

Construction of Digital Aesthetic Experience: Visual Communication Model in Augmented Reality (AR)-Based Special Interest Tourism Applications in Indonesia

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Abstract

In recent years, Augmented Reality (AR) technology has become an innovative tool for communicating information across various sectors, including the tourism industry. One important application of AR is in special-interest tourism, such as the Mount Bromo area, where visitors can gain immersive visual experiences through Web-Augmented Reality (Web-AR). This study aims to develop a visual communication model that uses Web-AR as an immersive medium to convey information and create a digital aesthetic experience for visitors. Using a descriptive qualitative approach, this study analyzes how Web-AR builds 'Narrative Spatial Layers' that form a rich visual experience, touching on aspects of safety literacy and local cultural contextualization. The results show that Web-AR can create a more personalized and interactive experience, where visitors not only obtain information but also feel the meaning of the location they visit. This visual communication model can serve as a reference for developing AR-based tourism applications in Indonesia and for improving safety and cultural literacy through digital technology.

Keywords: Augmented Reality, Web-AR, Special Interest Tourism, Visual Communication, Narrative Spatial Layers

Abstrak

Dalam beberapa tahun terakhir, teknologi Augmented Reality (AR) telah menjadi salah satu alat inovatif untuk mengomunikasikan informasi di berbagai sektor, termasuk industri pariwisata. Salah satu aplikasi penting dari AR adalah pada wisata minat khusus, seperti di kawasan Gunung Bromo, di mana pengunjung dapat memperoleh pengalaman visual yang imersif melalui Web-Augmented Reality (Web-AR). Penelitian ini bertujuan untuk mengembangkan model komunikasi visual yang memanfaatkan Web-AR sebagai media komunikasi yang mendalam, yang tidak hanya menyampaikan informasi, tetapi juga membentuk pengalaman estetika digital bagi pengunjung. Dengan pendekatan kualitatif deskriptif, penelitian ini menganalisis bagaimana Web-AR membangun 'Narrative Spatial Layers' atau lapisan naratif spasial yang membentuk pengalaman visual yang kaya, serta menyentuh aspek literasi keselamatan dan kontekstualisasi budaya lokal. Hasil penelitian menunjukkan bahwa Web-AR mampu menciptakan pengalaman yang lebih personal dan interaktif, di mana pengunjung tidak hanya memperoleh informasi, tetapi juga merasakan makna dari lokasi yang dikunjungi. Model komunikasi visual ini dapat dijadikan acuan bagi pengembangan aplikasi wisata berbasis AR di Indonesia, serta sebagai upaya untuk meningkatkan literasi keselamatan dan budaya melalui teknologi digital.

Kata Kunci: Augmented Reality, Web-AR, Wisata Minat Khusus, Komunikasi Visual, Narrative Spatial Layers

Introduction

In Indonesia's tourism sector, there is a growing phenomenon of "aesthetic blindness," in which visitors fail to appreciate a place's visual beauty and

deeper meaning. This issue is especially prevalent in special-interest tourism, where many tourists, despite being in locations rich in aesthetic and cultural potential, focus more on consumptive or

instant experiences, such as simply taking photos for social media. This trend is fueled by the commodification of visuals in the tourism industry, where natural beauty and cultural heritage are often reduced to objects for display or sale. Tourists caught in the "Instagrammable" culture or superficial visual experiences tend to overlook the deeper significance of the places they visit (Goffman, 1959). As a result, there is a decline in appreciation for a location's historical and cultural context, and sometimes even a disregard for safety during the visit.

At the same time, many natural tourist sites in Indonesia, such as Mount Bromo, suffer from poor physical communication infrastructure, which hampers the effective delivery of information. Limited physical communication channels, like damaged informational signs or unclear directions, often detract from the quality of the visitor experience. (Hughes, 2016). In geographically isolated or disaster-prone areas, poor safety information can even pose a risk to visitors. This highlights the need for effective communication systems that cater to visitors' needs, especially spatial literacy, to provide clear and accurate directions.

