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# Exploration of Visitors' Experience and Preferences on Virtual-Reality Application in Museum

## *Eksplorasi Pengalaman dan Preferensi Pengunjung akan Aplikasi Realitas Virtual di Museum*

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**ABSTRACT**

In their traditional role, museums have served the purpose of preserving and educating cultural and historical artifacts. However, as time goes by, museums have grown from their traditional roles into leading-edge, interactive, experiential education platforms for visitors using the latest technological media, such as virtual reality. The study aims to explore the Indonesian museum visitors' perceptions—both positive and negative—toward VR usage in a museum and examine their expectations of an immersive VR experience, particularly related to VR games. The study employs content analysis through an exploratory descriptive survey to address respondents' demographic background, past museum visit experience, and expectations of VR experience. Data were analyzed using thematic analysis and descriptive statistics, accompanied by a general discussion. Findings reveal the potential for utilizing VR technology at museums. Over the past ten years, there has been an expectation for museums to expand their focus from object preservation and display to visitor engagement, enabling them to create enjoyable and memorable experiences, while maintaining their mission of knowledge dissemination.

***INFO ARTIKEL***

***Kata kunci:***
*museum, pengalaman virtual, pengalaman pengunjung, realita virtual*

***ABSTRAK***

*Secara tradisional, museum memiliki tujuan untuk pelestarian serta edukasi artefak budaya dan sejarah. Akan tetapi, seiring dengan perkembangan zaman, museum telah berubah menjadi wadah edukasi pengalaman interaktif terdepan bagi pengunjung dengan menggunakan media teknologi terbaru, seperti realitas maya (Virtual Reality). Dalam menyikapi perubahan ini, penelitian bertujuan untuk mengeksplorasi persepsi pengunjung museum di Indonesia–baik yang positif maupun negatif–terhadap penggunaan VR di museum dan memeriksa harapan mereka terhadap pengalaman VR yang imersif, terutama yang berkaitan dengan game VR. Penelitian ini menggunakan analisis konten melalui survei deskriptif eksploratif untuk mengetahui latar belakang demografis responden, pengalaman kunjungan museum sebelumnya, dan ekspektasi terhadap pengalaman VR khususnya yang berkaitan dengan tema "Museum Bahari".*

*Data dianalisis menggunakan analisis tematik dan statistik deskriptif yang disertai dengan diskusi umum. Temuan mengungkapkan potensi pemanfaatan teknologi VR di museum. Sejak dekade terakhir, lembaga-lembaga tersebut diharapkan untuk memperluas kepedulian mereka dalam melestarikan dan memamerkan objek dengan melibatkan pengunjung, membantu membuat pengalaman berkesan yang menyenangkan, dan tetap menjaga tujuan untuk penyebaran pengetahuan.*

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## Introduction

A significant drawback of traditional museums is the inherent gap between visitors and artifacts, which imposes numerous constraints on the visitors' ability to connect with the museum (Kyriakou & Hermon, 2019). Even though the delicate or fragile condition of the objects may cause such restrictions, visitors are eager to gain a deeper understanding of the artifacts, adopting an active and dialogic approach that contrasts with the traditional didactic museum approach. In contemporary times, museum visitors are no longer simply engaged in casual observation but instead they seek to immerse themselves fully and even surpass their sensory experiences (Ciolfi, 2013). Therefore, museums must evolve beyond their traditional focus on acquiring, preserving, and educating about artifacts. They should also prioritize providing interactive and entertaining experiences for visitors while acknowledging the growing role of museums in personal contemplation and mental healing (Packer & Bond, 2010). Consequently, the focus of museums has shifted from objects to visitors.

In terms of visitor experience, Young (2002) highlights the significance of experiential learning. This approach emphasizes the need to balance the user's sensory engagement (hands-on) and cognitive engagement (minds-on), which would achieve the most effective outcome by utilizing technology. Hence, the curator must possess the ability to expressively communicate the intended message, while the designer is responsible for transforming the curator's concepts into visual elements (Ahmad et al., 2014; Mayrand, 2001). The curator may present intangible exhibits, such as dance performances or the demonstration of crafting handmade products, with the aim of eliminating temporal and spatial limitations.

This paper will discuss virtual reality (VR), an emerging display technology for museum installations, which is associated with the concept of virtual environments (VE). Virtual environments (VEs) are fully computer-generated environments that visually present non-existent items on a device, enabling users to interact in real-time through a technical interface. Virtual Worlds (VW), such as Second Life, are persistent virtual worlds that are always accessible. Avatars represent users, enabling them to engage in real-time creation, play, and interaction with other avatars (Penfold, 2009; Schroeder, 2008). Meanwhile, VR is a digitally created environment that allows users to traverse and interact, resulting in a real-time replica of their senses (Guttentag, 2010). VR enables museum visitors to immerse themselves in the museum's curated virtual experience, which can mimic a physical museum visit or diverge significantly from the current physical visit experience. Such an approach allows a fresh take on the museum experience.

