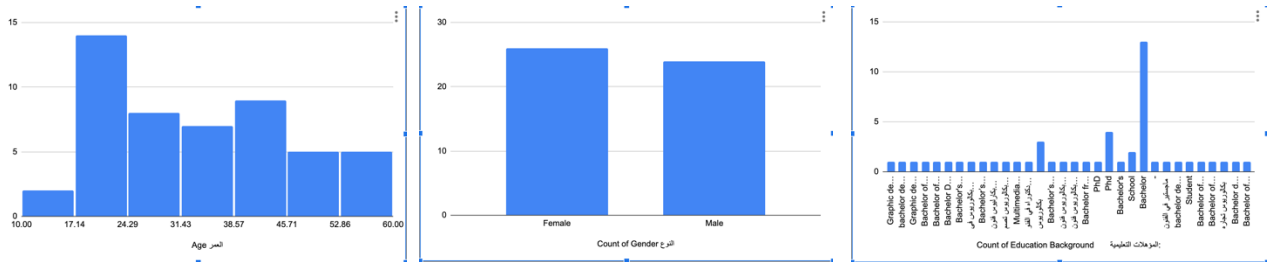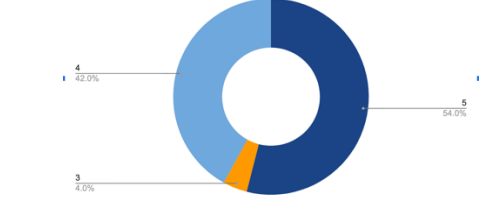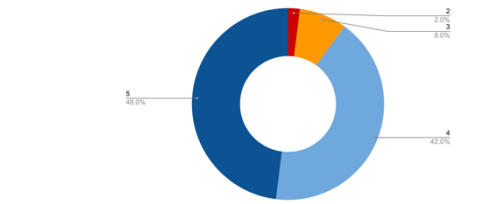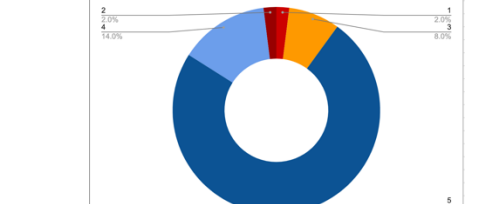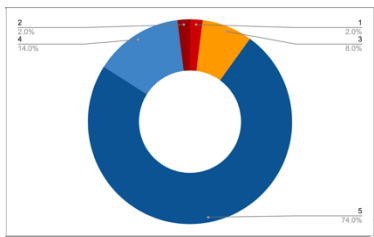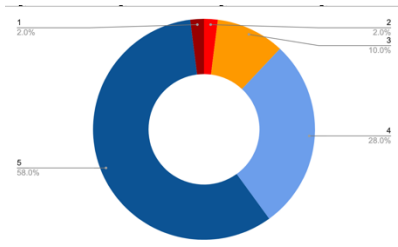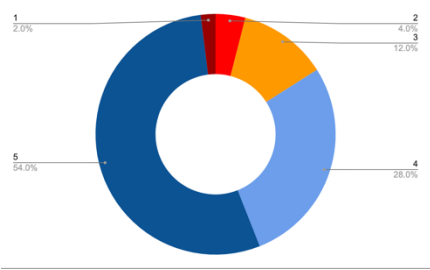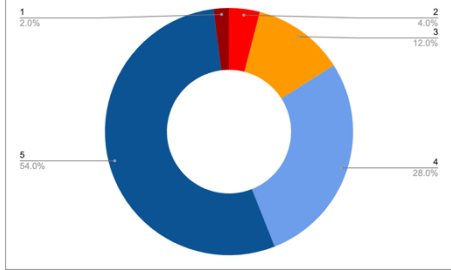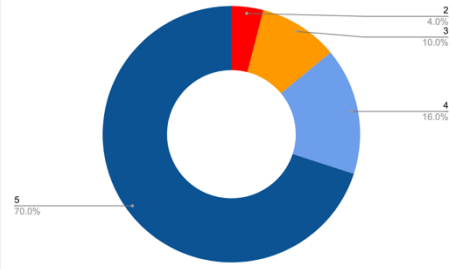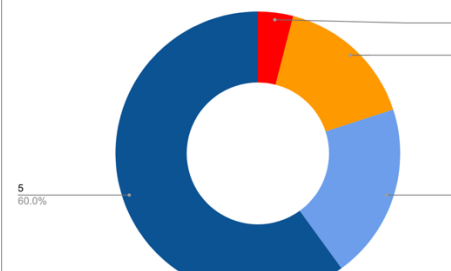

