

# MetaUniTour: Enhancing Engagement and Intercultural Understanding through A Metaverse Tourism Platform

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**Abstract**—We propose "MetaUniTour", a remote tourism platform designed to address key limitations in conventional Metaverse-based tourism, including perceptual and experiential asymmetries between tourists and hosts, the lack of collaborative engagement due to individualized exploration and high barriers to participation. MetaUniTour is structured around three core design principles: (1) spatial design that creates "mixed spaces" integrating cultural elements from both tourists and hosts; (2) experience design based on semi-structured, group-oriented activities that balance individual autonomy and collective participation; and (3) a browser-based, device-independent system architecture that ensures broad accessibility. A two-month field deployment, "Reality of Kenya," virtually connected Higashiyama Zoo in Nagoya, Japan, with Kenya's Maasai Mara and attracted 3,615 participants. A follow-up survey answered by 66 people revealed that over 60% perceived spatial integration between the two locations, also participants found the experience enjoyable and felt a sense of unity through experienced intercultural exchanges. Our findings demonstrate that MetaUniTour offers an effective design framework for fostering symmetrical cultural exchange and immersive shared experiences with any devices, suggesting promising potential for future applications in tourism, education, and cross-cultural communication.

**Index Terms**—Metaverse, Virtual Tourism, Communication, Cross-devices Platform

## I. INTRODUCTION

The rapid advancement of Metaverse technologies is transforming the tourism industry by providing immersive virtual alternatives to physical travel. These platforms are increasingly used to overcome geographic, economic, and environmental

barriers, offering remote access to digital recreations of distant destinations [1], [2]. While these experiences promise greater accessibility and new forms of cultural interaction, they currently suffer from fundamental shortcomings, including perceptual asymmetries, a lack of collaborative engagement, and high barriers to participation.

First, a critical issue is the perceptual asymmetry. Existing virtual tourism platforms typically replicate real-world locations literally. While this is novel and exciting for remote tourists [3], [4], it often leads to passive participation from local hosts who are familiar with the environment and are relegated to simply explaining information. This imbalance in engagement diminishes the potential for meaningful cultural exchange and shared experiences, often leaving travelers with only a superficial understanding of the local culture.

Next, these platforms tend to prioritize individual exploration over collaboration. They grant users the freedom to roam virtual spaces independently [5], which enhances individual agency but inadvertently reduces opportunities for shared, synchronous experiences. This lack of collaborative engagement can lead to fragmented and superficial interactions, undermining the cohesive social fabric that is crucial for a rich tourism experience.

Finally, virtual tourism often faces a high barrier to participation. Participation frequently requires users to travel to dedicated facilities or use specialized, expensive hardware like VR headsets [6]. This requirement privileges individuals

with access to these resources and excludes many others, undermining the goal of equitable access and limiting the potential user base.

In response to these critical issues, our research proposes a novel virtual tourism platform, "MetaUniTour". The platform is built on three core design principles: Spatial Design, Experiential Design, and System Design. In Spatial Design, rather than literal replication, our platform creates hybrid cultural spaces that fuse elements from both host and guest environments. This balances novelty and familiarity to enhance motivation, enjoyment, and active engagement for all participants. In Experiential Design, our platform fosters deeper social connections by integrating both individual and collective activities. It encourages communication and collaboration through shared goals and supports various participation models—including remote, co-located, and hybrid—to maintain unity regardless of a user's physical location. In System Design, we offer a device-agnostic, scalable platform that seamlessly supports AR, MR, and VR. It is accessible via a single URL on any web browser, synchronizing physical and virtual environments to drastically reduce barriers to participation [7].

To evaluate its effectiveness, we conducted a two-month pilot event called "Reality of Kenya" (February 4–March 30, 2025), which virtually connected Japan's Higashiyama Zoo [8] with the Maasai Mara in Kenya [9]. Over 3,600 visitors collectively explored the virtual safari, and a survey of 66 respondents revealed that approximately 60% experienced a strong sense of spatial fusion, also the experience was enjoyable and felt a sense of unity through experienced intercultural exchanges. These results suggest our proposal is effective not only in addressing the perceptual and experiential asymmetries of virtual tourism but also in increasing participants' interest in actual places.