Academics have used Milgram and Kishino's (1994) reality-virtuality continuum as a foundation to categorize the diverse range of realities within the revised taxonomies. This classification spans from tangible to intangible settings at the opposite ends of the spectrum. Real environments (RE) refer to the physical surroundings and existing conditions. Direct and indirect observations of an actual scene, whether physically present or viewed through a television display, fall under this category. Virtual reality users do not need to be near the tourist attraction. VR only requires an internet connection and stable power charge to transport the users to the place of interest in the virtual universe, or metaverse, as it is today popularly called. Reduced physical visits also provide some relief for museum management, whose museum and its objects must undergo a considerable amount of maintenance or refurbishment. Real museums, with their physical space, limited resources, and operating hours, may limit the variety of experience features

they can provide to customers. However, the museum management can customize the VR experience to suit their preferences. Compared to rearranging physical exhibitions, the VR experience offers a higher level of personalization options.

Flavian et al. (2019) added to and improved the previous taxonomy by including Ihde's (1990) technology embodiment theory. This theory says that embodiment happens when technological gadgets make the users' experience better, making the technology an extension of the human body that helps with understanding, perceiving, and interacting with one's immediate environment. Considering previous research on technological embodiment and user experience (Tussayadiah, 2014; Tussayadiah et al., 2017), there is a technological embodiment continuum that ranges from external devices, such as stationary external devices and portable external devices, to internal devices, such as wearable devices and implanted devices.

Furthermore, the user's psychological perception of presence would differ due to the various embodiments of these external and internal devices. According to Slater (2009), "presence" in this context refers to the "place illusion" a virtual world creates. Internal gadgets can transfer and immerse individuals into remote locations due to their extremely immersive capacity and sensory attachment. External gadgets such as computers, screens, and phones create a division between the physical and virtual worlds through their interfaces. These gadgets require users to exert mental effort in order to feel as though they are in a different place. Therefore, Flavian et al. (2019) proposed that while both internally and externally embodied technologies can evoke modest levels of presence perception, using internal devices can significantly enhance the sense of presence ("being elsewhere").

A recent study in Spain found that the cognitive and emotional performance levels of the young audience, specifically millennials and Generation Z individuals, increase as the level of immersion in a VR museum experience increases (Roabina et al., 2023). The study results on Spanish Generation Z and Millennials indicated that a higher level of immersion leads to improved psychological engagement, cognitive performance, and the intention of users to actively seek out comparable virtual reality experiences. This discovery suggests that museum administrators should incorporate VR into their museum marketing plan to attract and engage young visitors.

Simultaneously, Li et al. (2024) characterize the use of virtual reality in destination promotion as a form of narrative storytelling. They assert that virtual reality significantly influences the flow state of viewers or potential tourists, thereby influencing their visitors' behavioral intentions, emotional healing, and restorative experiences more profoundly than traditional video viewing. Thus, virtual reality is critical to enticing future travel intentions for potential visitors, and management must develop a VR experience that helps reduce emotional distress. It has the potential to enhance the longevity of cultural assets by providing curious travelers with an immersive experience of the heritage asset. This alternative method allows people to explore the asset without causing any direct or indirect damage to the physical artifact or location (Hajirasouli et al., 2021). In addition to creating an immersive experience, the development of VR must also consider the importance of interactivity. This ensures that users are not merely becoming passive observers of the information (Beck et al., 2019).

In the Indonesian context, despite the steady increase in museum visitors and the growing need from stakeholders to enhance the quality, management, and promotion of Indonesian museums, museums continue to require innovative ideas to attract more visitors. Researchers have found that VR centered around Indonesian culture, like gamelan game applications and Bali temples, offers numerous advantages. Gamelan VR applications can enhance user engagement in learning gamelan without the need to purchase an expensive physical gamelan instrument. These applications provide a realistic experience that simulates the usage of an actual gamelan instrument (Pangestu et al., 2022). Additionally, the VR application allows users to archive cultural assets and introduce Balinese culture to a broader audience (Darmawiguna et al., 2020).

The study aims to explore Indonesian museum visitors' perceptions—both positive and negative—of VR usage in a museum and examine their expectations of an immersive VR experience, particularly

related to VR games, in light of the limited research on VR for Indonesian culture and heritage. In collaboration with Museum Bahari in Jakarta, Indonesia, we conduct the study to gain a more grounded understanding. This is part of a prolonged research project that aims to create and test a newly developed VR game installation based on the museum's theme and visitor questionnaires analyzed in this research. It attempts to answer the following research questions:

1. What motivates tourists to visit a museum in Indonesia?
2. How do visitors perceive VR in the museum and their current understanding of the technology?
3. What prompts the visitor to use and not use VR in the museum?
4. What are the visitors' expectations and preferences of VR experiences, specifically related to the theme of the "Bahari Museum"?