Diagram 3 (The demographic analysis)

revealed that 52% were women and 48% were men, reflecting a wide range of educational qualifications, including bachelor's, master's, and doctoral degrees. Most participants were residents of Egypt, offering a localized viewpoint on their experience of the exhibition.

Phase	Key findings	Result
Interactive digital storytelling	**Interactive design:** A significant 90% of participants concurred that the exhibition elements enhanced their engagement, while 8% remained neutral and 2% expressed disagreement.	To what degree did the elements of interactive digital storytelling (such as touch screens, virtual reality, augmented Diagram 4 (interactive design analysis) reality, and multimedia installations) enhance your engagement with the exhibition?

Interactive Storytelling elements: Regarding the interactive storytelling components, an impressive 96% acknowledged that these elements positively impacted their understanding and appreciation of the Tutankhamun artifacts and the exhibition as a whole, with 4% remaining neutral.	To what extent did the interactive storytelling components influence your Diagram 5 (interactive Storytelling elements analysis) understanding and appreciation of the Tutankhamun artifacts and the overall exhibition content?
Narrative structure and Imagination In terms of narrative structure and imagination, 90% agreed that the visual components contributed to increased engagement, while 8% were neutral and 2% disagreed.	I liked the plot and visuals/images of the story Diagram 6 (Narrative structure and Imagination analysis)
Authenticity Concerning authenticity, 74% affirmed that the character design was authentic, with 20% neutral and 6% disagreeing.	The characters within the story seemed genuine. Diagram 7 (Authenticity analysis)

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Audience Experience	**Motivation and emotional engagement** In terms of motivation and emotional engagement, 88% reported feeling positively inclined to explore the history of Ancient Egypt, while 8% were neutral and 4% disagreed.	I feel motivated to further explore the history of Ancient Egypt and its people. Diagram 8 (Motivation and emotional engagement analysis)
	Interaction experience 86% agreed that the interaction experience facilitated their understanding of Ancient Egyptian history, with 10% neutral and 4% expressing disagreement.	The experience allowed me to perceive Diagram 9 (Interaction experience analysis) the past from the perspective of its people.
Cultural and historical awareness:	**Audience Perception** 70% of respondents indicated that they comprehended and acquired knowledge regarding the history of Ancient Egypt, while 20% remained neutral and ten percent expressed disagreement, with a majority of the sample originating from Egypt.	My perception of Ancient Egyptians has Diagram 10 (Audience Perception changing analysis) changed through this experience.

	Audience Perception 82% of participants affirmed that they understood and gained knowledge about the history of Ancient Egypt, with 12% neutral and 6% percent disagreeing.	I discovered new information about Ancient Egyptian culture that I was previously unaware of. Diagram 11 (Audience Perception analysis)
Emotional bond	**emotional engagement** 86% reported a positive sentiment towards the experience, while 10% remained neutral and 4% disagreed.	 Diagram 12 (emotional engagement analysis) I would like to share this experience with others.
	Memorability 80% held a favorable impression of the experience, with 16% neutral and 4% disagreeing.	This experience will linger in my Diagram 13 (Memorability analysis) thoughts for an extended period.