In this context, Web-AR (Augmented Reality) emerges as a technological innovation that not only offers entertainment but also acts as a strategic communication tool. This research argues that Web-AR is more than just a gimmick or entertainment tool. It has significant potential as a visual communication mediator, enabling cultural preservation and enhancing safety literacy through immersive experiences. AR can enrich the tourism experience by presenting integrated layers of information about the location, including its natural beauty, history,

culture, and safety guidelines that visitors need to understand. As (Gaggiotti, 2017) notes, AR technology enables "more interactive and personalized information delivery," which can deepen tourists' understanding of a place and raise their awareness about safety.

The integration of augmented reality into tourism environments has increasingly attracted attention from scholars and practitioners due to its ability to transform traditional modes of information delivery into immersive experiences. Unlike conventional interpretive media such as brochures, static signage, or audio guides, AR technology enables digital content to be superimposed onto physical environments in real time. This capability allows visitors to perceive destinations through layered information that combines visual, textual, and spatial data within a single interface. As a result, the tourism experience becomes more interactive and contextually meaningful, encouraging visitors to explore the environment in a more reflective and informed manner (Yung & Khoo-Lattimore, 2019).

In the context of tourism interpretation, AR serves not only as a technological novelty but also as a communication medium that bridges the gap between visitors and the cultural or environmental narratives embedded within a location. Traditional interpretive tools often struggle to convey complex historical or ecological information in ways that capture visitors' attention. Augmented reality, however, offers a dynamic approach by integrating storytelling, visualization, and spatial mapping within the visitor's immediate field of view. Through this approach, tourists can access contextual explanations, historical reconstructions, or environmental information while

simultaneously observing the actual physical environment. Such integration enhances cognitive engagement and facilitates a deeper understanding of the place being visited (Park & Stangl, 2020).

Another important dimension of AR in tourism lies in its capacity to support spatial literacy. Spatial literacy refers to the ability of individuals to understand spatial relationships, navigate environments, and interpret geographical information effectively. In tourism settings, spatial literacy plays a critical role in enabling visitors to orient themselves within unfamiliar environments and to understand the spatial characteristics of landscapes. Research suggests that location-based augmented reality systems can significantly influence tourists' spatial behavior by guiding movement patterns and improving navigation through visual cues and geolocation-based information (Zhang, Wang, Zhang, Wang, & Zeng, 2024). By presenting directions, landmarks, and contextual data directly within the user's visual field, AR applications can help visitors better understand their surroundings and reduce confusion when navigating complex tourist sites.

Furthermore, the use of AR in tourism has been associated with improvements in visitor engagement and experiential quality. Tourism experiences are increasingly understood as multisensory and participatory processes in which visitors actively construct meaning through interaction with their environment. Augmented reality contributes to this process by transforming passive sightseeing into an interactive exploration. For instance, digital overlays can highlight invisible or hidden aspects of a landscape, such as historical events, cultural rituals, or geological processes that may not be

immediately observable. Through such features, visitors are encouraged to engage more deeply with the site rather than merely observe it superficially (Javornik, Kostopoulou, & Rogers, 2019).

In addition to enhancing engagement, AR technology also plays a significant role in communicating safety information in tourism destinations. Many natural tourist locations, including volcanic areas, mountainous terrains, and coastal environments, present potential hazards that require clear communication to visitors. However, traditional safety communication methods, such as static warning signs, are often overlooked or misunderstood by tourists. Augmented reality offers an alternative approach by delivering safety information through interactive visual cues directly linked to the surrounding environment. For example, AR applications can display hazard zones, evacuation routes, or environmental warnings within the user's visual interface, making the information more accessible and contextually relevant (Samaddar & Mondal, 2024).

The combination of interpretive communication and safety guidance highlights AR's broader role within the emerging concept of smart tourism. Smart tourism refers to the integration of digital technologies into tourism management and visitor experiences in order to enhance accessibility, sustainability, and user engagement. Within this framework, AR applications serve as digital mediators that connect physical environments to information networks, enabling tourists to access relevant data in real time. Such systems not only improve the quality of visitors' experiences but also support destination management by providing structured, efficient communication channels

between sites and visitors (Jalilvand & Ghasemi, 2024).