This paper structures the result and discussion as follows: It first details the respondents' profiles and motivations for visiting a museum. Then, it describes the respondents' perceptions towards VR usage, using an example of an existing VR game that aligns with the "Bahari Museum" theme. The analysis includes both Likert and thematic elements and is complemented by a comprehensive discussion. We constructed the Likert scale based on Pekarik et al.'s (1999) theory, which categorizes museum experiences into object, cognitive, introspective, and social experiences. The four elements must be balanced for a satisfying experience, though one may dominate depending on the exhibition. Meanwhile, the thematic analysis incorporates a multifaceted model of visitor experience by Packer & Ballantyne (2016), which includes physical, sensory, emotional, hedonic, cognitive, introspective, restorative, transformative, spiritual, and relational aspects. Table 1 illustrates the mapping of the two complementary models of visitor experience classification. In the second model, the term "object" is translated into four corresponding categories—physical, sensory, emotional, and hedonic—while the term "introspective" is expanded to include three more definitions—restorative, transformative, and spiritual—that are still related to the introspective value. Lastly, social and relational are deemed to have similar values.

**Table I Two Models of Visitor Experience Classification**

| No | Pekarik et al., 1999 | Packer & Ballantyne, 2016 |
|---|---|---|
| 1 | Object | Physical |
| 2 | | Sensory |
| 3 | | Emotional |
| 4 | | Hedonic |
| 5 | Cognitive | Cognitive |
| 6 | Introspective | Introspective |
| 7 | | Restorative |
| 8 | | Transformative |
| 9 | | Spiritual |
| 10 | Social | Relational |

## Method

The study uses an exploratory descriptive survey questionnaire with open-ended questions. The survey questions address respondents' demographic backgrounds, past museum visit experiences, and expectations of VR experiences, particularly related to the theme of the "Bahari Museum." Populix, a web-based market research company, conducted the survey online. Among 300 respondents who filled out the questionnaire, 282 answers were usable.

A descriptive statistical analysis was used to analyze the demographic-based responses and Likert-scaled questions' responses, and then a thematic analysis was used to perform axial coding on the responses of the open-ended questions. A second coder will later verify emerging themes until the inter-

coder agreement exceeds 90%. This research is part of a long-term project, and the results will guide the development of a VR game application for "Bahari Museum."

## Result and Discussion

### Respondents' Profile

There were 282 samples collected and used for the analysis. The majority of respondents are female (n = 169, 60%). Respondents mostly reside in DKI Jakarta (n = 156, 55%). Most belong to the SES Middle 1 to Upper 2 Income Class (88%). Most respondents work full-time either in permanent status or on a contract basis (n = 148, 52%), followed by active university students as the second biggest (n = 43, 15%). The details can be found in Table II.

**Table II Profile of Respondents**

| Category | Variables | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 113 | 40% |
| | Female | 169 | 60% |
| SES Grade | Lower 1 | 28 | 10% |
| | Lower 2 | 4 | 1% |
| | Middle 1 | 62 | 22% |
| | Middle 2 | 43 | 15% |
| | Upper 1 | 65 | 23% |
| | Upper 2 | 80 | 28% |
| Domicile | Banten | 35 | 12% |
| | DKI Jakarta | 156 | 55% |
| | West Java | 91 | 32% |
| Job Status | Part-time worker | 15 | 5% |
| | Full-time worker (contract) | 49 | 17% |
| | Full-time worker (permanent) | 99 | 35% |
| | Other paid jobs | 3 | 1% |
| | Active university students | 43 | 15% |
| | Inactive university students (on leave) | 2 | 1% |
| | Active high school students | 11 | 4% |
| | Entrepreneur | 25 | 9% |
| | Freelancer | 9 | 3% |
| | Housewife | 9 | 3% |
| | Persons with disabilities | 1 | 0% |
| | Looking for jobs | 16 | 6% |

### Museum Visit

Contrary to the previous literature review on the expanding role of museums beyond education, the research reveals that 54.61% of respondents still wish to visit museums to learn and discover something. The second major reason is to spend recreational time by visiting museums on holidays (23.76%). The rest of the respondents want to spend quality time with their romantic partners, friends, family, or loved ones (12.41%) and seek entertainment values to amuse them (9.22%). Table 3 displays the breakdown of the descriptive data. In the Kota Tua area itself, several respondents have visited Museum Sejarah Jakarta or Museum Fatahillah (n = 223), Museum Bank Indonesia (n = 181), Museum Wayang (n = 118), Museum Bahari (n = 115), and Museum Seni Rupa dan Keramik (n = 105). Furthermore, 27 of the respondents have also visited museums located outside the Kota Tua area.