Conclusion:

1. Interactive Digital Storytelling:

The survey results indicate that the elements of interactive digital storytelling, such as touchscreens, virtual reality, augmented reality, and multimedia installations, have significantly

enhanced the visitors' engagement with the exhibition. 90% of respondents agreed that these elements increased their engagement, while only 2% disagreed. Furthermore, 96% of respondents agreed that the interactive storytelling components influenced their understanding and appreciation of the Tutankhamun artifacts and the overall exhibition content, highlighting the power of interactive narratives in facilitating meaningful connections between the audience and the historical content.

2. Narrative Structure and Imagination:

The survey findings also suggest that the plot and visuals/images of the story were well-received, with 90% of respondents expressing their approval. This indicates that the narrative structure and the use of imagination in the digital storytelling were successful in captivating the audience and drawing them into the world of ancient Egypt.

3. Authenticity and Emotional Engagement:

While the majority of respondents (74%) agreed that the characters within the story seemed genuine, a significant portion (20%) remained neutral. This suggests that there may be room for improvement in terms of character design and the portrayal of historical figures to enhance the audience's sense of authenticity and emotional connection.

The survey results also reveal a strong emotional engagement among the audience, with 88% of respondents feeling motivated to further explore the history of ancient Egypt. Additionally, 86% of respondents had a positive feeling towards the experience, indicating that the interactive storytelling was successful in fostering a deep, lasting connection with the audience.

4. Cultural and Historical Awareness:

The interactive storytelling approach employed in the "Tutankhamun: The Immersive Exhibition" has also had a significant impact on the audience's cultural and historical awareness. 70% of respondents agreed that their perceptions of ancient Egyptians have changed through the experience, and 82% discovered new information about ancient Egyptian culture that they were previously unaware of.

This suggests that the interactive digital storytelling has been effective in challenging pre-existing perceptions and expanding the audience's knowledge and understanding of ancient Egyptian civilization, a crucial aspect of museum experiences.

5. Emotional Bond and Memorability:

The survey results also indicate a strong emotional bond and lasting impression created by the "Tutankhamun: The Immersive Exhibition." 86% of respondents agreed that they would like to share this experience with others, and 80% felt that the experience would linger in their thoughts for an extended period.

This highlights the power of interactive storytelling in fostering a deep, personal connection between the audience and the historical content, making the exhibition more memorable and impactful.

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Results

The analytical examination of the survey findings reveals the considerable influence of interactive digital storytelling on improving the audience experience within museums. The "Tutankhamun: The Immersive Exhibition" has adeptly utilized a range of interactive technologies to captivate visitors, promote a more profound comprehension of historical narratives, and establish a lasting emotional bond with the culture and heritage of ancient Egypt. By emphasizing interactive narratives, museums can effectively connect the historical past with contemporary experiences, enabling visitors to not only acquire knowledge about history but also to engage with it through immersive and compelling storytelling. As digital technologies advance, the potential for museums to enchant and educate their audiences will continue to expand, thereby establishing interactive storytelling as an essential element of the contemporary museum experience.