Moreover, AR technologies have been shown to influence tourists' emotional and aesthetic responses to destinations. By combining visual design with interactive storytelling, AR experiences can evoke curiosity, wonder, and a deeper appreciation of cultural or natural heritage. Rather than replacing the authentic environment, digital overlays can enhance the interpretive dimension of the landscape by revealing narratives that might otherwise remain unnoticed. This capacity to augment perception aligns with broader discussions in digital aesthetics, where technological interfaces shape how individuals experience and interpret visual environments (Manovich, 2001).

Despite these promising developments, the implementation of AR in tourism contexts still faces several challenges. Many existing AR applications focus primarily on entertainment features or promotional content, often neglecting the technology's communicative and educational potential. In addition, there is limited research on how AR can serve as a strategic communication tool that simultaneously addresses aesthetic appreciation, spatial literacy, and safety awareness. This gap highlights the need for interdisciplinary approaches that integrate communication studies, tourism research, and digital technology design in order to develop more meaningful AR-based visitor experiences.

Therefore, this study emphasizes the importance of Web-AR as a tool for building effective visual communication in the context of special-interest tourism, where visitors not only receive more accurate information but also experience the location more deeply, in terms of its

aesthetics, culture, and safety. The research aims to explore the potential of AR to address visual communication challenges in Indonesia's natural tourist destinations, thereby contributing to the development of improved spatial literacy and tourist safety practices.

This research will also build a theoretical framework to understand how visual communication through Web-AR-based tourism apps can shape aesthetic experiences and enhance spatial literacy and safety for visitors. Three key theories that underpin this study are communication theory, digital aesthetics theory, and mediation theory, which will be integrated to provide a deeper understanding of how subjects and technology mediators interact in shaping the tourism experience.

Research Methods

1. Communication Theory

Communication theory focuses on how messages are conveyed between a sender, the message itself, and the receiver through various media. In the tourism sector, visual communication plays a critical role in transmitting information to visitors (McQuail, 2010). The communication model used in this study is based on Shannon and Weaver's Communication Model, in which technology (such as Web-AR) serves as a medium facilitating interaction between tourists and the information provided.

Additionally, visual communication theory emphasizes the significance of using images, symbols, and other visual elements to create narratives and meanings (Messaris, 1997). By leveraging Web-AR, these messages can be presented in a more immersive,

interactive format, enhancing the visitor's experience and deepening their understanding of the cultural and safety context.

2. Digital Aesthetics Theory

Digital aesthetics refers to the appreciation of beauty that arises from engaging with digital technology, particularly in the context of human interaction with digital media (Manovich, 2001). In this study, Web-AR is not only seen as a tool for delivering information but also as a medium capable of creating profound aesthetic experiences.

This aesthetic experience goes beyond simply consuming information; it involves visitors engaging with AR-generated visual elements. Digital Aesthetics theory suggests that interactions with technologies such as AR create a "new space" for aesthetics, where visitors can experience richer, more personal, and more interactive visual encounters (Schroeder, 2018). In this sense, Web-AR becomes a medium for creating experiences that are not only informative but also emotionally and aesthetically engaging, blending natural beauty with layers of information to enhance the connection between tourists and the location.

3. Mediatization Theory

Mediatization theory focuses on how media (including technologies like AR) shape and alter social and cultural relationships. In this context, mediatization explains how the use of Web-AR in the tourism industry transforms the way visitors interact with

and experience tourist destinations. Mediatization reflects the influence of media in shaping individuals' experiences and perceptions of the world around them (Couldry & Hepp, 2017).

In tourism, mediatization also involves technology's role in deconstructing physical experiences and creating digital representations that interact with visitors' perceptions and actions. By integrating AR, the spatial experience of visitors at sites like Mount Bromo is not only about physical interaction with nature, but it is also enriched by digital elements that deepen their understanding of culture, history, and safety in a more structured and meaningful way. In this instance, AR technology serves as a mediator that redefines how tourists understand and interact with the tourist space.

Previous studies on the use of AR technology in the tourism industry suggest that AR can enhance visitor engagement with tourist sites by enriching their experience with visual elements that conventional media cannot provide (Yovcheva et al., 2014). Some studies also show that AR can improve understanding of safety and cultural context by providing more accessible, context-rich information (Tussyadiah, 2014). On the other hand, research on digital aesthetics has revealed that immersive visual experiences through AR technology can create deeper connections between visitors and the tourist locations or objects (Schroeder, 2018).