**Table III Museum Visit Motivation**

| Motivation | Frequency | Percentage |
|---|---|---|
| Education: Learn and discover something new | 154 | 54.61% |
| Entertainment: Seek something pleasant and amusing | 26 | 9.22% |
| Recreation: Holiday, visit tourist attractions | 67 | 23.76% |
| Social: Spend time with friends, partner, or family | 35 | 12.41% |

The result from the thematic analysis reveals 35 themes discussing motivation and memorable experiential aspects of respondents' museum visits, as illustrated in Figure 1. The majority of respondents' motivations and memorable aspects of their museum visit are to learn more about Indonesian history and local Indonesian culture (65), add new knowledge (11), learn arts (9), feel nostalgic about the past (3), enhance nationalistic pride (2), spend quality time with loved ones (3), and do recreational activities (3) as well as entertainment purposes (2), to name a few.

The majority of respondents mention immersing themselves in Indonesian history and local culture as the most important part of their visit. The selected responses from study participants, translated from Bahasa Indonesia, align with the theme below.

"Museum Lubang Buaya is one of those museums that gives me goosebumps." The atmosphere evokes a sense of sorrow and uneasiness, particularly when one sees the hole filled with blood. Despite the scary atmosphere, this place is quite memorable to me."

"Museum Bank Indonesia. There are many things to see, including the development of currency in Indonesia, the evolution of [physical] money from era to era, and other unique items that I haven't seen before. Seeing the exhibition makes me pleased as it also provides valuable information."

Museums also offer respondents excellent insights into history, culture, and the arts. Respondents frequently emphasize that the knowledge they acquire during their museum visit is a noteworthy component of the experience.

"So far, Museum Zoologi is the most memorable museum for me. This is due to my childhood fascination with animals. Hence, the visit to the Museum Zoologi leaves a long-lasting impression in my memory."

"I once visited Museum Fatahillah, which provides new education on the history of Jakarta, including the underground prison, iconic paintings about colonialism, and the Si Jampang cannon."

Museums also serve as a window into the world of art for visitors. Respondents consider their enhanced awareness of the arts in museums to be a memorable feature of their experience.

"I first realized my child's interest in artworks when I visited Museum Seni Rupa dan Keramik." My child's motivation to enjoy the arts continues to this day. When we visited the museum again, it seemed like he/she had found his/her own world."

"Museum Affandi. The museum collected paintings. The artworks from those artists are exceptional, stunning, and possess hidden messages inside them."

Respondents also noted that a museum visit allows them to spend quality recreational time with family, friends, or romantic partners.

"I took my partner to a museum for our first date because it wasn't too crowded at the time." During the date, we connected well, so when I reminisced about that time, it was indeed memorable. There were many new things [we experienced] when we were there."

"On a vacation to Museum Fatahillah, I'm spending quality time with my partner while trying to ride the busway together."

The museum also elicits nostalgic memories and emotions from the participants. Visiting a museum evokes memories of their childhood and helps them recall joyful occasions from their formative years.

"When I visited Museum Fatahillah. Back then, when I was just a child (around 8 years old), I did not know much about the history portrayed in that museum. However, despite not understanding much about history, I adored the diorama at the exhibition."

Visitors also view museums as a source of pride. Studying Indonesian history and culture enhances individuals' sense of nationalism by showcasing objects and dioramas at museums that represent significant moments in the country's development.

"Museum Nasional. There, the voice of the first president of Indonesia, Mr. Soekarno, filled me with amazement and shivers."

Based on the results, respondents' satisfying experiences blend between object and cognitive experience since they are complementary to each other. Respondents express their memorable experiences seeing museum objects or being in awe of museum dioramas and narratives that describe the object or diorama. This, in turn, gives them more knowledge and understanding of the culture and history embedded in the object.

Specifically, thematic analysis reveals that a unique aspect of their memorable museum experience is to be able to learn about Indonesia's cultural richness and history. Respondents' responses also highlighted introspective and social experiences. Findings indicate respondents find meaning-making instances and gratitude to be able to spend time with their family and friends at the museum and also recollect joyful childhood or nostalgic memories from their visit to museums.

## Virtual Reality Usage

While the descriptive analysis reveals that 48.5% of respondents have not used VR, 45% acknowledge the existing VR technology and are familiar with it. This was followed by those who had used VR for playing games (24%), watched VR content like interactive videos (17%), and underwent a learning process from a simulation (10%). This provides a relevant background for further discussions about the preferences of museum visitors and the development of a VR application for Museum Bahari. Table IV details the remaining VR usage and non-use.