This research study concludes a conceptual framework (diagram 3) that elucidates the essential components and interconnections influencing the effects of interactive storytelling within museum settings. The framework is comprised of three main elements: Interactive Storytelling, which includes narrative design, interactive technologies, authenticity, and a tailored user experience. Audience Experience, which emphasizes emotional engagement, imagination, memorability, and the overall visitor experience, and the Influence of Interactive Storytelling, which explores the emotional connections established, the memorability of the experience, and the heightened cultural and historical awareness that results. The framework posits a causal relationship in which the elements of interactive storytelling contribute to the audience experience, subsequently affecting the outcomes and impacts on the audience. This
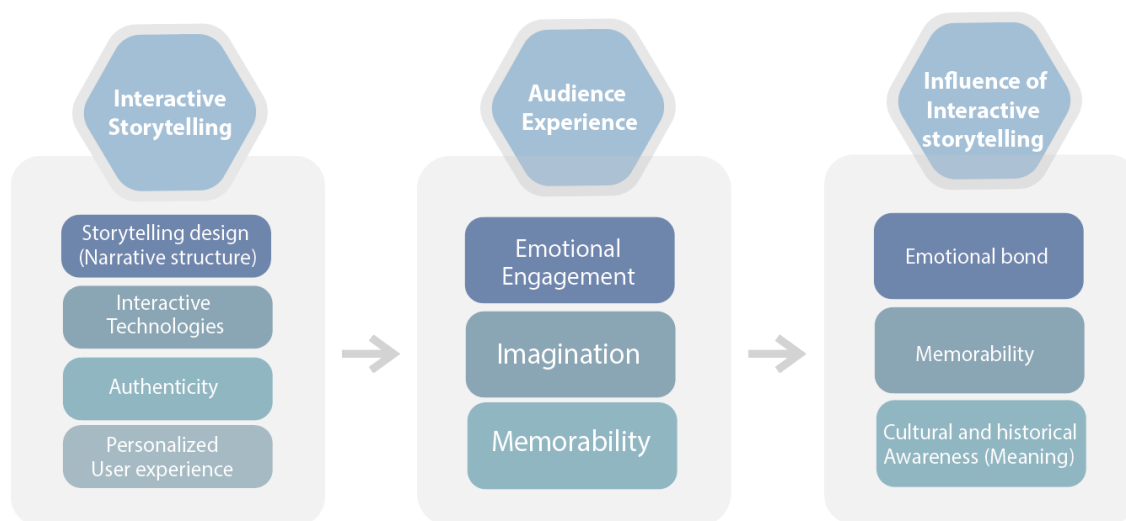

Diagram 14 (the impact of interactive storytelling in museums.- conceptual framework) (Designed by the Author)

highlights the necessity of meticulously crafted interactive components to enhance the overall museum experience and promote deeper engagement, understanding, and emotional ties with the content.

References:

1. **Abma, T. A. (2003).** Learning by telling. *Management Learning, 34*(2), 221–240. https://doi.org/10.1177/1350507603034002004

2. **Baker, S., Istvandity, L., & Nowak, R. (2016).** Curating popular music heritage: Storytelling and narrative engagement in popular music museums and exhibitions. *Museum Management and Curatorship, 31*(4), 369–385. https://doi.org/10.1080/09647775.2016.1165141

3. **Barber, H., & Kudenko, D. (2008).** Generation of dilemma-based interactive narratives with a changeable story goal. In *Proceedings of Second International Conference on Intelligent Technologies for Interactive Entertainment (INTETAIN).*

4. **Barteit, S., Lanfermann, L., Bärnighausen, T., Neuhann, F., & Beiersmann, C. (2021).** Augmented, mixed, and virtual reality-based head-mounted devices for medical education: Systematic review. *JMIR Serious Games, 9*(3), e29080. https://doi.org/10.2196/29080

5. **Bassano, C., Barile, S., Piciocchi, P., Spohrer, J. C., Iandolo, F., & Fisk, R. P. (2019).** Storytelling about places: Tourism marketing in the digital age. *Cities, 87*, 10–20. https://doi.org/10.1016/j.cities.2018.12.025

6. **Bates, J. (1992).** Virtual reality, art, and entertainment. *Presence: Teleoperators and Virtual Environments, 1*(1), 133-138.

7. **Beevor, M. C., Campos, A. C., & Guerreiro, M. M. (2022).** Storytelling and experience design in heritage tourism. In A. C. Campos & S. Almeida (Eds.), *Global Perspectives on Strategic Storytelling in Destination Marketing* (pp. 1–21). Hershey PA, USA: IGI Global.