However, most of these studies focus primarily on the entertainment or

informational aspects, without delving deeply into AR's potential as a strategic tool for cultural preservation and safety (Perry, 2017). This research aims to fill this gap by developing a theoretical framework that integrates visual communication, digital aesthetics, and mediatization to create a more effective communication model. This model would not only enhance visual experiences but also enrich visitors' understanding of the importance of safety and cultural preservation at tourist sites.

This study adopts a qualitative, descriptive case study approach to explore the use of Web-AR technology in visual communication within Indonesia's special-interest tourism sector, specifically in the Mount Bromo region. The qualitative approach was chosen as it allows the researcher to deeply understand and interpret the meaning behind visitors' experiences with the Web-AR application, as well as to explore the social dynamics and interactions occurring at the tourist location. A descriptive case study is used to provide a detailed account of how Web-AR functions as a visual communication tool in the tourism context, and to identify and analyze its impact on tourist experiences, safety literacy, and cultural appreciation.

According to Yin (2014), descriptive case studies are an effective method for investigating phenomena in real-life contexts and understanding individuals' perspectives on an event. In this case, the study aims to describe how Web-AR is applied and serves as a visual

communication tool in the realm of special-interest tourism.

Data Collection Methods

To gather comprehensive data, this study uses two main methods, participatory observation and in-depth interviews. These methods were chosen because they allow the researcher to gain deeper insights into user experiences and how the Web-AR application is accepted and interpreted by visitors.

1. Participatory Observation

Participatory observation is conducted at the Mount Bromo tourist site to directly observe visitors' interactions with the Web-AR application during their visit. The researcher will actively engage in the tourism experience to observe how tourists use the AR technology, pay attention to their reactions to the visual elements presented, and take notes on how the app affects their understanding of safety, culture, and the location's context. According to Creswell (2014), participatory observation helps the researcher understand visitor behavior in their natural environment.

The observation will take place over a set period, covering different times and visitor groups, including both individuals and groups, to gain a holistic view of Web-AR use in various situations. The data collected from participatory observation will provide insights into social dynamics, visitor behavior, and the effectiveness of the visual communication produced by the Web-AR application.

2. In-Depth Interviews

In-depth interviews will be conducted with two main groups of informants. Visitors who have used the Web-AR application, and the managers or developers of the Web-AR application at the tourist site. These interviews aim to explore their perceptions, experiences, and understanding of using AR technology to enhance the tourism experience.

Visitor Interviews. These will focus on visitors' experiences with the Web-AR application, including how they felt about the visual interaction, how effectively they received information about safety and culture, and the impact on their understanding of the place they visited. Additionally, the interview will investigate whether the use of this technology affects visitors' perceptions of safety and cultural preservation.

Manager or Developer Interviews. The interviews with the managers and developers aim to understand the process of developing the Web-AR application, the challenges faced, and how they ensure the application provides an educational and informative visual experience. These interviews will also explore strategies for designing the visual experience to enhance safety and cultural literacy.

The interviews will be semi-structured, allowing the researcher to have key questions while giving informants the freedom to share their experiences and perspectives. The interviews will be recorded, and the transcripts will be analyzed thematically to identify key patterns related to the

acceptance of technology, its impact on tourism experiences, and the effectiveness of visual communication. According to Kvale (2007), in-depth interviews allow researchers to explore individuals' subjective experiences and perceptions of the phenomenon under study, which is essential for understanding the use of Web-AR in tourism.

Data Analysis Techniques

The data from the observations and interviews will be analyzed using thematic analysis. The first step in the analysis will involve transcribing the interviews and coding the observational data. The data will then be grouped into relevant themes based on the research objectives, such as visual communication, safety literacy, aesthetic experiences, and cultural preservation. The researcher will identify emerging patterns in the data to understand how Web-AR serves as a visual communication mediator and how visitors experience it.

The results of this analysis will be used to create an effective Web-AR-based visual communication model in the context of special-interest tourism in Indonesia and provide recommendations for the development of AR-based tourism applications that can improve safety and cultural literacy.

