



User Experience in Virtual Museums - Evaluating Assassin's Creed Odyssey: Discovery Tour

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Abstract. This paper investigates the user experience of virtual museums, based on a user study of Ubisoft's Assassin's Creed Odyssey: Discovery Tour. The study included 22 participants, who tried the virtual experience in a lab environment and answered a questionnaire. Four main user experience themes were identified—usability, presence, features and content. Issues of accessibility, authenticity, and the possibilities and limitations of virtual museum experiences are discussed.

Keywords: User Experience · Virtual Museum · Serious Games

1 Introduction

Developing serious games and applying game technologies have become increasingly popular in many types of contexts, including cultural heritage [15], education, [12] and tourism experiences [5]. One interesting application of these technologies is virtual museums, which allow cultural heritage content to be shown and experienced in a multi-sensory and interactive way, and to do it remotely. To gain insights into the user experience of virtual museums, we conducted a user study into the education mode of a historically-based game, *Assassin's Creed Odyssey: Discovery Tour*. The user study included participants trying out the virtual museum independently and sharing their evaluation of the experience by answering a questionnaire. Our research aimed to map out the user experience issues, and highlight aspects that should be considered in the development of virtual museums.

Our work can aid cultural heritage institutions and experts in developing the user experience of virtual museums. It can also guide game developers to consider the different types of users when developing virtual museum content, and identify the features which are most desired when creating educational modes on top of games. To position our work, we review existing research on virtual museums and Assassin's Creed. We then describe our study method, the collected dataset

from 22 participants, and our analysis process. As the main findings, we report on four user experience themes identified in *Assassin's Creed Odyssey: Discovery Tour*, usability, presence, features, and content. We also highlight that developer teams should take note of accessibility of virtual experiences and that beautiful visuals alone are not enough for an engaging experience.

2 Related Work

Virtual museums are positioned at the cross-section of cultural heritage, technology, design and arts. The term 'virtual museum' first appeared in the 1990s, but over time has changed in definition, and currently refers to a broad set of different concepts [19]. Kersten et al. [11] note that the advancement of technologies has been a major contributor to the rapid and ongoing evolution of the domain. To position our work, we briefly review works focusing on the user experience of virtual museums, those exploring the authenticity of virtual museums, and highlight prior works that have used the same source material - the Assassin's Creed game series.

2.1 Virtual Museums and User Experience

One approach to virtual museums is to recreate a physical museum, such that visitors can virtually walk around the museum space [22]. In contrast, Jokanović [10] discusses the lack of interest in virtual museums, even during the COVID-19 pandemic, critiquing the exhibitions for merely presenting existing physical content, rather than immersive and innovative content. Hence, more innovative ways are needed to present museum content, optimally in the virtual format. However, as with physical museums, it is critical that ethical issues are considered when implementing virtual museums and cultural heritage content [2]. Already during the design phase, different cultures and user groups should be considered [8]. In our previous study about museum experiences, the role of interactive and multisensory experiences was highlighted [14].

When developing virtual museums, experts from various fields are needed [12] and good collaboration between them is important [21]. Paliokas & Sylaiou [15] created a classification of serious games used for virtual museums and exhibitions. In their model, user experience is divided into two subcategories; navigation/exploration and motivation/challenge. Following this framework, the Assassin's Creed Discovery Tour is primarily navigation/exploration focused. Sundar et al. [22] studied three elements in relation to virtual museums - navigability, interactivity and customization, reporting that navigation in a virtual 3D world can be challenging for those less familiar with using technology. Whilst Styliani [21] notes the engaging nature of virtual museums, and their ability to promote learning and entertainment, they call for a complementary approach, "Virtual museums cannot and do not intend to replace the walled museums".

