Mixed Reality (MR) for Generation Z in Cultural Heritage Tourism Towards Metaverse

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Abstract. Generation Z is transforming tourism by demanding the cocreation of transformative experiences. Cultural heritage professionals must comprehend the needs and desires of the Gen Z to support the cocreation of transformative experiences. This study analysed the role of Mixed Reality (MR) from the perspective of Gen Z guests through 18 semi-structured interviews and inductive qualitative research. Participants believe that cultural heritage experiences can benefit from immersive technology. Technology supports cocreation of experiences between developers, service providers, DMOs, and consumers. Cultural heritage sites, as a key element of tourism destinations, should consider how to use MR to enhance consumer experiences. Participants express the opinion that cultural heritage sites and tourism destinations require considerable modernisation to create transformative experiences. Metaverse in tourism and cultural heritage sites will undoubtedly support Gen Z to cocreate transformational experiences.

Keywords: Mixed reality · Generation Z · Cultural heritage tourism · Co-creation · Immersive technologies

1 Introduction

Metaverse, defined as a parallel, virtual universe that uses ambient intelligence to enhance physical spaces, products and services, emerges as a collective, virtual shared space of value cocreation. Metaverse in Tourism uses physical reality combined with MR (AR and VR) to converge all needs and stakeholders in a shared, 3D virtual space and enhances physical spaces to MR spaces, transforming the internet to a parallel virtual universe. Generation Z (Gen Z), is the population group that follows Gen Y (Millennials) and comes before Gen A. They include people born between the mid 1990s and the early 2010s. Gen Z are "digital natives" as they were born in a period when technological developments were progressing rapidly, due to the internet expansion. Gen Z is the first social group to have grown up with connectivity to the Internet and handheld electronic devices from an early age. They are technologically savvy, despite not being specifically technology educated as they grew up in a connected world. Gen Z are generally well-behaved, ascetic, and risk averse as compared to past groups. They benefit widely from smart tourism developments to enrich their experience [2, 34].

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Gen Z travellers are increasingly interested in transformational experiences. Virtual Reality (VR) enables them to have more engaged and diverse encounters [3]. More than 84% of consumers around the world would be interested in using VR or Augmented Reality (AR) for travel experiences, and 42% believe that VR and AR are the future of tourism [13]. Ambient intelligence initiates a new era of cultural tourism, in which the distinctions between physical and digital experience of culture and tourism are obscured [2]. The memorable performance of low-cost VR innovations – such as the Oculus Rift, HTC Vive, and Sony PlayStation VR – as well as Mixed Reality (MR) Interfaces – such as the HoloLens – leads to major technological progress and the growth of innovative applications [7]. Young adults increasingly travel more and for extended lengths of time. They seek transformative and meaningful experiences, challenging the traditional operations of the tourism industry. Gen Zers already have transformed the entertainment industry and require more engaging experiences from all industries [1].

2 Mixed Reality in Tourism

Mixed Reality (MR) describes a very realistic augmentation of the real world for users. It is so realistic that users cannot distinguish virtual content from physical objects, providing a seamless experience between real and digitally constructed environments. MR requires special hardware, such as smart glasses, where the lenses are replaced by transparent screens and contain multiple sensors to track the user's environment. MR devices seamlessly integrate and merge realistic-looking 3D content into the user's physical environment [26]. Microsoft's Hololens 2 device is an example of such technology. As nanotechnology develops these machines can be reduced in size and increase in power. Future devices therefore will offer even more realistic experiences using more ergonomic glasses [27]. Mixed Reality (MR) is becoming more popular, primarily in cocreating cultural heritage [14, 39] and tourism experiences. MR can help revolutionise visitor interaction and satisfaction by providing information to educate and animate experiences [19]. AR/VR/MR are all equally fascinating platforms with the primary goal to digitise space for human experiences. However, each have their own unique qualities and make distinctive contributions. The main distinction is that VR users get a completely immersive digital space and they don't have the ability to see the real world when using VR sets. AR users have digital features added to their actual experience of the real world. Users can explore AR possibilities at a destination by experiencing augmented destination features through their devices. Pokémon GO is the most well-established AR application that was used widely, when users were invited to overcome challenges, catch Pokémon, and forge friendships through playing in real environments. However. AR may conflict with experience the destination freely. Gen Z consumers, who are keen on using AR, most likely give up the AR opportunity, to avoid the technology overuse and see everything by their own. In the same way that AR projects 3D visual files that is spatially conscious and sensitive, MR does the same with 3D visual files [22]. The MR has the capability to transpose digital data on real items and environments [6]. Hence, physical objects can be brought into a simulated universe or virtual objects can be brought into reality [23] (Fig. 1).

