

The Impact Of Virtual Reality On Travel Behaviour

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Abstract: *The way that people research and interact with places before actually going there has been completely transformed by virtual reality (VR) technology. This experimental study looks into how VR affects travel behaviour, particularly how it affects decision-making processes, travel goals, and destination selection. After exposing individuals to realistic virtual reality simulations of several locations through a controlled experiment, their preferences and actions connected to travel were examined. The findings suggest that VR experiences greatly improve destination awareness, influence preferences, and heighten the desire to visit places that are highlighted. The study also emphasizes how VR might increase travellers' confidence by lowering their perceived level of uncertainty about new places. These results highlight VR's potential as a potent instrument for destination promotion and travel marketing, providing companies and travel boards with creative approaches to draw in and interact with potential tourists. The study offers useful applications for virtual reality in influencing future travel trends, adding to the expanding corpus of research on technology-driven behavioural changes in tourism.*

Keywords: Virtual Reality (VR), Travel Behavior, Destination Marketing, Tourism Technology.

INTRODUCTION

The travel industry has undergone significant transformations recently, driven by technological advancements and shifting consumer behavior. As Ebiyefa (2023) notes, tourism is like research in motion and must adapt to the evolving needs and preferences of travelers, particularly in how technology influences destination perception and decision-making. Among these innovations, virtual reality (VR) has emerged as a powerful tool for destination marketing. As Ho, P. T., Ho, & Huang (2024) highlight, VR offers immersive, interactive experiences that simulate real-world travel, reshaping how destinations are promoted and experienced.

The term 'metaverse' originated in Neal Stephenson's 1992 science fiction novel *Snow Crash*, depicting a vast virtual reality (VR) world parallel to the physical one, where geographically dispersed users interact through digital avatars for entertainment and socialization (Dionisio et al., 2013). Rather than a single technology, the metaverse is an overarching concept—a convergence of advanced digital technologies like 5G, artificial intelligence (AI), and big data (Bourlakis et al., 2009; Choi & Kim, 2016)—to create a fully immersive, interconnected virtual world.

The metaverse, characterized by unprecedented levels of virtuality, immersion, and connectivity (Collins, 2008; Barassi & Treré, 2012), is poised to redefine consumer behavior across industries, with travel and tourism standing to benefit significantly. Its core selling point of immersion has already found practical applications in virtual tourism (Schwarz et al., 2012; Burton & Schlieman, 2021), as demonstrated by pioneers like Disney, which leverages AI, VR, and IoT to create personalized, immersive theme park experiences (Mine et al., 2012). To achieve true immersion, virtual tourism must address critical sensory dimensions - enabling tourists to perceive temperature changes, seasonal transitions, and other environmental factors through carefully constructed virtual spaces (Zheng et al., 2010). These multisensory elements, ranging from dynamic weather simulations to tactile feedback systems, are fundamental to creating the diversified, lifelike experiences that form the backbone of metaverse tourism (Singh et al., 2020). The success of virtual tourism in the metaverse ultimately depends on this sophisticated integration of technological innovation and sensory-rich environmental design to replicate and even enhance the complexities of physical travel.

Virtual visitors and the environment are constantly exchanging information (Trunfio and Campana, 2020). A simulated virtual tourism space scenario based on the integration of sight, hearing, and temperature sensations will provide tourists with an unparalleled immersive tourism experience (Bogicevic et al., 2019). Various virtual tourism spatial situations offer tourists different virtual tourism experiences (Loureiro et al., 2020). The experienter gathered information from the virtual tourism space and formed the perception of temperature comfort, such as cold, heat, comfort, or discomfort, using a variety of multi-sensory systems (visual, hearing, touch, etc.) as well as prior knowledge, memory, and real-world experience (Jendritzky et al., 2012; Hemmatjo et al., 2017).

The perception of thermal comfort among virtual tourists plays a crucial role in establishing authentic and immersive virtual tourism environments (Riva et al., 2011). While environmental temperature undeniably influences thermal comfort perception (Lam et al., 2018), this relationship is mediated by multiple factors including the human multisensory system, prior knowledge, memories, and personal experiences, resulting in varied comfort levels across different virtual tourism scenarios (Mieczkowski, 2010). Current research has examined the impact of spatial contexts on thermal sensation and physiological responses through experimental

approaches (Ma et al., 2019), with some scholars employing microclimate laboratories to simulate tourism environments (Fabbri et al., 2020). However, these studies have largely overlooked virtual tourism settings. Furthermore, existing investigations have predominantly focused on single-sensory impacts on thermal comfort (Schott & Marshall, 2018), leaving a significant gap in understanding multisensory interactions. This underscores the critical need for comprehensive research examining how visual-auditory multisensory integration affects thermal comfort perception in virtual tourism contexts.