The contribution of this paper is following:

- A comprehensive analysis and articulation of perceptual asymmetries and limited communal interactions present in current virtual tourism platforms.
- The proposal and detailed implementation of a hybrid spatial and experiential design methodology, fostering symmetrical cultural engagement and enriched social interactions.
- Empirical validation of the MetaUniTour platform through an extensive real-world deployment demonstrating improved user engagement, communal interaction, and cultural appreciation.

## II. RELATED WORK

This section reviews existing studies and case studies on virtual tourism, organizing related studies according to the three design principles of the proposed methodology: Spatial Components, Forms of Experience, and Models of Participation, and identifies issues in each aspect.

### A. Spatial Components

Most conventional virtual tourism projects have emphasized faithful reproduction of real-world destinations and land-

scapes. For example, Chrysanthakopoulou et al. (2025) built a virtual environment that fuses Finland's historical architecture with Spain's cultural landmarks; this space was shown to give users a strong sense of "being there," thereby increasing their interest in the real-world sites [10]. In addition, Chourouk et al. (2023) proposed that telepresence in a VR tour is built upon three interrelated dimensions—realism, immersion, and sense of presence—and demonstrated that intensifying these dimensions both directly and indirectly boosts users' actual visit intentions [11]. However, scholars have also reported mismatches between the "place" as designed by hosts and the place experienced by guests, leading to uneven levels of attachment and immersion [12]. To date, almost all implementations remain "reproduction-type" spaces; very few realize a true "hybrid space" that meaningfully integrates both host and guest perspectives. Designing and implementing such fusion-type environments remains an open challenge. Accordingly, in this work we aim to construct a space that integrates information for both hosts and guests, yielding an environment that feels everyone comfortable and novel to all participants.

### B. Forms of Experience

The paradigm in virtual tourism is free exploration: users individually navigate virtual replicas of sites. While this grants personal visual exploration, it tends to lack social interaction and shared experiences. VR-based tour enabled individual viewing but offered only limited opportunities for visitor interaction [13]. However, some multi-user VR experiences also exists. In that effort, visitors can move freely and talk with each other, which dramatically increases immersion and the feeling of a shared trip. Studies have found that compared to solo VR, multi-person interactions can amplify certain experience factors, such as higher telepresence (feeling "there") and perceived reality of the experience [14]. Other efforts have enabled user-driven socialization—e.g. via avatars in VRChat [15]—but the quality of shared experiences depends heavily on users, as a result, social engagement tends to be inconsistent. While Böckle et al. (2023) proposed design process model: business opportunity, design, and build. In particular, it offers a valuable perspective on providing collaborative experiences with others in the design. However, the discussion on applications in the tourism domain remains limited. [16] In our study, we seek to preserve exploratory freedom while embedding mechanisms that naturally encourage multi-user shared experiences.

### C. Modes of Participation

Current virtual tourism participation modes remain restrictive. As an example of the restrictiveness, VR museum exhibits require dedicated HMDs or on-site facilities, creating high entry barriers [17]. In addition, accessibility-focused VR tours like for wheelchair users often able to participate only for them [18]. Attempts to combine on-site and remote participation exist, but practical deployments still face significant constraints. Thus, we propose an accessible, browser-based virtual tourism experience requiring no special hardware.



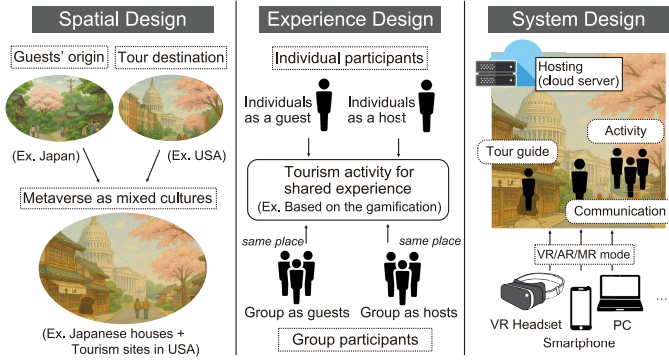


Fig. 1. Design principles of MetaUniTour: Spatial design, experience design and system design.