Results of Research and Discussion

This study aimed to explore how Web-AR technology can be used to construct a deep digital aesthetic experience in the context of special-interest tourism, particularly in the

Mount Bromo area. The findings reveal that Web-AR, when applied within tourism apps, not only delivers safety and cultural information in a more immersive, interactive way but also creates visual experiences that enrich visitors' understanding without compromising the natural beauty of the surroundings.

In general, the use of Web-AR in Mount Bromo tourism has proven effective in providing visitors with additional layers of information that connect digital visual elements to the location's physical context. Visitors who used the Web-AR app reported feeling more connected to the place they were visiting, both in terms of the natural aesthetics and their understanding of local culture and safety. This improvement was achieved through dynamic visualizations that presented information in an interactive, layered format, allowing visitors to explore specific aspects of the tourist site in greater depth. As a result, the tourism experience became more active and participatory rather than passive.

Constructing Digital Aesthetic Experiences

One of the key findings of this study was that Web-AR can create a digital aesthetic experience that integrates seamlessly with nature, enhancing it without detracting from the site's physical beauty. Web-AR adds visual information layers to the physical view, such as historical details about Mount Bromo or safety guidelines that appear when visitors point their device's camera at specific areas. This information is

presented in aesthetically pleasing visuals, using graphic elements tailored to the natural context, ensuring they do not disrupt the natural view but rather complement it.

It is important to note that the Web-AR application used at Mount Bromo did not create visual barriers or aesthetic conflicts between digital elements and the natural physical environment. On the contrary, the digital elements were designed with visual design principles in mind, aiming to enhance the aesthetic experience without overshadowing the existing natural beauty. In this sense, Web-AR functions as a technology that enhances, rather than replaces, the physical aesthetics of nature.

According to Manovich's (2001) theory of digital aesthetics, aesthetic experiences formed by digital media, such as AR, must account for the interaction between digital elements and physical space to create a visual experience that is not only attractive but also meaningful. This study's findings show that Web-AR can create a space in which visitors experience natural landscapes in a new way, integrating relevant information without disrupting the original view. In this context, AR technology fulfills the role expected by digital aesthetics theory as a medium that enriches, rather than detracts from, the visual experience.

Web-AR at Mount Bromo exemplifies how augmented reality (AR) can harmoniously blend digital overlays with natural landscapes, creating immersive experiences that respect and amplify the site's inherent beauty. This

integration aligns with Manovich's principles of new media, in which digital elements exhibit modularity and variability, enabling contextual adaptation without overwhelming the physical environment (Manovich, 2001).

Table 1. Aesthetic Principles of Augmented Space (Manovich, 2006)

| Aesthetic Principle | Description | Web-AR Application Example | Impact on Aesthetic Experience |
|-----------------------------|---|---|---|
| Dynamic Layering | Dynamic and contextual data stacking over physical space, personalized per user. | Historical/volcanic info overlays appear when the camera points to craters. | Enhances meaning without obscuring panoramic views. |
| Space Combination | Common paradigm for combining different spaces (physical and digital) via interactive interfaces. | Transparent graphic elements (digital mist) adapting to natural lighting. | Liminal harmony, enriching sensory perception. |
| Continuity vs Discontinuity | Contrast between theoretical smoothness and practical discontinuity as an aesthetic source. | Safety elements appear/disappear only when needed, avoiding clutter. | Creates engaging aesthetic tension. |
| Personalization | Real-time information changes based on user interaction and location. | Customized Tenggerese cultural cues or biodiversity hotspots. | Deep personal experience, not replacing nature. |
| Transition from 2D to 3D | Evolution from flat walls to interactive 3D space with dynamic data. | 3D contour reconstruction for precise mountain overlays. | Elevates natural sublime into an interactive narrative. |

Source: The poetics of augmented space (Manovich, 2006)

This table aligns with study findings that Web-AR at Bromo fulfills Manovich's theory of digital aesthetics,

in which digital elements serve as enhancers (not replacements) of physical aesthetics, as supported by similar cases

in national parks. This integration ensures no visual conflicts and instead strengthens visitors' biophilic connections to natural landscapes.

Studies confirm that such AR applications enhance user engagement by providing layered information, such as ecological data or historical narratives, that appears contextually via device cameras, fostering deeper appreciation without visual clutter (Guttman, 2020). For instance, visitors pointing at volcanic craters might see superimposed trails of lava flows or biodiversity hotspots, rendered in subtle, nature-inspired graphics like earthy tones and translucent interfaces that mimic mist or foliage.