**Table IV Analysis of VR Usage**

| Description | Frequency | Percentage |
|---|---|---|
| Have not used it and are not familiar with VR technology | 11 | 3.90% |
| Have not used it but know about VR technology | 126 | 44.60% |
| Have used it to play games | 69 | 24.47% |
| Have used it to learn something (simulation) | 28 | 9.93% |
| Have used it to watch something | 48 | 17.02% |

## Likert Analysis

According to Table V, the research uses a Likert scale from 1 (very not interested) to 5 (very interested) to measure interest in VR usage in a museum. The importance of implementing VR technology for exhibitions earned an average score of 4.29, with 47.16% answering very important. Moreover, the average score for interest in using VR technology is higher at 4.74, with 78.37% indicating a high level of interest. In other words, most respondents are positive about VR usage in museums, fortified by the absence of respondents who chose number 1 on the Likert scale for both questions.

**Table V VR Interests**

| Description | Frequency | Percentage |
|---|---|---|
| *How important is the implementation of VR in a museum?* | | |
| 1 Very not important | 0 | 0.00% |
| 2 Not important | 4 | 1.42% |
| 3 Indifferent | 43 | 15.25% |
| 4 Important | 102 | 36.17% |
| 5 Very important | 133 | 47.16% |
| *How interested are you in using VR in a museum?* | | |
| 1 Very not interested | 0 | 0.00% |
| 2 Not interested | 1 | 0.35% |
| 3 Indifferent | 11 | 3.90% |
| 4 Interested | 49 | 17.38% |
| 5 Very interested | 221 | 78.37% |

To narrow down the design possibilities, further questions about the respondents' preferences for VR experiences are evaluated using a similar Likert scale. The questions are arranged based on the four classifications of satisfying experiences in a museum (Pekarik et al., 1999), namely: (1) object experience, (2) cognitive experience, (3) introspective experience, and (4) social experience, to ensure the questionnaire has covered the broad range of plausible human-technology interactions at museums. Table VI then breaks down each experience into narrower categories.

There is a strong link between wanting to learn and liking three types of cognitive experiences: having fun with new experiences (4.76), learning new things and improving your knowledge (4.74), and better understanding the exhibition's content, setting, and theme (4.66). The social experience, specifically sharing the experience with friends and family, receives the highest average score (4.57). Meanwhile, respondents show little interest in introspective experiences, especially when it comes to play-pretend (3.83), despite the fact that an average score above 3 is still regarded as positive. The next research phase will use the four highest scores as the basis for developing the VR application.

**Table VI VR Experiences and Preferences**

| No | Type | Experience (I want to…) | Average Score |
|---|---|---|---|
| 1 | Object experience | feel mesmerized or awed by the immersive presentation of the museum artifacts (hedonic) | 4.54 |
| 2 | | feel moved or touched by the immersive presentation of the museum artifacts (emotional) | 4.49 |
| 3 | | improve and expand my professional competence | 4.53 |
| 4 | Cognitive experience | enrich my understanding of the content, context, and theme of the exhibition | 4.66 |
| 5 | | gain new information and knowledge | 4.74 |
| 6 | | gain pleasurable new experiences | 4.76 |
| 7 | Intros-pective experience | pretend to be another person or another profession | 3.83 |
| 8 | | imagine time and places beyond my current reality as if teleporting to another space | 4.53 |
| 9 | | feel nostalgic by enjoying past periods | 4.51 |
| 10 | | reflect/contemplate what I experienced | 4.49 |
| 11 | | experience spiritual connection | 4.21 |
| 12 | Social experience | experience belonging and connectedness | 4.27 |
| 13 | | share the experience with friends and family | 4.57 |
| 14 | | see my friends and family learn something new | 4.56 |

## Thematic Analysis

94 open-ended responses were coded from respondents who answered "Yes" to the question, "Have you ever tried VR technology in a museum?" While 36 of those could not be thematically coded as they did not answer the question, 58 responses were usable for coding. Packer & Ballantyne (2016) proposed a multifaceted model of visitor experience, which expands on the theory by Pekarik et al. (1999), based on Table I.

The thematic analysis identified seven themes in the coding. The distribution of codes is as follows: sensory experience (19), hedonic experience (18), cognitive experience (13), introspective experience (5), physical experience (1), relational experience (1), and transformative experience (1). The findings align with the previous Likert analysis, emphasizing cognitive and hedonic experiences, where pleasure was identified as a cognitive characteristic in the previous section. While Packer & Ballantyne's proposed sensory experience may align more closely with Pekarik et al.'s (1999) object experience classification, the respondents viewed it as a tool for enhancing their comprehension of the objects, thereby facilitating the acquisition of new knowledge.