Scholarly interest in experimental approaches to virtual tourism research has grown in recent years, especially through controlled investigations that look at certain sensory experiences (Huang et al., 2020). Traditional approaches have used VR technology and visual stimuli (pictures, films) while tracking physiological reactions with heart rate monitors, electroencephalograms, and other biomedical equipment (Dieck et al., 2018; Marasco et al., 2018). The current study goes beyond previous methods by developing a thorough multimodal simulation of virtual tourism enabled by the metaverse. Two essential elements of our experimental design are (1) a climate-controlled tourism simulation chamber that accurately regulates temperature, wind speed, humidity, and illumination to mimic real-world environmental conditions, and (2) immersive virtual reality technology that presents virtual tourism environments.

We gathered multimodal data during the tests, including subjective assessments using thermal sensation and comfort questionnaires and continuous physiological measurements (blood oxygen, pulse rate, blood pressure, heart rate, and breathing rate via ECG monitoring). A thorough investigation of how integrated multisensory elements affect thermal comfort perception in virtual tourist environments is made possible by this dual-method approach. This study advances theoretical knowledge and real-world applications for creating human-centered, sustainable virtual tourist experiences in constructing metaverse frameworks by methodically examining these composite sensory impacts.

2. Research background and hypothesis development

2.1. Metaverse research

The Evolution of the Metaverse: From Science Fiction to Virtual Tourism Reality

Originally conceived as a science fiction concept, the metaverse was first popularized by Neal Stephenson's 1992 depiction: "Through headphones and eyepieces connected to a terminal, users could access a computer-generated virtual world existing parallel to physical reality" (Perry & Williams, 1995; Girvan, 2018). This fictional vision remained largely theoretical until March 2021, when Roblox Corporation's successful NYSE listing as a "metaverse company" marked the concept's transition from speculative fiction to practical application (Joo-Eon, 2021).

The metaverse's emergence has been enabled by significant advancements in media and information technologies (Williams & Hobson, 1995). Modern smart devices and internet connectivity have increasingly blurred the boundaries between virtual and physical realms, fundamentally transforming human lifestyles and cognitive frameworks (Mueller, 1998; Martinez-Grana et al., 2013). Currently evolving from Web 2.0 (Razmerita et al., 2009), the internet is progressing toward Web 3.0 - a more human-centric network architecture that promises to facilitate the "interconnection of all things" (Hendler, 2009; Aghaei, 2012). This technological progression has transformed the metaverse from a literary "possible world" into tangible virtual tourism experiences that users can actively see and interact with (Bonnard et al., 2019).

The Metaverse as a Digital Mirror of Reality and Its Tourism Potential

At its core, the metaverse represents a comprehensive digital reconstruction of physical reality (Russell, 2017). To achieve full sensory immersion - encompassing vision, hearing, smell, taste, touch, and cognitive awareness - this virtual ecosystem requires the integration of multiple advanced technologies (Matsubara & Oguchi, 2010; Fei et al., 2019). Critical technological components include:

- Artificial intelligence and digital twins
- Blockchain and cloud computing infrastructure
- Robotics and brain-computer interfaces
- Next-generation networks (5G/6G)

These elements collectively enable seamless virtual-reality convergence, forming the foundation for an idealized digital world (Ariyadewa et al., 2010; Suzuki et al., 2020). Current metaverse research has predominantly examined technical architectures, potential applications, and developmental frameworks (Ben et al., 2018; Gao et al., 2022), while largely overlooking user experience dimensions.

This gap becomes particularly significant for the rapidly expanding virtual tourism sector, where creating truly immersive experiences represents both a critical challenge and major opportunity for metaverse implementation. The present study therefore focuses on optimizing user immersion as a key factor in virtual tourism development within metaverse environments.

2.2. Research on virtual tourism

The Evolution and Technological Foundations of Virtual Tourism

The concept of "virtual tourism" emerged in the mid-1980s, originally framed as a form of human-machine interaction with the potential to digitally reconstruct immersive environments for users (Steuer, 1992; Zyda, 2005). A pivotal development occurred in 1995 when Hobson and Williams pioneered the application of virtual reality (VR) to tourism, defining it as an innovative industry sector blending VR technology with travel experiences. This fusion enabled the dynamic digital representation of both existing and fictional destinations through internet-based or virtual platforms (Bowman & McMahan, 2007; Saposnik et al., 2010).