2.2 Authenticity and Realism in Virtual Museums

One aspect discussed in relation to virtual museums is their authenticity, i.e. how authentic can and should the experience and environment be? Shehade and Stylianou-Lambert [20] examined authenticity in relation to the virtual transformation of cultural tourism and identified three approaches: objective, constructivist and postmodernist. The objective approach bases authenticity on the object itself. Thus, a virtual copy is inherently inauthentic. In the constructivist approach, authenticity is dependent on the viewer's perception of authenticity. In the postmodernist approach, the line between copy and original is not clear, and authenticity is determined by the quality of the representation. Hence, following constructivist and postmodernist approaches a digital representation could be close enough to the real artefact to be considered authentic.

The graphical style of Assassin's Creed can be classified as photorealistic i.e. "photographic likeness with reality" [9]. The environment and objects are modelled and textured after their real-life counterparts and lighting is made to imitate the behaviour of real light. The visual aspect, however realistic, is not the only factor in making a virtual environment feel like real life, audio and interactivity can significantly enhance the "realness factor" of a virtual environment [18]. Roussou and Drettakis [18] argue, that the benefit of photorealism depends on the intended use, e.g. for professional archaeologists it is less useful but is very important in educational contexts, where it provides "a window to the past" for the audience [18].

The Assassin's Creed Odyssey: Discovery Tour shows the world of Ancient Greece, often including places that still exist in some form, e.g. the Acropolis of Athens. The game developers have recreated the locations as they could have appeared in 431–422 BC. The accuracy of this type of restoration is only as good as current knowledge allows, and gaps in knowledge have to be filled with approximations and interpretations to make an immersive virtual environment. One approach, to ensure maximum historical accuracy, is to exclude details on which there is no verified information. However, leaving such blank spaces in the virtual environment diminishes the scene's realism [13].

2.3 Research on Assassin's Creed

The Assassin's Creed video game series has been studied from many angles, including social education, architecture, storytelling and historical studies [4, 6, 17, 24]. Our work focuses particularly on the 'discovery tour' feature within the game, which guides users to explore the virtual game world (Fig. 1). The first Assassin's Creed discovery tour released by Ubisoft was an educational mode added to the Assassin Creed Origins game, based on ancient Egypt. Later discovery tour additions focused on ancient Greece and the Viking age. The discovery tour enables users to 'travel back in time' to the simulated everyday life of the featured places and to see and hear the culture recreated by the game's artists and developers. Ubisoft describes the game-based software as a "living museum" [23]. Poiron [16] attributes one of the main benefits of the discovery

tour to the fact that you can see the reference museum material in context when exploring, combined with the game artists' rendering of places and other objects.



Fig. 1. The introductory tour teaches the user to climb over obstacles.

3 Study and Participants

In 2019, the Discovery tour mode was added to the Assassin's Creed Odyssey game. The mode is based on the game and employs features and interactions from the game, such as climbing, navigation, and interaction. The discovery tour mode includes a virtual guide, who instructs the user on where to go next and provides information. At the end of a tour the guide presents a quiz on the information contained in the tour. Poiron [16] has described the development process of the tours in detail, which included consulting historians. The duration of each tour is limited to 20 min, to be within peoples' attention span, even though there would be more content available [16]. The user has the freedom to choose, which tour to take (Fig. 2) and at any point can travel by using the world map.

3.1 Study Setup

The user tests were conducted at University of Lapland campus, in a user test lab with a computer, mouse and keyboard and a pair of headphones (Fig. 3). The participants received an introductory briefing and printed instructions on the tour's main interaction controls, and after that, completed the test procedure alone. Each participant had one hour to complete the tasks and questionnaires and had technical support available on request. First, the participants completed a consent form and provided background information, after which they