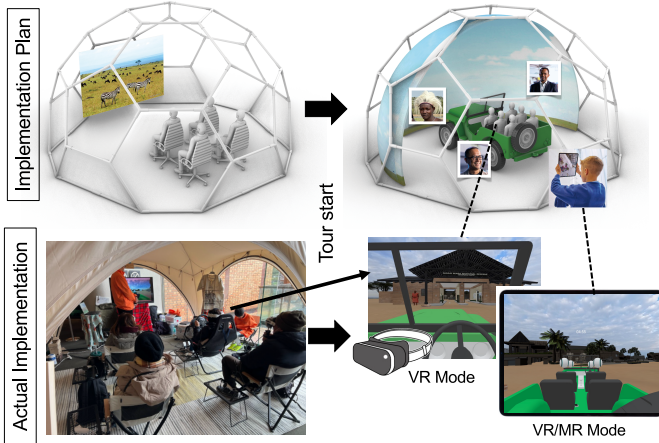


Fig. 2. Implementation of the MetaUniTour called 'Reality of Kenya': upper illustrates original implementation plan, and lower illustrates actual implementation in on-site (Higashiyama Zoo) and the metaverse scenes.

### III. DESIGN AND IMPLEMENTATION OF THE PROPOSED SYSTEM: METAUNITOUR

This section first describes an overview of the proposed system. Then, we explain the design details of the system and its implementation.

#### A. Overview

Our research aims to dissolve the perceptual asymmetries and lack of collaborative engagement between hosts and guests to create a new, integrated tourism experience. We propose MetaUniTour, a system designed to bridge the gap between a host's everyday environment and a guest's new experience through three guidelines: Spatial, Experience, and System Design (See Fig. 1).

As a practical demonstration, we implemented "Reality of Kenya," a MetaUniTour system (See Fig. 2) that virtually connects Japan's Higashiyama Zoo with Kenya's Maasai Mara [19]. This implementation uses Meta Quest 3 headsets and steering wheel controllers for an immersive, interactive experience. The system is built on the browser-based ARENA platform [20], which merges 3D models and spatial data

from both locations. In this blended virtual environment, participants from both cultures collaborate on a game drive to find specific wildlife, mixing familiar elements with the exotic.

#### B. Spatial Design and Implementation

Our first design challenge is to create a virtual space that fosters mutual understanding between users from different cultures. Traditional approaches that simply replicate a real-world location often create an asymmetrical dynamic. In these spaces, users are divided into "hosts," who are familiar with the environment, and "guests," who are experiencing it for the first time. This asymmetry can create an experiential gap: while guests are engaged by the novelty, hosts may feel disengaged or bored in a space they already know well.

To address this, we propose a spatial design called the "Mixed Cultures" space. This approach moves beyond simple replication by actively integrating the spatial and cultural characteristics of both the host's and guest's backgrounds. The goal is to create a fused environment where commonalities and differences coexist. This is achieved through a three-step process:

1) *Feature Extraction*: We begin by analyzing the unique cultural and historical characteristics of both the host and guest environments to identify their distinct spatial identities.

2) *Information Fusion and Integration*: Using these extracted features, we design a new, composite space. This environment strategically merges cultural attributes from both sides, incorporating familiar elements to provide comfort while introducing novel features to spark curiosity. This duality is intended to evoke a sense of ambivalence, making the space feel both recognizable and fresh to everyone involved.

3) *Mixed Cultures Space Realization*: The result is a dynamic and interactive environment where users naturally encounter a blend of their own cultural identity with that of others. We anticipate that interacting within this shared, co-created space will foster greater mutual understanding and more effective intercultural communication.

As a practical implementation of this concept, we designed a virtual world that integrates elements from both the Higashiyama Zoo in Japan and the Maasai Mara in Kenya. We manually merged 3D models from both locations to create a novel virtual landscape reflecting the unique appeal of each region. Figure 3 illustrates an overview of the developed space. This directly realizes the "Mixed Cultures" design by providing a shared environment where familiar and new cultural attributes are merged, mitigating the host-guest asymmetry and encouraging cross-cultural engagement.

#### C. Experience Design and Implementation

The second design challenge is to create an active, collaborative engagement that fosters a strong sense of shared presence. Many online platforms prioritize individual autonomy, which can prevent users from feeling they are truly sharing an experience together.