Subsequent advancements in geographic information systems (GIS), 3D visualization, and VR technologies (Brown & Green, 2016) have significantly enhanced virtual tourism's capabilities. Today, these technological integrations allow users to engage in fully immersive travel experiences from any location, fundamentally transforming traditional notions of tourism accessibility (Lin et al., 2020). This progression underscores virtual tourism's evolution from a theoretical concept to a sophisticated, technology-driven sector within the broader digital economy.

virtual standstill (Gössling et al., 2020). During this crisis, virtual tourism emerged as both a viable alternative for grounded travelers (Lee et al., 2020) and a dual-purpose solution - serving as both a temporary substitute during lockdowns and an effective marketing tool for post-pandemic recovery (El-Said & Aziz, 2021). Advancements in information technology have significantly enhanced the quality of virtual tourism experiences (González-Rodríguez et al., 2020), leading to increased adoption among diverse user groups (Sigala, 2020). This innovative approach to travel enables immersive exploration of protected heritage sites and otherwise inaccessible locations - from fragile archaeological treasures to extraterrestrial landscapes - through interactive digital environments (Nolin et al., 2016; Wagler & Hanus, 2018). Notably, virtual tourism has demonstrated exceptional value in promoting inclusive travel by removing physical and financial barriers for mobility-restricted individuals, including elderly and disabled populations (Cho et al., 2002). By transcending conventional limitations of time, space, and economic resources (Ritchie et al., 2011; Bonetti et al., 2018; Dieck & Jung, 2018), this digital transformation has redefined the very concept of accessible tourism.

The Ongoing Debate: Virtual Tourism's Role in the Travel Industry

Since its inception, virtual tourism has remained a subject of ongoing debate within academic and industry circles. The central question persists: Can virtual experiences truly replace physical travel? Most scholars maintain that virtual tourism cannot fully substitute for authentic travel experiences (Huang et al., 2013; Kim et al., 2020). Critics further argue that digital representations may compromise destination authenticity (Tan et al., 2014), as virtually presented information risks being unreliable or deliberately manipulated (Dueholm & Smed, 2014).

However, the emergence of metaverse technologies has significantly advanced virtual experiences through enhanced sensory simulation (Dinh et al., 1999; Riva et al., 2004). These developments have made truly immersive, multisensory virtual travel increasingly feasible. To achieve optimal virtual tourism experiences, two critical elements must be prioritized: (1) heightened environmental immersion through advanced scene simulation, and (2) incorporation of real-world thermal conditions to create authentic multisensory interactions within virtual tourism spaces.

2.3. Research on tourism spatial situation

Conceptualizing Spatial Situations in Tourism and Research Gaps in Thermal Comfort Studies

The theoretical foundations of "situation" trace back to Thomas & Znaniecki's (1919) seminal work, with subsequent development through physical-psychological field theory that elucidates the dynamic interplay between individual behavior and environmental contexts (Borgatti et al., 2009). Contemporary psychology defines spatial situations as environments that influence psychological processes through meaningful spatial configurations and symbolic elements (Dade, 2010). Within tourism studies, spatial situations encompass the contextual backdrop of tourist activities, comprising both individual characteristics and environmental factors that collectively shape the travel experience (Yang et al., 2004; Shi et al., 2005; Deller, 2010). These situations exert significant psychological impacts on tourists primarily through multisensory engagement (Jansson, 2002).

Current Research Limitations:

Contextual Focus: Existing studies on spatial situations and thermal comfort predominantly examine indoor environments, largely neglecting outdoor contexts

Disciplinary Imbalance: While architecture and landscape design have extensively investigated spatial situations (Vera & Simon, 1993; Richter et al., 2011), tourism research has paid insufficient attention to this critical dimension

Sensory Reductionism: Current understanding of audio-visual perception and thermal comfort relies heavily on single-sensory investigations, overlooking the complex interplay of multisensory integration

These research gaps motivate the present study's examination of tourist thermal comfort across varied virtual tourism spatial situations, with particular emphasis on how combined audio-visual stimuli influence comfort perceptions in immersive digital environments.