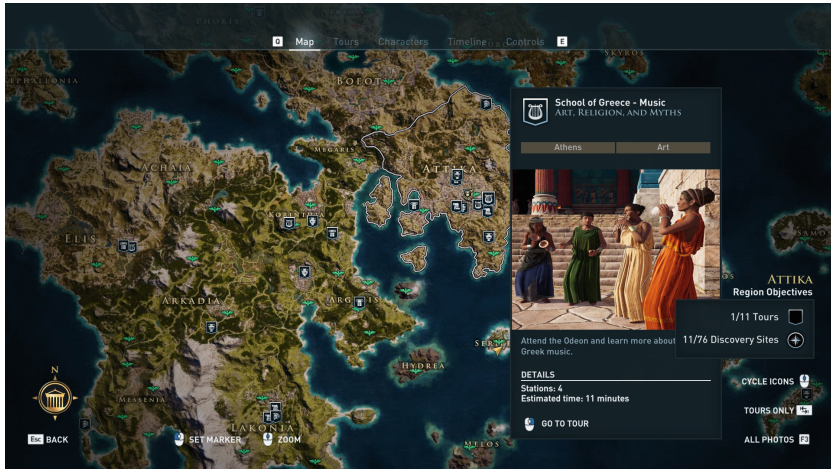


Fig. 2. The user can travel and select tours in the map menu.

were instructed to explore the introductory tour for 15 min. Following this, participants answered questions about their first impressions and any negative or positive experiences they had. Next, participants were instructed to explore the discovery tour for 30 min, choosing freely where to go and what to do, such as selecting from the many tours included. At the end of the exploration time, participants completed a final questionnaire. The study included 22 participants, both university students (15) and staff (7), and represented different levels of prior experience in playing virtual world-type games. They were recruited based on their interest to try out a virtual museum experience, from design and art history classes, and through local networks. 45% of the participants were female, 45% male, and the remainder non-binary or did not wish to answer. Most of the participants (41%) were aged 18–25, 36% were between the ages of 26–35, and the remainder were 36 or older.

3.2 Participants' Backgrounds

Experience with Games and Technologies. More than half of the participants (64%) had visited some kind of virtual museum or virtual exhibition. Many (45%) reported having experienced an online 360-type tour, similar to Google's Street View. Lower experience with 2D online virtual museums was reported (32%). Around one-third (36%) of the participants reported having no experience with any form of virtual museum or exhibition. The participants had a varied experience of gaming, 50% reported playing video games monthly or more often, whilst 18% reported never playing video games. The most popular devices used in gaming were computer/laptop (86%), mobile/tablet devices (82%), consoles e.g. Xbox and PlayStation (82%). Altogether 32% of the participants had played Assassin's Creed, and in total most (73%) had at least heard of it before.



Fig. 3. User study setup.

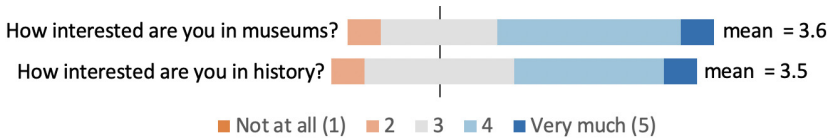


Fig. 4. Participants' interest in history and museums.

Interest in History and Museums. The questions included the participants' interest in history and museums, which were asked using a 5-point rating scale of 1 “not at all” to 5 “very much”. Overall, the participants' responses were on the positive side (see Fig. 4), with mean values of 3.5 for history and 3.6 for museums. Most participants (64%) reported visiting museums between 1 and 4 times per year (pre-COVID-19). Only one participant reported visiting museums less than once per year.

4 Findings

The data from the questionnaires were analyzed using a thematic coding approach. Four high-level themes related to user experience emerged, under which the findings are presented; usability, features, tour content, and the feeling of presence (Fig. 5). The framework was developed through discussion between the researchers, by identifying different themes and their relation to each other. They were all linked to general usability, and together formed the whole user experience. Additionally, participants' general wishes for virtual museum experiences were collated.