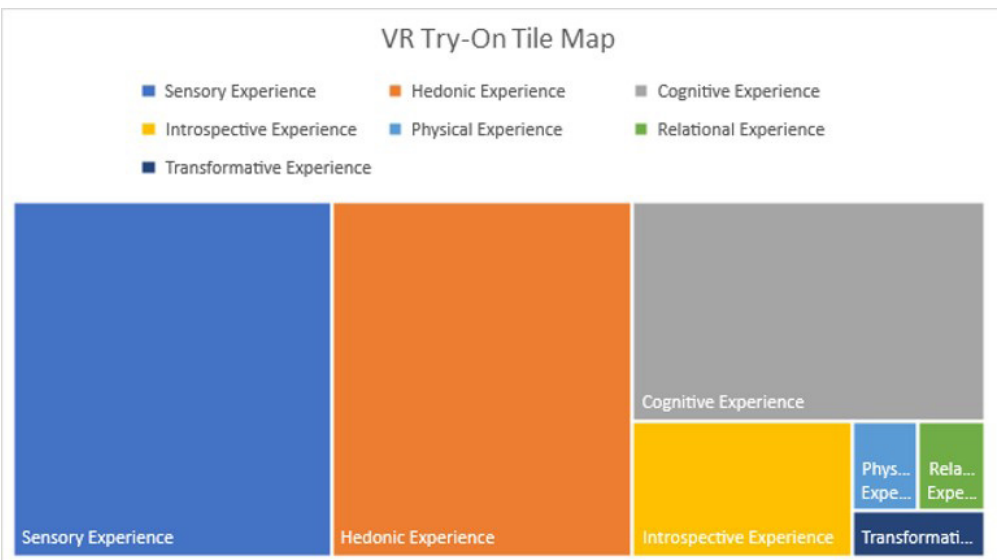


**Figure 2** Thematic analysis of VR experience preferences (1)

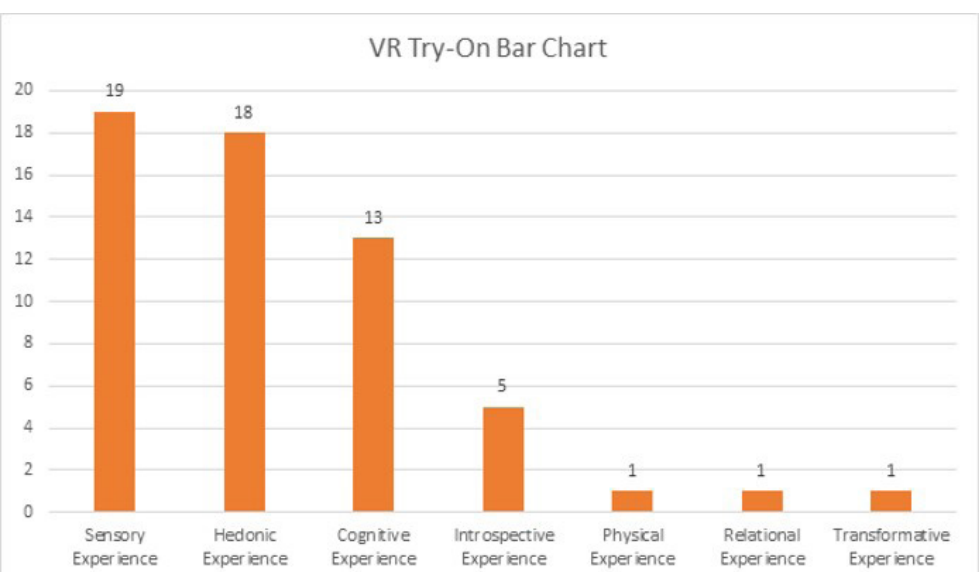


**Figure 3** Thematic analysis of VR experience preferences (2)

The majority of respondents prefer sensory, hedonic, and cognitive experiences from their VR usage. This aligns with previous research on the reality-virtuality continuum and the embeddedness of technology in technological devices. Both Slater (2009) and Flavian et al. (2019) postulated that internal devices (i.e., virtual reality wearables) possess the ability to transport individuals into new realms and increase their degree of presence in such realms. Findings concur with such postulation, as respondents express novel sensory, hedonic, and cognitive experiences when they use VR devices. Museum management can leverage the hedonic and cognitive experiences provided by VR to encourage repeat visits from the wearer, given their proven ability to shape the behavioral intentions of potential tourists (Li et al., 2024).

The findings also suggest that we can design VR to enhance the pragmatic and hedonic qualities of museum experience characteristics, thereby producing high appeal, pleasure, and satisfaction from museum visitors (King et al., 2023). Han & Hyun (2017) identified satisfaction as an important and significant mediating factor in influencing intention. Their study also suggests that visitors' involvement in the museum can further amplify this influence. With VR, museum visitors can engage more deeply through design manipulations in the VR experience, which emphasize interaction and gamification between visitors and museums, as well as between visitors and other visitors.