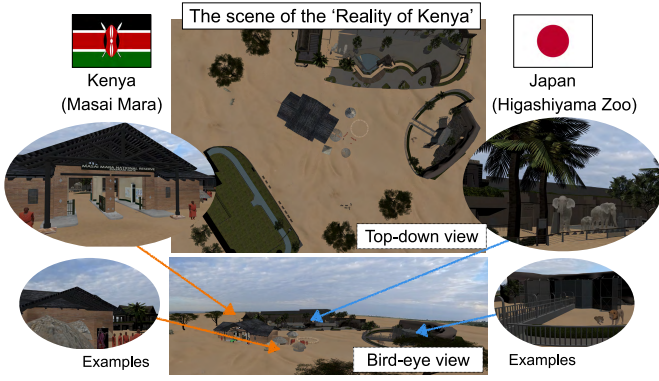


Fig. 3. Space Overview: Mixed cultural space combining elements from Maasai Mara (Kenya) and Higashiyama Zoo (Japan).

To address this, MetaUniTour introduces a framework that balances individual freedom with structured group collaboration. This is based on three principles:

1) *Semi-Structured Activity Design*: We provide shared objectives and collaborative tasks while still allowing participants the freedom to explore independently. This balances autonomy with cooperative interaction.

2) *Interaction Design Promoting Collaboration*: The environment includes tasks that explicitly require input from multiple users, naturally encouraging dialogue and reinforcing a sense of co-creation.

3) *Support for Diverse Participation Modes*: The system is designed to support on-site, fully remote, and hybrid participation, ensuring that all users can have a synchronous, collaborative experience regardless of their physical location.

We implemented these principles in a "game drive" experience within the mixed-cultures virtual space. Participants collaborate to find five designated animal species, which provides a semi-structured goal. The roles are designed for collaboration: on-site participants act as drivers and passengers who must coordinate their actions, while remote participants join as tour guides offering navigation and insights. This hybrid scenario, with both on-site and remote users interacting in real-time, directly realizes our goal of supporting diverse participation modes to create a unified, collective experience.

#### D. System Design and Implementation

The third design challenge is to create a scalable and device-independent system. MetaUniTour is designed as a versatile platform that supports various technologies like AR, MR, and VR, based on three core principles:

1) *Browser-Based Accessibility*: To ensure easy access for diverse groups, the platform runs on web browsers, eliminating the need for users to install special software. The architecture is lightweight and scalable to support many simultaneous participants smoothly.

2) *Multiplexed Experience Architecture*: The system is designed to allow multiple groups to participate in different sessions simultaneously using a single URL, enhancing accessibility and scalability.

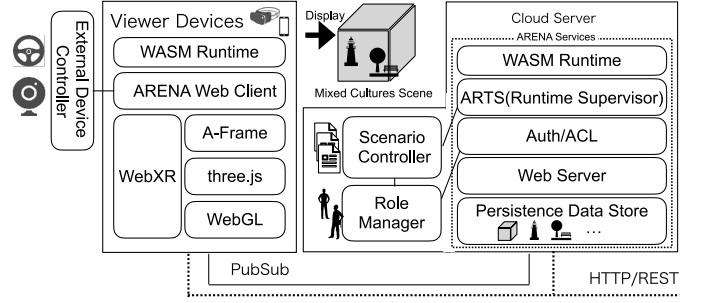


Fig. 4. Overview of software system implementation: The system utilizes ARENA [20], integrating additional components like scenario controllers and role managers, following our system design principles.

3) *Simplified Setup and Spatial Alignment*: To implement this, our system is built on the ARENA platform, which provides the necessary browser-based accessibility through its WebXR and multi-user capabilities (See Figure 4). This foundation ensures device independence and allows users to connect seamlessly. The hardware includes Meta Quest 3 headsets and steering wheel controllers for immersive interaction.

While the current system has proven robust enough for experimental operations with many simultaneous users, some design goals are still in development. Advanced features like experience multiplexing and a fully "zero-configuration" setup are planned for future enhancements.

## IV. EXPERIMENT

### A. Setting

To evaluate the MetaUniTour system, we conducted a two-month event (February 4–March 30, 2025) at the Higashiyama Zoo and Botanical Gardens in Nagoya, Japan. The event aimed to enhance the visitor experience by virtually connecting the zoo with Kenya through the common theme of animals.