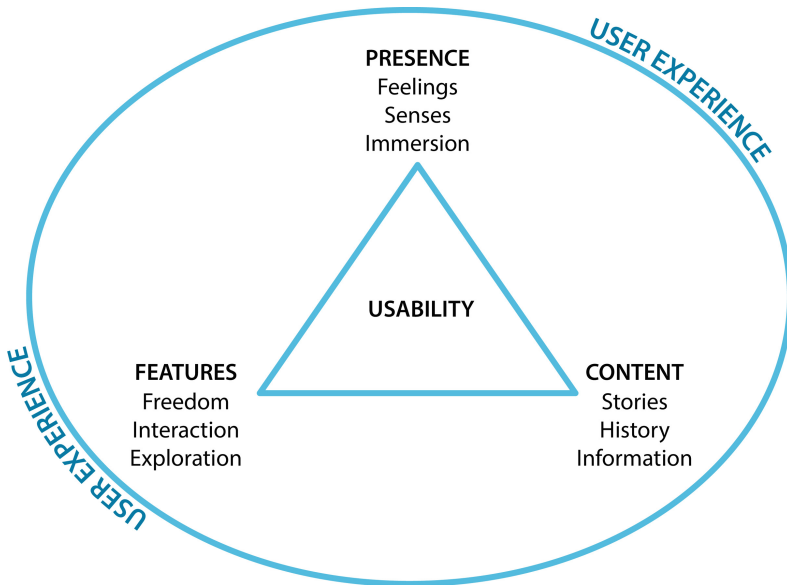


Fig. 5. Framework of the common themes identified in the User Experience of AC: Discovery Tour.

4.1 Coding and Analysis

Responses to the open-ended questions in the questionnaire were subject to thematic coding [1]. First, through an iterative process, discussing the questionnaire responses, two researchers created a codebook of the identified themes, (Table 1). The code book included 4 categories, which each included a number of individual codes; impressions about the game (11 codes), positive issues (9), negative issues (7), and finally desired features for the tour (8). Then, using the developed code book, the two researchers independently coded the questionnaire responses. A third researcher then arbitrated any differences in the coding. Each code could be attached to each participant only once, thus the maximum number of mentions of each code was 22. To investigate any changes after the initial novelty had worn off, some questions were asked both after the introductory tour and after the longer free exploration.

4.2 Usability and User Experience

After completing the 15-minute introductory tour, 66,7% of the participants answered that they would like to continue the tour, 28,6% maybe and 4,8% no. After a further 30 min of exploration, 52% of the participants still wished to continue to explore, while 29% answered maybe, and 19% no. When asked to liken the tour experience to other experiences, participants selected *playing a game* (18 mentions), *listening to stories* (15), and *visiting a historical location*

Table 1. Codebook of all four categories.

Impressions codes		#	Positive codes		#	Negative codes		#	Desired Features Codes		#
IM2	feeling	19	P2	freedom	18	N1	usability	12	D2	UX	10
IM1	senses	15	P3	content	14	N2	freedom	8	D7	freedom	6
IM9	knowledge	11	P4	features	13	N6	feelings	8	D1	gamified	5
IM6	gameworld	9	P8	visual	11	N7	interaction	8	D4	interaction	5
IM10	exploration	8	P1	usability	9	N4	features	7	D5	information	4
IM4	content	7	P6	history	9	N3	content	6	D6	content	3
IM11	history	7	P7	world	8	N5	authenticity	3	D3	immersion	2
IM5	features	6	P5	audio	5				D8	exploration	2
IM8	interaction	4	P9	immersion	4						
IM3	usability	2									
IM7	immersion	2									

(12). Some reported it *felt like watching a movie* (7), *visiting a museum* (7), and *browsing the internet* (4). The participants were also asked whether they would pay for the virtual tour - 19 of 22 reported they would pay for it.

The first category of codes was *impressions*, based on the responses to the question “What were your first impressions..?”, which was first posed after the introductory tour, and then again later in the end questionnaire. These code categories’ answers were also coded as positive and/or negative, depending on if they included negative or positive remarks. After the introductory tour, 21 out of 22 respondents reported something positive about the experience, while only 4 had something negative to say. Following the longer session, 19 respondents something positive, while 6 reported something negative. Thus, it appears some novelty effect was present for some participants.