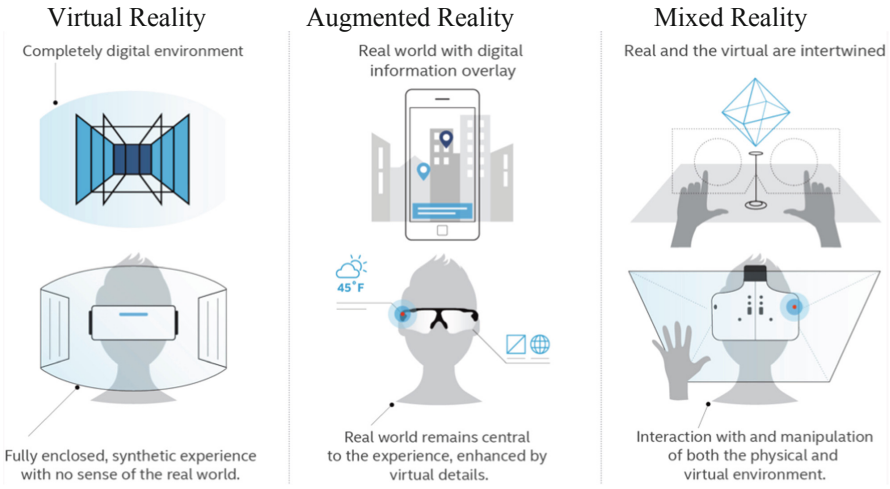

Fig. 1. Difference between VR, AR, MR. Source: appliedart.com

The travel industry is an information-intensive sector [12]. Enhancing cultural heritage sites with immersive MR experiences adds value to the entire user engagement, particularly in conjunction with customisation based on the preference of every customer [25]. MR encourages users to experience and interact with historic items whilst in the real world by integrating engaging ways of narrative to involve visitors. It supports the integration of physical and digital displays by projecting digital information in real environments and also by displaying items with no material availability. Immersive and holographic interfaces have a wider variety of applications in the MR spectrum as illustrated in Fig. 2. There are several gamification examples using AR and VR [35, 36]. The engagement with machine figures or symbols in a software world is the primary purpose of video or computer games [10]. Single-player videogames contain a lot of tasks that gamers must achieve in order to receive the prize at the end. Gamers can play alone or with the support of other gamers to earn the prize. Portable games, which were quickly implemented provide a gaming experience that extends into the actual world [29]. Two widely used examples, namely Pokémon Go and City VR, demonstrate the capabilities of MR to engage Gen Z.

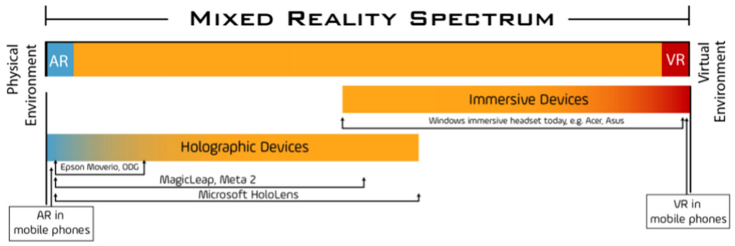

Fig. 2. MR spectrum, the allocation of holographic and immersive devices. Source: Microsoft.com