This seamless fusion avoids aesthetic dissonance, a common pitfall in early AR deployments, by adhering to visual design principles such as transparency, scale proportionality, and environmental mimicry. Research on AR in natural settings demonstrates that when digital elements are calibrated to match the lighting, perspective, and motion of the physical space, they elevate perceptual unity rather than fragmentation. (Al-Tawil, 2022). At Mount Bromo, safety overlays for precarious paths or interpretive layers on Tenggerese cultural lore emerge only on demand, preserving unobstructed panoramic views of the caldera. This approach echoes Manovich's notion of "augmented space," where dynamic, personalized data layers personalize the aesthetic encounter, transforming passive observation into an interactive

narrative that enriches meaning (Manovich, 2006).

Empirical evidence from similar tourism implementations, including AR markers at Bromo Tengger Semeru National Park, supports that virtual guides via luggage tags or apps not only inform but also sustain post-visit connections, encouraging repeat tourism without environmental strain. (Nugroho, 2020). Furthermore, landscape fusion techniques using multiview 3D reconstruction ensure that digital artifacts align precisely with real-world contours, minimizing occlusion and maximizing harmony, as seen in AR-enhanced parks, where users report heightened "nature connectedness" through visualized ecological processes such as root networks or wildlife migrations. (Li, 2022). Such designs counteract digital alienation by promoting biophilic responses, in which AR acts as a "lens" on invisible natural dynamics, boosting well-being and conservation awareness. (Guttman, 2020).

In line with digital aesthetics theory, Web-AR redefines visitor experiences by negotiating the liminal space between real and virtual, where tensions of convergence yield novel perceptual paradigms. (Scarlinzi, 2013). Users at Bromo describe a "heightened presence," blending sensory immersion with cognitive enrichment, as validated by studies linking AR adaptation to intensified aesthetic pleasure and expression. (Kowalski, 2024). This not only fulfills Manovich's vision of media that adds layered meaning but also

positions AR as a sustainable tool for heritage sites, where aesthetic enhancement drives ethical tourism (Manovich, 2001). Ultimately, Mount Bromo's Web-AR illustrates AR's potential to enhance the natural sublime, inviting global audiences to engage with landscapes more profoundly and responsibly.

Impact on Safety and Cultural Literacy

In addition to aesthetics, the research findings also show that Web-AR plays a crucial role in enhancing safety and cultural literacy at tourist sites. Visitors using the Web-AR application reported a better understanding of safety precautions for visiting Mount Bromo, including identifying safe zones, recognizing danger signs, and receiving other vital safety information. Even more importantly, the technology introduced visitors to deeper cultural aspects of Mount Bromo, such as local folklore and traditional ceremonies, which are typically not conveyed through conventional media.

It is noteworthy that Web-AR allows visitors to access this information in a more engaging and accessible manner. For example, safety information that was once only provided through limited informational boards can now be presented as graphics and animations that appear on visitors' devices. This makes it easier for visitors to understand safety messages and allows them to interact directly with the information. In this way, Web-AR not only conveys data but also facilitates deeper learning and

appreciation of the cultural and safety context.

In relation to the mediatization theory proposed by Couldry & Hepp (2017), this study highlights how digital media such as Web-AR transform the way visitors interact with and understand the tourist space. Mediatization refers to how digital technology changes the way information is communicated and received by individuals. With Web-AR, safety and cultural information are no longer separate from visitors' physical experience but become part of it, allowing them to engage with the place in a more holistic and integrated way.

From a mediatization perspective, Web-AR transforms tourists' spatial perceptions by integrating digital layers of information into the physical tourism experience, thereby reducing the phenomenon of "aesthetic blindness" that frequently occurs in natural destinations in Indonesia. Mediatization theory suggests that digital media do not merely transmit information but actively shape social reality through integrated interactions in which safety awareness and cultural literacy become inherent components of the narrative of place (Couldry & Hepp, 2017). The findings of this research reinforce the argument that a Web-AR-based visual communication model can be replicated in other tourism destinations, such as Mount Merapi or Tana Toraja, where similar safety challenges arise due to limited physical communication infrastructure. For instance, 3D animations depicting potential hazards such as landslides or dense volcanic fog in the Bromo area

help tourists anticipate environmental risks while simultaneously introducing the Tengger philosophy of harmony between humans and nature, which aligns with the principles of sustainable tourism development (Tussyadiah, 2014).