The questionnaire then included screenshots and a brief video from the game "MarineVerse Cup: Sailboat Racing" to introduce the VR application under development and clarify the scope of the research. We instructed the participants to evaluate the photographs and identify the elements that most captured their attention. The adjectives "interesting," "exciting," "cool," and "nice" (translated from Bahasa Indonesia) frequently indicated a positive response from 95% of respondents to the images. Although most of the respondents reacted positively to the image, some responses leaned toward a neutral impression, as seen by using terms such as "realistic" and "real." The most captivating part for them is imagining having the experience of sailing while being inside an indoor space. While the immersive experience of using VR technology indeed allows for a more engaging and participatory experience compared to watching a screen, respondents expressed an interest in the interactivity when they are expected to play instead of simply watching. Thus, optimizing user experience is crucial for the VR game.

Based on the open-ended questions, we can categorize the preferred VR experiences into three groups: (1) sailing; (2) historical settings; and (3) underwater scenes, which include either submarine or swimming exploration. The underlying similarity among these three experiences is that they desire an immersive encounter that diverges from their regular circumstances, encompassing changes in time, location, and activities. For instance, due to the specific skill and high expenses associated with diving, several individuals expressed an interest in attempting it through VR. A few participants also imagined the inclusion of more sensory encounters, such as the sensation of water splashing and realistic textures of objects. Unfortunately, the topic of marine life does not align well with the subject and exhibits of the Museum Bahari, which primarily showcases the history of sailing, including a variety of boats from different ages and continents, significant historical figures, and spice routes.

Within the sailing group, several respondents expressed a desire to be a ship captain. However, there were variations in their preferences, such as differing storylines of overcoming storms and serving on warships. Furthermore, some participants expressed a desire for additional recreational pursuits, such as fishing, operating the helm, and exploring the intricacies of the ship's interior. Similar to the respondents who favored the underwater experience, some respondents who preferred sailing expressed a desire to physically feel the waves and wind on their skin in order to fully engage in the activity.

Meanwhile, the historical settings group comprises respondents who are interested in going to a past period that they have never experienced before, such as the colonial period. This will be distinguished from the clothes, buildings, or the surrounding area, such as the atmosphere of Batavia Port during the 17th century. In other words, they wanted to instantly enter a different dimension without the necessity to travel, even meeting a historical figure who had passed away. Initially, this idea is interesting since there is a room at Museum Bahari that exhibits statues of famous sailors, be they from Indonesia, like

the first female sailor named Laksamana Malahayati, or a foreign sailor who once raised the Indonesian archipelago, like James Cook.

In addition to preferences, the research documented the concerns that respondents expressed about the use of VR. These issues can serve as valuable ideas for the museum if they intend to bring VR games to the public. Regarding personal matters, the concerns experienced are as follows:

- Spacers can improve the product's usability and comfort for visually impaired users.
- The VR experience of being on a ship could trigger symptoms of motion sickness, including dizziness, imbalance, and fear of falling.
- A malfunction, electrical discharge, and other technical difficulties can occur.
- Personal preferences, like adjusting the sound and brightness, are not customizable.
- Horror VR games often portray the appearance of disturbing or shocking elements that could lead to trauma.

In terms of a social-use product that will be exhibited to the general public, the primary concern is hygiene because the VR devices will be shared with others. Furthermore, the devices are limited to individual use, which may result in long queues. Anticipating a brief duration for each round of the VR game raises concerns about comfort, especially for visitors who may find the game experience not worth the significant time they spend waiting in line. It is imperative to take this condition into account to create a more favorable situation.

Research on VR interaction reveals that respondents desire the ability to delve deeply into the VR realm, as well as the opportunity to assume the role of a main avatar or protagonist in the experience narrative. The findings reveal that respondents desire their avatar's capabilities to go beyond the core museum experiences, but also to provide a supplementary experience that meets their secondary experiential needs, such as engaging in social and recreational gaming activities.

## Conclusion

This paper has illustrated a high potential for utilizing VR technology at museums. Over the past ten years, museums have expanded their focus from object preservation and display to visitor engagement, aiming to create enjoyable and memorable experiences, all while maintaining their mission of knowledge dissemination. Therefore, in addition to exploring advanced technologies, it is crucial to design experiences that are grounded in evidence-based research, as this study has demonstrated. It gathered quantitative and qualitative data from 282 respondents who have visited museums in the Jakarta area. Their main motivation for visiting museums is experiential learning, where they expect playfulness and unique ways of acquiring the information. Their memorable experiences, evoking emotional responses such as nostalgia and goosebumps, serve as evidence.

Even though 3.9% of the respondents are not familiar with VR, and 45% are familiar with VR but have not used it, the respondents respond positively to the integration of VR. More than half of respondents have used VR for various purposes, boosting its popularity. 47.16% of respondents believe the implementation of VR is very important, and 78.37% express great interest in using VR in museums. Still, this does not eliminate individual concerns such as dizziness and technical malfunctions, as well as social concerns such as the long queue to try the VR headset that could be remedied by providing a collective experience while the visitors are waiting for their turn.