The most frequently occurring code in the *negative experiences* category was *usability* (N1) with 12 mentions. These covered basic usability issues, e.g. not being used to the game control scheme (which followed the de facto standard for PC games), and criticism of how the software was controlled, e.g. lack of innovation in the way the individual tours were accessed. Almost all users reporting negative experiences with the physical control devices or control scheme were not active PC game players. As one commented; “Control/navigation can be slightly confusing if not used to using gaming controls” #9. Responses mentioning the lack of innovation in navigating and controlling the software came from participants of all experience levels with games, e.g. “Not much imagination is used on the whole concept. You were just moving between cut scenes by running, I don’t see how this differs from a DVD scene menu” #4.

In the *positive* category, comments on *usability* (P1) with 9 codes were related to how the player controlled the software from menu functions to avatar movement. One participant commented how the instructions are clear #17, and another how it was positive that “..the infosplashes were kept short” #11. Considering *impressions*, *usability* (IM3) was found in 2 answers - Participant #5

commented that the picture moved nicely and the controls were easy even for a new player. Another commented that they liked the experience but might not ever install it on their PC but would rather access it easily on a website #6. The most popular code for *desired features* was *user experience* (D2) with 10 mentions, ranging from highlighting small helpful features such as the minimap #5 and pausing audio #8, to things such as listening to the information texts while walking #21 and “A tour guide avatar that actually guides you through the spaces and details” #9.

4.3 Features

The main points highlighted related to the theme features were freedom, exploration, and interaction. The most popular code in the *positive experiences* category was *freedom* (P2) with 18 occurrences. It included any mentions of discovery, exploration, and choices the participants had. The participants appreciated both the freedom of movement, such as walking freely around the area and climbing buildings and the freedom of choice in choosing which tours to attend. For example, one participant commenting, “Getting to choose where I want to go and run around aimlessly more to find random points of interest - Using Ikaros’ eyes also gives a nice way to check the way ahead” #11. The participants also felt the free movement gave them a good way to assess their surroundings, e.g. “You move through the place so you have an idea where everything is” #16 and, “I understood the layout of the temple area better when I could climb it myself” #12. Similarly to the *positive experiences* category, *freedom* (N2) placed high in the *negative* category, being mentioned 8 times. Under *desired features*, *freedom* (D7) got 6 mentions, with the respondents wishing for more independent exploration #1, more things to do themselves #7, and a sandbox style - free camera #19. *Exploration* (D8) was mentioned twice, e.g. “stories and info that you can accidentally find by exploring and stopping to listen” #11. For the *impressions* category, *exploration* (IM10) was mentioned 8 times, and often in conjunction with the code *gameworld*. Participants often mentioned exploration in relation to discovering the world and understanding the area. The code for *gameworld* (IM6), mentioned by 9 participants, relates to the comments about the virtual environment, e.g. expecting the tour to be more like a game #4, or being impressed by the size of the virtual world, and how much there is to explore #21. Similarly, the *positive* category code *world*(P7) including descriptions of area size, the atmosphere, and spatial dimensions of the game environment was mentioned by 8 participants.

In the *positive* category, *features* (P4) received 13 mentions mostly referring to features of the software, e.g. quizzes, guides, and gamified elements. For example, one participant stating, “The quiz at the end of a tour was an interesting addition and the guides were good” #1. In the *negative* category, *features* (N4) received 7 mentions, where participants highlighted lacking features, for example commenting, “... everything is set up the same, no minigames or so” #13. In the *impressions* category, *features* (IM5) received 6 mentions with different perspectives, one participant was confused about what they should do in the virtual

museum and would like to have some defined quests #15. Another said they were expecting something more like a game #4. *Interaction* (IM8) was mentioned by 4 participants, 3 of which stated that the interaction was too simple or lacking, e.g. “Quite disappointed. There was no real interaction or playability” #4. Also in the *negative* category, *interaction* (N7) was mentioned 8 times, calling for more interaction with the virtual people or the world, e.g. “Lack of complexity in interaction made a little one-dimensional” #9. Related to this, the *desired features* codes *gamified elements* (D1) and *interaction* (D4), both had 5 occurrences, mentioning features such as minigames #13 and activities like buying things. Although participants found some gamified elements in the virtual tour, it was mentioned that the collectibles etc. should be more obvious #19. When it comes to *interaction* (D4), more interaction was called for (#4, #9) e.g. “I would want to take part in the stories told, instead of merely watching and listening.” #2.