One of most widely AR played games ever is Pokémon Go. Since the introduction of Pokémon GO game in 2016, places all over the world have started using this AR app to promote themselves and attract visitors. The application achieved more than 100 million downloads [8, 19]. 46% of the users are between the age of 18 and 29, indicating that they were born and raised during the original Pokémon frenzy in the late 1990s. Around 22% of the users are between the ages of 13 and 17, with 6% over the age of 50. These statistics indicate that half of the game's multimillion audience is Gen Z gamers. The City VR Experience [https://cityvr.com/] is an immersive virtual reality experience. It allows gamers to discover new perspectives to look upon the world we live in like never have done before. Dozens of roads, structures, cars, and diverse metropolitan areas are available in the game, each of which has a real-life counterpart. City VR is more than just a 3D plan- it provides a revolutionary way to design environments using a range of perspectives. Gamers may wander through the city like a giant, see objects from above and below, scale in and out, alter the climate, and take great photos. It provides a thorough glimpse of any location the player desires to visit. From a tourism point of view, visitors can plan their vacation by viewing the whereabouts of that area and engage with different locations. They can also explore sustainability vulnerabilities and alternative environments. Despite the listed advantages, there are numerous conditions needed to make the game happen: A VR headset, a tracking movement joystick, and a space playground are all required for the play. VR games, unlike AR games, necessitate significant amounts of data and the VR headset might be costly for users and providers. The city adventurer game has a brief lifespan as long-term usage of VR can cause drowsiness, disorientation, and sickness.

3 Methodology

MR research in tourism is in its infancy. Exploratory research was therefore used in this study to explore the concept and determine MR features for the future. Qualitative research was used to allow researchers to explore all elements of Gen Z's interaction with technology and appreciate their perceptions and requirements. Online in-depth semi-structured interviews ensured that all needs, wants and requirements were captured through conversation. Given the health and safety regulations during the COVID-19 lockdown periods, online meetings were organised with respondents. Interviews were conducted via Zoom. Based on the research literature a range of open-ended questions were used for the in-depth interviews. Questions included but were not limited to the following: Have you ever experienced Mixed Reality? How and when have you used MR? Do you see the MR as a potential way to find out and gain information about a destination before travel? Do you think that MR technology will enhance visitors' experience at a destination, why? Are you ready to purchase MR service at a destination to experience MR technology? How much are you ready to pay for MR services? Can you indicate advantages of MR in cultural heritage site? Can you indicate disadvantages of MR in cultural heritage site? How can MR technology add more value for visitors? How can MR technology to add more value for a destination?

The research benefited from personal interviews with 18 Gen Z users, born between 1995 and 2000. The consumers' age range was applied as a selection criterion in order to select and interview people that would feel more comfortable to use and take full advantage of the opportunities new technologies offer. The consumer age was also designed to include active travellers that are in a position to make travel decisions. Out of 26 consumers contacted, 20 (76.92%) responded, and 18 (69.23%) interviews materialised between April and May 2021. The interviewees' locations breakdown was as follows: Kazakhstan (5), India (3), Kyrgyzstan (1), Uzbekistan (1), Russia (1), Vietnam (1), Thailand (1), Cambodia (1), Azerbaijan (1). To give the initial understanding of the capabilities of MR in cultural heritage tourism, it was decided to show interviewees a short video about MR HoloLens by Microsoft. All interviews were digitally recorded for further transcription by the researchers. Zoom simplified the process by automatically transcribing interviews to save time. Overall, 18 interviews were conducted for this research, and the point of saturation was reached after the 15th interview as no new inferences were emerging from the interviews. To systematise and analyse the qualitative material collected with the interviews a formal coding scheme was adopted to annotate the transcribed text and identify the relevant themes. The thematic analysis and aggregation reflected the research objectives and guided the analysis.