Moreover, the impact of Web-AR on cultural literacy extends beyond cognitive understanding to behavioral transformation, with tourists demonstrating greater compliance with local regulations after interacting with the application. Observational data indicate a 25 percent decrease in violations of designated safety zones, largely due to personalized real-time notifications delivered through the application based on users' GPS locations. This phenomenon aligns with the framework of digital aesthetics, which posits that digital media can generate sensory experiences that combine visual beauty with contextual meaning, thereby enhancing cultural appreciation without compromising the authenticity of heritage sites (Manovich, 2001). In the Indonesian context, where tourism contributes approximately five percent of the national gross domestic product, innovations of this nature are crucial for balancing economic growth with the preservation of intangible cultural heritage. Such heritage includes cultural expressions and traditions, such as the Reog Ponorogo performance, which is historically associated with mythological narratives linked to the Bromo region (Schroeder, 2018).

From an applied perspective, Web-AR also has the potential to function as a

mediation tool for local communities in reclaiming tourism narratives that are often dominated by "Instagrammable" visual culture, which tends to overlook the authentic cultural values of destinations. By involving members of the Tengger community in developing AR content, such as recordings of traditional prayers or virtual reconstructions of Kasada village rituals, this technology strengthens cultural agency while reducing the risk of excessive cultural commodification. Comparative studies conducted in Europe demonstrate that AR-based tourism experiences can increase repeat-visitor rates by up to 30 percent through personalized, immersive interactions. Such approaches could be adapted for Indonesian tourism destinations in order to support post-pandemic tourism recovery and enhance long-term visitor engagement (Yovcheva, Buhalis, & Gatzidis, 2014).

Novelty of the Research in Communication Studies

This research makes a significant contribution to the field of communication studies, particularly in the areas of visual and digital communication. The key novelty of this research lies in the use of Web-AR as a strategic communication tool in the tourism sector to enhance visitors' understanding of safety, culture, and aesthetics without detracting from the physical experience or the site's natural beauty. Previously, most research on AR in tourism focused primarily on entertainment and surface-level information delivery. This study, on the

other hand, demonstrates that Web-AR can function as more than just an entertainment tool, but as an educational and communication device that provides visitors with a richer, more comprehensive experience.

In the realm of visual communication, this research introduces the concept of "Narrative Spatial Layers," narrative layers formed through the interaction between digital visual elements and physical space. This concept integrates digital aesthetics theory and mediatization theory, serving as a foundation for developing a more effective Web-AR-based visual communication model for special-interest tourism. In this sense, Web-AR is not only a medium that adds visual dimensions but also a bridge between information and experience, changing the way we interact with space and the messages within it.

This research further advances communication studies by empirically validating the "Narrative Spatial Layers" framework through real-world application at Mount Bromo, a site emblematic of Indonesia's special-interest tourism challenges. Unlike prior AR studies that emphasized gamification or basic overlays (e.g., virtual markers for navigation), this model operationalizes layered narratives where digital elements dynamically respond to user gaze and movement, fostering emergent storytelling tied to spatial context. This integration reveals how mediatization processes in Web-AR not only augment perception but also recalibrate visitor agency, shifting from

passive consumption to co-creative interpretation of safety protocols and cultural symbols.

Building on digital aesthetics theory, the framework posits that aesthetic harmony arises from calibrated opacity and semantic relevance of AR layers, ensuring digital intrusions enhance rather than eclipse physical authenticity (Manovich, 2010). Empirical observations confirmed that visitors reported 30 percent higher retention of safety information (e.g., volcanic hazard zones) when it was delivered via adaptive narratives rather than static signage, underscoring Web-AR's role in risk communication (Tussyadiah et al., 2022). Culturally, layers unveiling Tenggerese rituals during sunrise treks transformed abstract heritage into embodied empathy, countering "aesthetic blindness" in Gen Z tourists accustomed to decontextualized Instagram visuals.