8. **Booth, B. (1998).** Understanding the information needs of visitors to museums. *Museum Management and Curatorship, 17*(2), 139–157. https://doi.org/10.1080/09647779800301702

9. **Campos, A. C., Guerreiro, M. M., & Beevor, M. C. (2023).** Storytelling in heritage tourism: An exploration of co-creative experiences from a tourist perspective. *Museum Management and Curatorship*, 1–26. https://doi.org/10.1080/09647775.2023.2230194

10. **Cavazza, M., Charles, F., & Mead, S. J. (2002).** Interacting with virtual characters in interactive storytelling. In *Proceedings of the First ACM Joint Conference on Autonomous Agents and Multi Agent Systems* (pp. 318-325). Bologna, Italy.

11. **Charles, F., Lozano, M., Mead, S. J., Bisquerra, A. F., & Cavazza, M. (2003).** Planning formalisms and authoring in interactive storytelling. In *Proceedings of TIDSE'03: Technologies for Interactive Digital Storytelling and Entertainment.* Darmstadt.

12. **Coerver, C. (2016).** On digital content strategy. *San Francisco Museum of Modern Art.* https://www.sfmoma.org/read/on-digital-content-strategy/

13. **Dal Falco, F., & Vassos, S. (2017).** Museum experience design: A modern storytelling methodology. *The Design Journal, 20*(sup1), S3975–S3983. https://doi.org/10.1080/14606925.2017.1352900

14. **Danks, M., Goodchild, M., Rodriguez-Echavarria, K., Arnold, D. B., & Griffiths, R. (2007).** Interactive storytelling and gaming environments for museums: The

interactive storytelling exhibition project. In K. C. Hui et al. (Eds.), *Technologies for E-Learning and Digital Entertainment: Edutainment 2007, Lecture Notes in Computer Science, Vol. 4469* (pp. 131–141). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-73011-8_13

15. **Doyle, J., & Kelliher, F. (2023).** Bringing the past to life: Co-creating tourism experiences in historic house tourist attractions. *Tourism Management, 94*, 104656. https://doi.org/10.1016/j.tourman.2022.104656

16. **El-Nasr, M. S. (2007).** Interaction, narrative, and drama: Creating an adaptive interactive narrative using performance arts theories. *Interaction Studies, 8*(2), 209-240.

17. **Falk, J. H., & Dierking, L. D. (2000).** *Learning from museums: Visitor experiences and the making of meaning.* Altamira Press.

18. **Frost, W., Frost, J., Strickland, P., & Maguire, J. S. (2020).** Seeking a competitive advantage in wine tourism: Heritage and storytelling at the cellar-door. *International Journal of Hospitality Management, 87*, 102460. https://doi.org/10.1016/j.ijhm.2020.102460

19. **Gerroir, J. (2015).** *Constructing visual narratives of museum experiences* (Master's thesis). Carleton University.

20. **Haas, C. (2007).** Families and children challenging museums. In B. Lord (Ed.), *The manual of museum learning* (pp. 69–79). Lanham: AltaMira Press.

21. **Hürst, W., Tan, X. J., & de Coninck, F. (2016).** Using digital extensions to create new VR museum experiences. In A. C. Campos & S. Almeida (Eds.), Proceedings of the 13th International Conference on Advances in Computer Entertainment Technology (pp. 1–6).

22. **Johnsson, E. (2006).** *Telling tales: A guide to developing effective storytelling programmes for museums.* Renaissance London, London Museums Hub.

23. **Karmakar, Dr (2021).** Design And Development of Animation Software for Interactive Storytelling. 161-170. 10.52783/nveo.5494.

24. **Karayılanğlu, G., & Arabacıoğlu, B. C. (2020).** Digital interactive experiences in contemporary art museums. *The Turkish Online Journal of Design, Art and Communication, 10*(4), 423–440.