When it comes to VR preferences, respondents tend to prioritize gaining a better understanding of the exhibition or objects at the museum through pleasurable new experiences. It also highlights the importance of sensory experiences. By actively engaging their senses, they can gain knowledge while keeping the element of fun. For Museum Bahari, we can categorize the expected experiences into sailing, historical settings, and underwater, with the combination of the first two being the most viable for further development in this project.

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## References

Ahmad, S., Abbas, M. Y., Taib, M. Z. M., & Masri, M. (2014). Museum exhibition design: Communication of meaning and the shaping of knowledge. *Procedia-Social and Behavioral Sciences, 153,* 254-265.

Beck, J., Rainoldi, M., & Egger, R. (2019). Virtual reality in tourism: a state-of-the-art review. *Tourism Review, 74*(3), 586-612.

Ciolfi, L. (2013). Embodiment and place experience in heritage technology design. *The International Handbooks of Museum Studies,* 419-445.

Darmawiguna, I., Pradnyana, G. A., Sindu, I., Karimawan, I. P. P. S., & Dwiasri, N. K. R. A. (2020). Bali Temple VR: The virtual reality-based application for the digitalization of Balinese temples. arXiv preprint arXiv:2004.13853.

Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2019). The impact of virtual, augmented and mixed reality technologies on the customer experience. *Journal of business research, 100,* 547-560.

Guttentag, D. A. (2010). Virtual reality: Applications and implications for tourism. *Tourism management, 31*(5), 637-651.

Hajirasouli, A., Banihashemi, S., Kumarasuriyar, A., Talebi, S., & Tabadkani, A. (2021). Virtual reality-based digitisation for endangered heritage sites: Theoretical framework and application. *Journal of Cultural Heritage, 49,* 140-151.

Han, H., & Hyun, S. S. (2017). Fostering customers' pro-environmental behavior at a museum. *Journal of Sustainable Tourism*, *25*(9), 1240-1256.

Ihde, D. (1990). *Technology and the lifeworld: From garden to earth.* Indiana University Press.

King, E., Smith, M. P., Wilson, P. F., Stott, J., & Williams, M. A. (2023). Creating meaningful museums: A model for museum exhibition user experience. *Visitor Studies*, *26*(1), 59-81.

Kyriakou, P., & Hermon, S. (2019). Can I touch this? Using natural interaction in a museum augmented reality system. *Digital Applications in Archaeology and Cultural Heritage, 12,* e00088.

Li, N., Li, L., Chen, X., & Wong, I. A. (2024). Digital destination storytelling: Narrative persuasion effects induced by story satisfaction in a VR context. *Journal of Hospitality and Tourism Management, 58,* 184–196.

Mayrand, Y. (2014). The role of the exhibition designer. In Lord, B., & Piacente, M. (Eds.). *Manual of museum exhibitions,* 405-424. Rowman & Littlefield.

Milgram, P., & Kishino, F. (1994). A taxonomy of mixed reality visual displays. *IEICE TRANSACTIONS on Information and Systems, 77*(12), 1321-1329.

Packer, J., & Ballantyne, R. (2016). Conceptualizing the visitor experience: A review of literature and development of a multifaceted model. *Visitor Studies, 19*(2), 128-143.

Packer, J., & Bond, N. (2010). Museums as restorative environments. *Curator: The Museum Journal, 53*(4), 421-436.

Pangestu, A. W., Primasari, C. H., Sidhi, T. A. P., Wibisono, Y. P., & Setyohadi, D. B. (2022). Comparison analysis of usability using controllers and hand tracking in virtual reality gamelan (Sharon) based on user experience. *Journal of Intelligent Software Systems, 1*(2), 89-103.

Pekarik, A. J., Doering, Z. D., & Karns, D. A. (1999). Exploring satisfying experiences in museums. *Curator: The Museum Journal, 42*(2), 152-173.

Penfold, P. (2009). Learning through the world of second life—A hospitality and tourism experience. *Journal of Teaching in Travel & Tourism, 8*(2-3), 139-160.

Schroeder, R. (2008). Defining virtual worlds and virtual environments. J*ournal for Virtual Worlds Research, 1*(1).

Slater, M. (2009). Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical Transactions of the Royal Society of London: Biological Sciences, 364*(1535), 3549–3557.

Tussyadiah, I. (2014). Expectation of travel experiences with wearable computing devices. In Z. Xiang, & I. Tussyadiah (Eds.). *Information and communication technologies in tourism 2014* (pp. 539–552). Springer.

Tussyadiah, I. P., Jung, T. H., & tom Dieck, M. C. (2017). Embodiment of wearable augmented reality technology in tourism experiences. *Journal of Travel Research, 57*(5), 597–611.

Young, M. R. (2002). Experiential learning = hands-on + minds-on. *Marketing Education Review, 12*(1), 43-51.