4.4 Tour Content

This theme collects together the codes related to the content, history, and information about the tour. In the *positive* category, the code for *content* (P3), was noted 14 times and included mentions of the stories and narration, the amount and quality of the information the player was given, and objects in the game world. For the code *content* (N3) in the *negative* category, there were 6 occurrences. For one person, the tour contained unfamiliar words #8, and for another too many new names to remember #16. In the *desired features* category, the code for *content* (D6) received 3 mentions, such as wanting more stories about myths #3. For *impressions*, *content* (IM4) was mentioned 7 times, as well as *history* (IM11). *Content* related to things such as a narrative, which some participants were missing; “It is very cool, I like it. The thing missing is a plot or story” #12. One participant noted that they appreciated the possibility to choose a topic, but the way the content was shown was boring #12. *History* (IM11) was mentioned in relation to bringing history to life #9, understanding the scale of buildings in comparison to people #5, and experiencing a past time #18. For *positive experiences*, *history* (P6) received 9 mentions, as an example, one participant wrote how it was positive “To see the locations of the spots just as they were in ancient times” #8.

The third most mentioned code in the *impressions* category was *knowledge* (IM9), mentioned by 9 participants, which was related to the information provided by the tour. One participant compared the virtual museum tour with a physical museum and felt that the physical museum tours they have participated in have given them more information and details #20. Another said how they learned things during the tour, and it got them thinking: “...I wonder how much of these architectural structures are still there in the real world” #2. The code for *information* (D5) in *desired features* received 4 mentions, such as wanting more narration on architectural findings #10, and information spread out in smaller pieces #1. In the *negative* category, *authenticity* (N5) was mentioned

3 times, with one participant commenting; “well, it is game so it is artificial I guess” #19, and another commenting how it is not a real-world #18.

4.5 Presence

Here, codes related to presence are explored, such as senses, feelings, and immersion. The most popular mentioned code for impressions was *feeling* (IM2), with 19 mentions. This related to the feelings people expressed about the game, both in positive and negative senses, such as “Beautiful landscape and I was excited” #18, and “Quite disappointed. There was no real interaction or playability #4. For *negative experiences*, the code for *feelings* (N6) was mentioned by 8 participants, some commenting how they felt bored after a while #16, #18, #13, and one participant commenting how they lost interest in the “linear repetitive structure” #22. The code for *senses* (IM1) with 15 mentions was the second most mentioned code in the *impressions* category, which related to the auditory, visual and other aspects of the experience noted by the participants. Examples of this include: “positive, good looking game with pleasant voice acting” #10, “Liked the atmosphere, lighting and sounds” #9. In the *positive* category, the code for *audio* (P5) occurred 5 times, including mentions of any audio inside the world and the act of listening. The code *visual* (P8) with 11 mentions included descriptions of the visual outlook of the environment and the act of looking at it, e.g. “A lot of details to look at, beautiful graphics” #14.

For *impressions, immersion* (IM7) was mentioned only twice, one participant commenting that the tour was an immersive experience #21, and another how it became less immersive over the course of the test #22. Also, under *positive experiences, immersion* (P9) only received 4 mentions in total. The participants mentioning immersion wrote how experiencing the world as a whole instead of individual artifacts or fragmented pieces of information created a feeling of immersion, e.g. “To not just see artifacts from the past but to live during those times. It was immersive” #22, and “Seeing the buildings, statues, and art in a fully realized environment is really immersive.” #21. For *desired features, immersion* (D3) was mentioned by 2 participants, e.g. calling for an “immersive gaming experience” #4.