A questionnaire was administered on the final weekend (March 29–30) to evaluate the guest experience. A total of 66 visitors participated in the survey, which assessed their understanding of the system, satisfaction, sense of spatial integration, and changes in their interest in animals. It is important to note that this evaluation focused only on the "guests." The "hosts" for this implementation were a Kenyan living in Japan who were from the Maasai Mara region of Kenya and were knowledgeable enough to serve as guides, and Japanese who had visited Kenya before; we plan to conduct future experiments involving hosts located in Kenya. The event experience followed a clear flow:

- 1) **Participate in the Experience**: On-site participants at the zoo wore VR headsets, while a remote guide joined them in the same virtual space from a PC.
- 2) **Pre-Experience Orientation**: The remote guide first explained the system's controls and the objectives of the experience, with all parties communicating in real-time.
- 3) **Experience Start**: Participants engaged in a collaborative mission to find five specific animals. A designated driver navigated the virtual environment, guided by both their

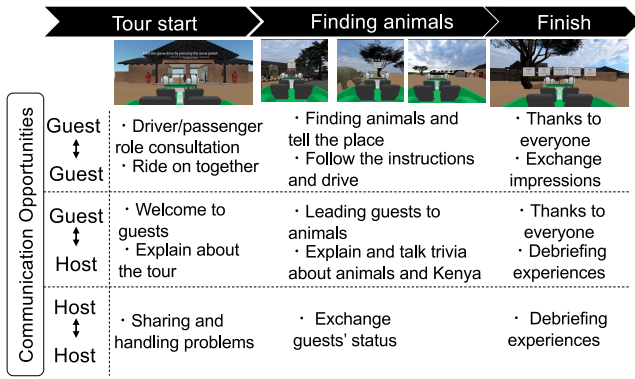


Fig. 5. Overview of the 'Reality of Kenya' tourism experience and expected communication opportunities among the guest to guest, the guest to host, and the host to host.

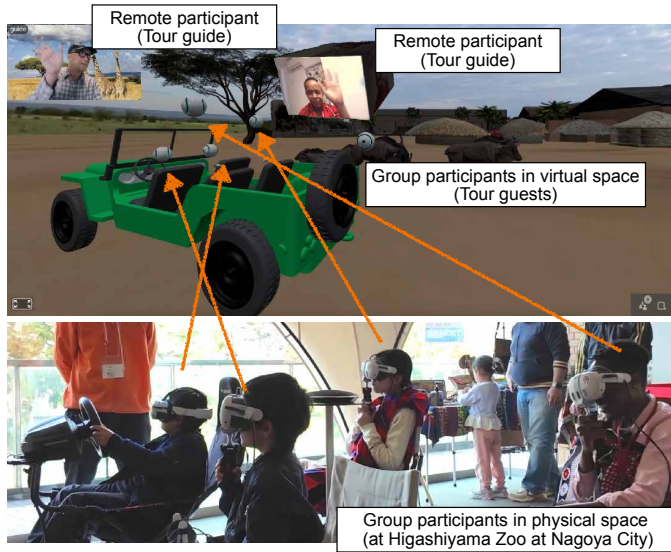


Fig. 6. An actual scene of the 'Reality of Kenya' experience: upper illustrates the virtual space that both hosts and guests participate, and bottom illustrates local site that guest participate)

fellow passengers and the remote guide. Throughout the drive, the guide provided cultural context about Kenya and information about the animals.

- 4) Experience Completion: The experience concluded with participant feedback after all animals were found.

Figure 5 outlines the overall flow of the event and the conversations that occur at the hosts and guests. Also, Figure 6 represents the actual experience.

## B. Result

In this part, we report the results of the analysis of the data obtained by the questionnaire survey and observation. And we discuss about the impact of our system on zoo visitors. From the results, our system has significance from two main perspectives: degree of spatial integration and sense of shared experience.