25. **Katifori, A., Karvounis, M., Kourtis, V., Perry, S., Roussou, M., & Ioannidis, Y. (2018).** Applying interactive storytelling in cultural heritage: Opportunities, challenges and lessons learned. In R. Rouse, H. Koenitz, & M. Haahr (Eds.), *ICIDS 2018, Lecture Notes in Computer Science, Vol. 11318* (pp. 603–612). Springer, Cham. https://doi.org/10.1007/978-3-030-04028-4_70

26. **Kelso, M., Weyhrauch, P., & Bates, J. (1993).** Dramatic presence. *Presence: Teleoperators and Virtual Environments, 2*(1), 1-15.

27. **Liarokapis, F., Voulodimos, A., Doulamis, N., & Doulamis, A. (Eds.). (2020).** *Visual computing for cultural heritage.* Springer, Cham. https://doi.org/10.1007/978-3-030-37191-3

28. **Little, C., Patterson, D., Skavronskaya, L., Moyle, B., & Bec, A. (2022).** Digital storytelling and 3D technologies for visitor experience and contested heritage

preservation. In A. C. Campos & S. Almeida (Eds.), *Global perspectives on strategic storytelling in destination marketing* (pp. 215–229). Hershey, PA: IGI Global.

29. **Lord, B. (2007).** *The manual of museum learning.* Lanham: AltaMira Press.

30. **Magerko, B. (2005).** Story representation and interactive drama. In *Proceedings of the 1st Conference on Artificial Intelligence and Interactive Digital Entertainment* (pp. 151-156).

31. **Marie, M. (2020).** Museums in Egypt. *Egypt Today*. Retrieved from https://www.egypttoday.com/Article/4/86879/All-you-need-to-know-about-Egyptian-Museums-in-Int

32. **Marstine, J. (2006).** Introduction. In J. Marstine (Ed.), *New Museum theory and practice: An introduction* (pp. 1–36). Oxford: Blackwell.

33. **Mateas, M. (1997).** An Oz-centric review of interactive drama and believable agents. In *AI Today: Recent trends and developments, Lecture Notes in Artificial Intelligence, Vol. 1600* (pp. 297-328). Springer, Berlin, Heidelberg.

34. **Mateas, M. (2000).** A neo-Aristotelian theory of interactive drama. In *Proceedings of the AAAI Spring Symposium on AI and Interactive Entertainment* (pp. 111-116).

35. **Mateas, M., & Stern, A. (2001).** Interactive drama: A thesis proposal (Ph.D. thesis). Carnegie Mellon University, Pittsburgh.

36. **Moscardo, G. (2020).** Stories and design in tourism. *Annals of Tourism Research, 83*, 102950. https://doi.org/10.1016/j.annals.2020.102950

37. **Nielsen, J. K. (2017).** Museum communication and storytelling: Articulating understandings within the museum structure. *Museum Management and Curatorship, 32*(5), 440–455. https://doi.org/10.1080/09647775.2017.1284019

38. **O'Keefe, B., Benyon, D., Chandwani, G., Menon, M., & Duke, I. I. R. (2014).** A blended space for heritage storytelling. In *Proceedings of the 28th International BCS Human Computer Interaction Conference* (pp. 120–129). https://doi.org/10.14236/ewic/HCI2014.13

39. **Pujol, L., Roussou, M., Poulou, S., Balet, O., Vayanou, M., & Ioannidis, Y. (2012).** Personalizing interactive digital storytelling in archaeological museums: The CHESS project. In G. Earl et al. (Eds.), *Proceedings of the 40th Annual Conference of Computer Applications and Quantitative Methods in Archaeology (CAA)* (pp. 77–90). Amsterdam University Press.

40. **Rafaeli, S. (1988).** Interactivity: From new media to communication. In R. P. Hawkins, J. M. Wiemann, & S. Pingree (Eds.), *Advancing communication science: Merging mass and interpersonal processes* (pp. 110-134). Newbury Park, CA: Sage.