4.6 Desired Virtual Museum Experiences

The participants were asked to select the five most desirable emotions in virtual museum experiences from a list of 15 emotions, based on Desmet and Hekkert’s [3] framework of product experiences. The most desirable emotions for virtual museums were; *curiosity* (19/22 selected), *inspiration* (17/22), *fascination* (16/22), *relaxed* (9/22). This finding aligns with that reported by Paananen et. al [14], where participants their emotions based on previous museum visits. Both studies report the same top 3 emotions.

5 Discussion and Conclusions

In general, the *Assassin's Creed Odyssey: Discovery Tour* was liked by the study participants, as most answered they would want to continue to explore it after the user test session was over. Most participants would be ready to pay for the experience, which is also indicative of a positive reception. The high-quality visuals of the experience were commented on many times, as well as the accompanying audio, but they were not always enough to keep the users engaged for a longer period. Many participants seemed to expect the tour to be a game rather than a virtual museum - this was reflected in the comments asking for more interaction, tasks, achievements, and narrative. Most of the participants' desired features related to user experience and adding helpful features or gamified elements, as well as increasing freedom and interaction.

In relation to both positive and negative experiences, freedom was frequently mentioned. The context depended on the participant, as some wished for more freedom and others less. Even when the virtual world is an open world, i.e. without a linear structured path, there are always some limitations, either technical or designed. When comparing real museums with virtual museums, both have their limitations, such as defined areas to move within or the need to follow a guide. In a physical museum, usually, all the exhibited objects are labeled and the information is shared - this isn't always the case in the *Assassin's Creed Discovery Tour*. Virtual representations offer alternative possibilities for displaying and handling items, compared to real fragile museum objects. Whilst virtual objects can't be physically touched, they afford a different set of actions, such as being able to rotate them, look inside them, or transport them to different places. In a virtual museum, it is possible to show structures that are hidden underground, show extreme close-ups or aerial views, or reconstruct broken or incomplete items or buildings. When crafting such experiences, developers should consider the additional value the technology can bring.

One question raised by the study participants' responses was how to make the virtual world navigation controls accessible for everyone. People with different skill levels visit museums (virtual and real), and they should all be able to have a pleasant, stress-free experience. Perhaps some things can be learned from games, which often accommodate novice users through a difficulty setting. In some cases, custom controllers have been suggested for virtual experiences in museums, as default 'gaming' controllers can be too difficult to use for some visitors [7]. Over half of the participants reported that the experience felt like actually visiting a historical location, which supports the concept of virtual museums as remote tourism experiences. As noted by Dubois & Gibbs [5], video games act as drivers for tourism, as players often want to visit the places they have seen virtually in the games.

When it comes to developing virtual museums, new exciting possibilities for museums and careers for professionals are becoming available. Various skills are needed for this work, not only technological but also design and art skills, as well as interdisciplinary experts as called for by Mortara et al. [12]. As new and exciting technologies are developed, interesting and engaging content is also

needed. Also, as noted by prior works in the area, cultural sensitivities need to be regarded when designing virtual experiences. Designing virtual museums is a balancing act between maintaining historical authenticity and providing an engaging experience. Creating an engaging virtual world needs delicate crafting and design. As Poiron [16] explained, a lot of cutting and editing was required in the final texts of *Assassin's Creed Discovery Tour* to maintain the audience's attention.

Our study has demonstrated the importance of feeling and using senses in a virtual museum experience. In particular, features, freedom, and the need for interesting content were identified. We recognize that our study has its limitations. The participants were mostly young people. However, even with this cohort, the capabilities of using the software varied. Hence, virtual museum designers should consider the different needs and skill levels of users, aiming to make the experience accessible for as many people as possible. We also recognize as a limitation that the virtual world originally designed as a game world does not have the same characteristics as a typical virtual museum. We still believe, that our findings are of interest for designers and developers, and provide helpful lessons learnt for virtual museum experience design.

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