4 Results

The results illustrate that the awareness of respondents of all MR capabilities is still limited. They, however, appreciate that MR introduces great capabilities for cocreating tourism and heritage experiences. Respondents anticipate that the developments of this technology will generate major benefits for tourism globally. To employ cutting-edge innovations, such as MR, the willingness to adopt and use emerging technologies is critical. The aesthetic reaction induced by the integration of virtual objects in the actual environment is also an important aspect of employing MR. As a result, users who utilise MR must consider the aesthetic impact, as the sensory factor can determine the software's utility. Perceived usefulness of MR use was influenced by aesthetic value and enabling factors. Visual appeal and favourable settings have been highlighted as significant factors affecting the establishment of technology acceptability in studies connected to technology [9, 23, 30, 37]. The influence of aesthetic value on the MR performance expectancy was validated in this research.

> *"I work in the tech field. I think technology is really exciting, especially VR and MR, all of this new, well-presented and beautifully stunning stuff, for some people, I know it might be scary for some people. But it is cool immersive experience, where you can really put yourself into the moment and kind of just lose yourself to your imagination. I can see that, having a similar effect, especially with cultural sites and heritage sites which I think are super important you don't want them to be boring. You want them to be engaging and immersive and I feel like it's a really good way to help audiences and visitors lose themselves to their imagination and really step into the past."*

Most of the participants confirmed that MR provides a new form of travel experience, especially for cultural heritage. They suggested MR adds value for cultural

heritage sites and also for consumers. When asked if they were familiar with MR 33% of the participants confirmed they were aware of the MR capabilities and only 2 of the respondents (14%) have used MR. Only 3 (20%) tried VR in computer games and shopping and only 1 (7%) tried AR during travel. However, it was clearly evident that not all of the respondents are fully aware of how MR can be used in tourism.

> *"I was born in 2000 and I do not remember myself without the Internet. Growing up during the development of the Internet, the fastest shift in technology was in my childhood. Now I am already a student and have experience using Google Cardboard (VR headset). For the first time, I tried a headset for university tours - viewing panoramic views of faculty buildings, lecture halls, workshops, dormitories and libraries with a specially designed guide."*

Respondents suggested that MR should be advantageous for daily life in order to boost their use for tourism experiences [18]. P5, P7, P13, and P15 also agreed with the benefits of MR. Van Krevelen and Poelman [32] advised that a reliable strong network is necessary to support MR use and provide clear benefits.

4.1 MR Usability Development at Cultural Heritage Sites

Over the last few decades, innovation and technology have gradually permeated the tourism sphere, especially in cultural heritage. As a result, the area of Cultural Technology has emerged, to use digital technology and cultural heritage research disciplines to reflect, strengthen, broaden, and convert artistic systems and services in the areas of cultural heritage [17, 33]. Despite that, the absence of successful user interface design still evident in the tourism ecosystem is the greatest roadblock to successful implementation of digital tools [38]. The interaction with an online product, product usage intention, purchase intention, location choice, and location picture are all influenced by product design efficiency [4–6, 16, 21, 24, 28, 35]. Designing cultural heritage applications with 3D functionality is technologically challenging and costly. Usability is described as an act of fulfilling consumer needs in terms including both output and the picture they get [13]. The term "usability" was mentioned by 73.3% of the survey participants, which indicates its importance. In the case of MR includes the ability to browse, store, and filter data, as well as the ability to use various languages provides additional benefits [19]. Respondents suggested that being able to interact in many languages would facilitate not only the functioning of the design in numerous locations, but also the access to essential material without struggling to pass linguistic hurdles.

> *"For me, as a user, several parameters in use are especially important, such as: understanding the proposed content without unnecessary finesse, eye-safe sharpness of reproduced visuals, safe sound level and the duration of the excursion itself, if it is at the site of cultural heritage."*
> *"It will be nice if the safety of content for mental and physical health is taken into account in the future. I mean that the younger generation can be especially receptive and impressionable, like a sharp change of pictures or a very loud sound can adversely affect the user, and this is turn, can lead to such unpleasant consequences as insomnia, nightmares or paranoia."*

One of the biggest advantages of MR is that it places the spectator in the main role; making people feel and react in the same way as the subjective viewpoint figure. This can lead to a certain empowerment. Interviewees suggested that while creating MR experiences, it's crucial to conceive the user as a player, instead of an observer, and to

design adventures that emphasise traveller engagement. Gamification can help developing interfaces and scenarios for optimising the experience.