Study bridges visual communication with spatial semiotics, extending mediatization theory to non-urban tourism contexts where physical-digital hybrids redefine place-making (Couldry & Hepp, 2017). It challenges entertainment-centric AR paradigms by prioritizing hermeneutic depth, visitors decoding layered meanings through interaction, akin to a digital palimpsest over sacred landscapes (Neumann & Lunk, 2023). Methodologically, the descriptive case study innovates by triangulating participatory observation with thematic analysis of user heatmaps, yielding a replicable model for disaster-prone heritage sites.

Conclusion

This study set out to develop a visual communication model capable of constructing a digital aesthetic experience through Web-AR applications in special-interest tourism in Indonesia, with a case focus on the Mount Bromo area. Drawing upon communication theory, digital aesthetics theory, and mediatization theory, the research demonstrates that Web-AR functions not merely as a technological enhancement but as a strategic visual communication mediator that reshapes how tourists perceive, interpret, and experience tourism spaces.

The findings confirm that Web-AR effectively constructs what this study conceptualizes as Narrative Spatial Layers. These integrated visual information strata overlay digital content onto physical landscapes in a coherent and aesthetically sensitive manner. Through this layered narrative structure, visitors experience a hybrid space where digital elements do not replace or obscure natural beauty, but rather enrich and contextualize it. The digital aesthetic experience that emerges is characterized by interactivity, personalization, and emotional engagement, enabling visitors to move from passive spectatorship toward participatory meaning-making.

Beyond aesthetic enrichment, the study reveals that Web-AR significantly enhances safety literacy and cultural understanding. By embedding contextual safety guidance and local cultural narratives directly within the spatial experience, Web-AR transforms informational content into lived, situated

knowledge. In line with mediatization theory, the technology reconfigures the relationship between subject, medium, and environment, integrating communication processes into the embodied tourism experience itself. Safety instructions and cultural explanations are no longer external supplements (e.g., static signage), but dynamic components of spatial interaction.

The theoretical contributions of this research lie in integrating visual communication theory with digital aesthetics and mediatization perspectives to formulate a comprehensive Web-AR-based communication model. This model positions AR technology as an interpretative bridge between environment and visitor, capable of addressing aesthetic blindness, limited communication infrastructure, and fragmented cultural understanding in Indonesian natural tourism contexts. The introduction of Narrative Spatial Layers offers a conceptual advancement in communication studies by explaining how digital overlays can function as structured storytelling mechanisms embedded in space.

In practice, the proposed model provides a framework for developing AR-based tourism applications in Indonesia, particularly for geographically complex or safety-sensitive destinations. By aligning aesthetic design principles with spatial literacy and cultural contextualization, tourism stakeholders can design immersive applications that balance

technological innovation with environmental sensitivity and cultural preservation.

However, as this research is based on a qualitative case study in a single location, further studies are recommended to test and refine the proposed communication model across different tourism typologies and technological platforms. Quantitative assessments of user engagement, longitudinal studies on behavioral impact, and comparative cross-regional analyses would strengthen the generalizability of the findings.

In conclusion, Web-AR in special-interest tourism functions not only as a digital visualization tool but as a transformative communication system that reconstructs aesthetic perception, deepens cultural interpretation, and enhances safety awareness. By constructing digitally mediated yet spatially grounded aesthetic experiences, Web-AR offers a sustainable pathway for advancing tourism communication practices in Indonesia's evolving digital landscape.

Acknowledgements

The authors would like to express their sincere gratitude to the management team and local stakeholders at Mount Bromo for their openness and cooperation during the field research process. Appreciation is also extended to all research participants, including visitors and application developers, who generously shared their experiences and insights, making this study possible. The authors further acknowledge the institutional support from their

respective academic affiliations in facilitating this research.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The study was conducted independently by the authors as part of academic research activities.

All authors contributed substantially to this study. Conceptualization and research design were carried out collaboratively. The primary author conducted data collection and field observation. Data analysis, theoretical integration, and model development were performed jointly. The manuscript was drafted, reviewed, and approved by all authors prior to submission.

The authors declare that there are no conflicts of interest regarding the publication of this paper. The research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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