41. **Robiady, N. D., Windasari, N. A., & Nita, A. (2020).** Customer engagement in online social crowdfunding: The influence of storytelling technique on donation performance. *International Journal of Research in Marketing*, 1–9. https://doi.org/10.1016/j.ijresmar.2020.03.001

42. **Rosli, H., & Kamaruddin, N. (2020).** A conceptual framework of digital storytelling (DST) elements on information visualization (Infovis) types in museum exhibition for user experience (UX) enhancement. *International Journal of Academic Research in Business and Social Sciences, 10*(9), 185-198.

43. **Ross, D., & Saxena, G. (2019).** Participative co-creation of archaeological heritage: Case insights on creative tourism in Alentejo, Portugal. *Annals of Tourism Research, 79*, 102790. https://doi.org/10.1016/j.annals.2019.102790

44. **Song, Q., He, L., & Hu, X. (2012).** To improve the interactivity of the history educational games with digital interactive storytelling. In *Proceedings of the 2012 International Conference on Medical Physics and Biomedical Engineering* (pp. 43-48). Xinyu, China: Modern Educational Technology Center, Xinyu University; Nanchang, China: Jiangxi Science and Technique Normal University.

45. **Sundar, S. S. (2007).** Social psychology of interactivity in human-website interaction. In A. N. Joinson, K. Y. A. McKenna, T. Postmes, & U. D. Reips (Eds.), *The Oxford handbook of internet psychology* (pp. 89-102). Oxford University Press.

46. **Szilas, N. (2003).** ID Tension: A narrative engine for interactive drama. In *Proceedings of the Technologies for Interactive Digital Storytelling and Entertainment (TIDSE) Conference* (pp. 187-203).

47. **Tenh, H. K., Shiratuddin, N., & Harun, H. (2012).** Core elements of digital storytelling from experts' perspective. *Journal of Visual Literacy, 31*(1), 24-40.

48. **Thue, D., Bulitko, V., Spetch, M., & Wasylishen, E. (2007).** Interactive storytelling: A player modelling approach. In *Proceedings of Artificial Intelligence and Interactive Digital Entertainment Conference (AIIDE)* (pp. 43-48). Stanford, California.

49. **Thyne, M., & Hede, A. M. (2016).** Approaches to managing co-production for the co-creation of value in a museum setting: When authenticity matters. *Journal of Marketing Management, 32*(15-16), 1478–1493. https://doi.org/10.1080/0267257X.2016.1198824

50. **Vrettakis, E., Kourtis, V., Katifori, A., Karvounis, M., Lougiakis, C., & Ioannidis, Y. (2019).** Narralive: Creating and experiencing mobile digital storytelling in cultural heritage. *Digital Applications in Archaeology and Cultural Heritage, 15,* e00114. https://doi.org/10.1016/j.daach.2019.e00114

51. **Weng, L., Liang, Z. X., & Bao, J. (2020).** The effect of tour interpretation on perceived heritage values: A comparison of tourists with and without tour guiding interpretation at a heritage destination. *Journal of Destination Marketing & Management, 16*(3), 100431. https://doi.org/10.1016/j.jdmm.2020.100431

52. **Wiyonoputri, W. T., Eppang, B. M., & Scott, N. (2022).** The development of stories of Bajo Mola in Wakatobi National Park. In A. C. Campos & S. Almeida (Eds.), *Global perspectives on strategic storytelling in destination marketing* (pp. 52–73). Hershey, PA: IGI Global.

Additional references from websites:

53. **Retrieved from:** https://blog.emb.global/elements-of-digital-storytelling/

54. **Retrieved from:** https://mw2015.museumsandtheweb.com/paper/the-museum-as-digital-storyteller-collaborative-participatory-creation-of-interactive-digital-experiences/index.html

55. **Retrieved from:** https://www.bayut.eg/mybayut/en/a-mesmerizing-tour-of-ancient-egypt-you-shouldnt-miss-at-tutankhamun-exhibition-inside-the-grand-museum/

56. **Retrieved from:** (https://www.linkedin.com/advice/1/what-best-tools-software-creating-interactive-game-r8gmf)