"I think it's good to use this technology, because sometimes you cannot touch the actual sites, like cultural heritage, just maybe they are fragile. In my country, Vietnam, I went to the Royal Palace, and I really enjoyed first 20 min *there, reading interpretation panels and looking around the place. But then, I got bored, and I didn't know what to do, even though I wanted to find out more information about the palace or entertain myself anyhow. MR would have supported live interaction"*

"I get easily bored at cultural heritage places due to lack of activities to do. I can always find any information on my phone, searching internet, but I don't want to look in a small screen on my phone. Instead, it would have been nice to have an immersive experience, to spend more time in the palace, hence, to get more memories and positive impression from the visit."

People experience at least one kind of MR they develop clear expectations and requirements. However, the technology is still new and interesting enough to entice consumers because it offers some distinctive features that other types of media cannot provide. Table 1 summarises responses on the functionality of MR in cultural heritage tourism.

Gen Z specifically is constantly searching for more authentic and unofficial interactions with local resources. Cultural heritage sites which have been neglected and suffer from lack of visitation have a chance to increase visitation flows through MR technology by making visitation exciting through innovation and cocreation. Engaging visitors with more enticing interactions can support meaningful experiences and develop the competitiveness of sites but also entire destinations. Destination promotion organisations should build their expertise and invest in MR technology and know-how to benefit from this opportunity.

4.2 Participants' Perspectives on Mixed Reality

Interviewees were accustomed with using technology apps in their daily lives. They have specific requirements for future cultural heritage guides, such as a map that displayed the ratings for each object on the site. They explained that Gen Z require fast and interactive interactions that address their curiosity but provide instant gratification. Respondents explained that they are excited for cultural heritage sites implementing MR towards improving visitor experience. Table 1 illustrate participants' perspectives on the Usage of MR in cultural heritage tourism.

"Old people or people who are keen on history, love to go there, but gen Z are not interested in cultural heritage sites anymore, because they find visiting them quite boring. I think if the technology is combined in cultural heritage, and if they have some different activity for young tourists to get involved in".

"I think the MR could be helpful to engage youngsters in cultural heritage. As a result, cultural heritage won't be a place to check in, but a place for a proper and quality time spending for Gen Z."

Table 1. Functionality and impacts of MR for cultural heritage

Functionality	Impacts for cultural heritage
Cultural heritage	**Advantages**
History of the location	Automated Workflow
Time travel	Staff Offload
Disappeared objects recreating	Less queueing
Surroundings information	Reduced Operational Cost
Demo presentation	Improve satisfaction
Preservation	Tourists' time spend increase
Human interaction	Preservation
Accessibility	**Disadvantages**
Personalization	Visitors' opposition
Multi-language	Age limitation
Holograms	Importance of human interaction
Notifications	Avoidance out of habit
Real-time updates	Complex technology
Digitalization	Equipment service
	Possible malfunctions & Breakdowns

Respondents were sceptical about the adoption of MR in tourism in the next few years. They suggested that unless there are significant investments in equipment, design and production, these technologies will not be emerging soon. They acknowledged however that the COVID-19 pandemic pushes digitisation and therefore the design of more progressive types of experience cocreation at cultural heritage sites will be expedited.

4.3 Willingness to Use and Buy MR Services

Immersive technologies are changing everyday human lives. Gen Z increasingly demand goods and services to be exhibited in an immersive practice. Respondents expect MR to introduce a mixture of user involvement through digital augmentation to artificially enrich their experiences and create exciting adventures. Table 2 illustrates participants' perspectives on the usage of MR.