- Degree of Spatial Integration

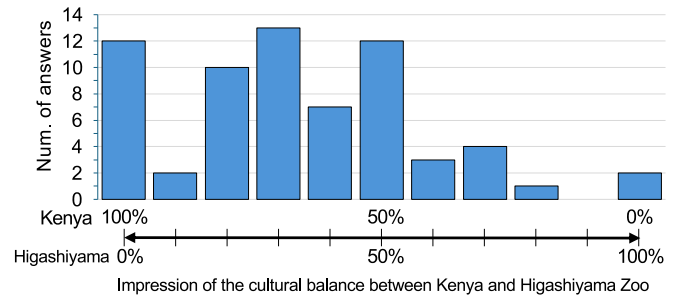


Fig. 7. Result of the question : the participants' impression to the balance of mixed cultures of Kenya and Higashiyama Zoo

A total of 66 participants answered the questions:

To what extent did you feel like you were in Kenya or Higashiyama Zoo?

(11-point scale: from 100% Kenya / 0% Higashiyama Zoo to 0% Kenya / 100% Higashiyama Zoo)

Figure 7 shows the answer to the questionnaire. Approximately 60% of respondents indicated that they "primarily felt in Kenya while still receiving information from the zoo side" (Kenya 80%/Zoo 20% through Kenya 50%/Zoo 50%). The "Mixed Cultures" environment we implemented in this study was designed to evoke perceptions of the familiar (Higashiyama Zoo) and the novel (Maasai Mara). Survey responses indicate that approximately 60% of participants primarily felt as though they were in Kenya, even while receiving information from the zoo side, suggesting that the virtual and real elements successfully merged to create a balanced sense of place. However, some participants reported perceiving the environment predominantly as "Kenyan." This may be due to the context of the experience itself. Since the implementation took place in Japan with Japanese participants, it is possible that when the environment did not feel like their own country (i.e., Japan), they defaulted to interpreting it as Kenya. In addition, since the survey was targeted at Japanese participants, their cultural background may have enhanced their evaluation. Although this system features an experience design that encourages communication among participants, it is possible that participants from cultures that prefer more individual exploration may have rated the experience differently. Therefore, in the future, we would like to develop this system through comparative research with people from different cultures.

- Impressions and Observational Evaluation

The MetaUniTour experience left participants with a highly positive impression, while also highlighting technical challenges with the system. Participants found the experience enjoyable and felt a strong sense of unity with the remote guide and fellow passengers. This positive feeling is attributed to the effective design, which merged virtual and real spaces, and features like being able to see the guide's face. The tour also demonstrated educational



value, as many participants reported a significant increase in their intellectual curiosity about animals and foreign cultures. However, this excellent experience was undermined for some by reports of VR sickness. This issue is observed to be a direct result of technical performance shortfalls, such as dropped frames, and a system usability that still requires improvement.

## V. CONCLUSION AND FUTURE WORK

In this study, we propose a novel tourism platform called MetaUniTour, based on three design principles (i.e., spatial, experiential, and system design) to address issues inherent in conventional virtual tourism, such as perceptual and experiential asymmetries, the lack of collaborative engagement and high barriers to participate. Its effectiveness was verified through the 2 months field experiments with more than 3,600 participants. The event “Reality of Kenya,” which connects Higashiyama Zoo and Botanical Gardens with Kenya, demonstrated through survey results that participants experienced intercultural exchanges beyond physical distances and were able to deepen mutual understanding and empathy.

In particular, the sense of unity brought from the integration of spaces and the social bonds formed through structured collaborative experiences were found to serve as a foundation for cultural experiences. Moreover, the technical inclusive, which enabled diverse visitors to participate regardless of their environment or device, suggests promising potential for future expansion and applications in other regions.

Meanwhile, we identified some limitations in the system, including VR sickness, visual load, and difficulties in automatically generating the spatial environment. Notably, the lack of automated 3D extraction for on-site exhibits and backgrounds makes it costly to update the virtual environment. Therefore, it is necessary to establish a workflow using SLAM and LiDAR to automatically extract 3D objects and update the environment in real time. By surmounting these technical and UX challenges, the system will be capable of expanding the platform beyond the Higashiyama Zoo–Kenya link into a genuinely multi-site, real-time, synchronized experience that connects multiple people and spaces. Through these extensions, it is anticipated that MetaUniTour will evolve into a sustainable, highly extensible platform, thereby establishing a novel standard for experience design across cultural, educational, and entertainment domains.

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