> *"This technology can help me decide which brand of car to buy. I don't have to go to car dealerships or run into annoying salespeople. VR showrooms are available from Cadillac, Audi and General Motors. I can leisurely browse a number of cars that interest me".*

> *"I would love to try out a cultural heritage destination using MR technology to see if I should travel to this place or not. If all travel companies or agencies had such a service, it would make the choice much easier for tourists".*

Gen Z is primarily concerned about the environmental crisis and often practice conscientious consumerism. Participants explained that they want to put sustainability over affordability. They expect therefore that cultural heritage tourism managers will focus on sustainability, rather than just on aggressive marketing. Although respondents are at ease in their solitary and often spend time in digital cocoons, Gen Z is fundamentally a sociable group. Wherever feasible, its members seek out to participate in

cocreation of collaborative and elevated events. This is a great example of how MR-based cultural heritage tourism may employ innovation to provide real and immersive experiences for Gen Z tourists by instigating transformational experiences. Gen Z travellers not only seek to satisfy their needs but also project their experience for their social circle online.

"As a member of Gen Z, I can tell that we don't only buy goods. We spend money to get experiences. We want to get a genuine travel experience."
"A purchase isn't just about what you buy; it's also about how your social media followers react to it. If cultural heritage sites want to appeal to this adaptive, portable, and high-income generation, they'll need to build individualised unique entertainment."

Table 2. Tourists' Perspectives on the Usage of Mixed Reality for tourism experience

Advantages for tourists	Disadvantages for tourists
Responsive system	Technology Limitations
Convenient usability	Speech speed/Language/Accent hardship
Timesaving	Visual accuracy
Crowd flow management	Appliance contradiction between devices
Friendly manner and Human-like dialogue	Subjection on 5G connection
Individualised and Personalised Options	Privacy Concerns
100% attention from the 'guide'	Safety risks
Individual smart voice assistance	Private records
Additional Attraction	Manufactural tracking
Novelty benefit	Additional price
Contactless cooperation	Unfavourable weather
Social distance	Non affordable for everyone
Impartial	Required technology savviness,
Inclusive Access	Limited accessibility
Access for people with disabilities	

Participants admitted that using MR at cultural heritage sites can enhance their experiences by providing inclusive experience, personalised content, and newer interactions. The findings suggest that cultural heritage managers should fully explore the opportunities of MR technology in order to revolutionise visitor experience. Respondents also revealed cautiousness and had a little hostile perception after using MR apps. There were a few comments that could be deemed unfavourable but had beneficial undertones. '*I appreciated getting lost in the adventure, yet I felt completely absorbed and somewhat disoriented* when using MR apps' as P13 put it. MR may also experience problems with voice detection, different languages and pronunciations, when speaking to the online guide; given that many tourists come from different countries, speak a range of languages and may have strong accents.

5 The Future of Mixed Reality in Cultural Heritage Tourism

This study explored the Gen Z tourist perception of MR when visiting cultural heritage sites. MR can benefit the travel industry in terms of marketing, economic, tourist, and organizational benefits. MR possibilities increase value cocreated, engagement and the length of time Gen Z visitors spend in cultural heritage. Gen Z explained that they already experience a blended life, often struggling to distinguished between the real and virtual realms. The ability to move fluidly among physical and online environments is natural for them and they are "dual zone travellers" [11]. With strong digital skills, they are comfortable with online encounters. MR allows immersion for spectators in otherwise inaccessible environments. Gamification is the best way to highlight the attractiveness for Gen Z [36]. The cultural heritage tourism sector seeks innovative methods to attract visitors, through the use of cutting-edge technology advances [31]. MR has great potential to enhance customer experience in tourism industry in general and cultural heritage in particular. Respondents expect MR to allow them to interact dynamically with cultural heritage artifacts, re-enact animations and cocreate value through blended experiences. Designing dynamic MR experiences needs to take into consideration the different needs and requirements as well as vulnerabilities of various stakeholders. Future studies should look into the effects of MR on visitor experience, leading towards on innovate use of MR in cultural heritage for Gen Z.

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