2.4. Research on tourism temperature comfort

The Interplay Between Climate and Tourism: From Thermal Comfort to Virtual Experiences

Tourism is a multidimensional activity deeply influenced by the climatic conditions of destinations, with temperature and humidity playing pivotal roles in shaping visitor comfort (Grimm & Zilli, 2009). These environmental factors collectively affect human physiological and psychological states (Tsutsumi et al., 2007), making climate comfort a critical determinant of tourism experiences (Frontczak & Wargocki, 2011).

The study of human climatic comfort dates to the 1920s when Houghton and Yaglou (1923) pioneered the concept of Physiologically Equivalent Temperature (PET), establishing empirical models to assess thermal conditions. Over time, climate itself has emerged as both a tourism resource and attraction (Brager & de Dear, 1998), with ideal destinations offering visitors a sense of thermal well-being (Scott & Lemieux, 2010).

Within climate comfort research, temperature perception has become a focal point, significantly influencing destination selection, trip duration, and activity choices (Perch-Nielsen et al., 2010; Abed & Matzarakis, 2018; Zhong et al., 2019). Importantly, studies reveal that temperature comfort is shaped not only by environmental factors but also by psychological adaptation, including prior knowledge, experiences, and memories (Lu et al., 2016). Building on these insights, this study develops an integrated model examining the relationship between microclimate and thermal comfort in virtual tourism. Through experimental methods, we investigate how different virtual spatial contexts influence participants' thermal sensations, physiological responses, and overall comfort perceptions.

2.5. Virtual tourism spatial situation and tourists' thermal sensation

Thermal Perception and Environmental Influences in Virtual Tourism Contexts

Thermal sensation represents the human body's physiological response to ambient temperature, while temperature comfort emerges from the interplay between physiological and psychological factors (Gagge et al., 1969). Unlike subjective comfort assessments, thermal sensation provides a more objective measure of environmental thermal conditions (Nikolopoulou & Steemers, 2003). Research confirms that rising ambient temperatures directly intensify thermal sensations (Yang et al., 2016), with spatial characteristics - including color schemes, acoustic environments, and architectural layouts - further modulating these perceptions (Zhang et al., 2004; Ali-Toudert & Mayer, 2006; Xu et al., 2021).

Environmental psychology research reveals two key mechanisms influencing thermal perception:

Visual stimuli, particularly color, significantly alter thermal sensation independent of actual temperature (Tetsuo et al., 1998; Wang et al., 2018)

Auditory inputs demonstrate measurable effects, where noise amplifies thermal discomfort while pleasant sounds enhance tolerance (Qu, 2010; Kilchenmann & Senn, 2015)

These findings align with the embodied cognition framework of tourism experiences, which emphasizes how spatial contexts fundamentally shape tourist perceptions (Yang & Moon, 2019). In virtual tourism environments, where experiences are inherently situated within designed spatial contexts, understanding these multisensory interactions becomes particularly crucial for creating comfortable and immersive digital experiences.

Therefore, the study hypothesizes that:

H1: Environmental temperature has a significant positive impact on virtual tourists' thermal sensation.

H2: Audio spatial situation has a significant positive impact on virtual tourists' thermal sensation.

H3: Visual spatial situation has a significant negative impact on virtual tourists' thermal sensation.

2.6. Virtual tourism spatial situation and tourists' physiological indicators

The environmental stress theory indicated that external environmental stimuli can evoke the psychological and physiological responses in the human body. The human body has a thermoregulatory mechanism that is closely related to thermal sensation and temperature comfort. According to the heat balance theory, when the heat storage in the human body is equal to 0, it will be in a comfortable temperature state.

Results & Discussion

The experimental results reveal that VR technology significantly impacts travel-related decision-making across three key dimensions:

Enhanced Destination Awareness

Participants exposed to VR experiences demonstrated substantially greater destination knowledge compared to non-VR users.

Increased Destination Preference

VR participants showed markedly stronger preferences for featured destinations.

Elevated Visit Intentions

The VR group reported significantly higher likelihood of visiting the promoted destinations.

These findings underscore VR's transformative potential in tourism marketing, demonstrating its capacity to simultaneously boost destination familiarity, appeal, and conversion rates. The technology effectively serves as a multi-dimensional engagement tool that influences the complete consumer journey from awareness to action.

Conclusions & Strategic Implications

This study establishes VR as a powerful behavioral influence mechanism in tourism, with three critical marketing applications:

Strengthening destination top-of-mind awareness

Shaping positive destination perceptions

Driving concrete travel intentions

Recommendations for Industry Practice

Destination Marketing Organizations should prioritize VR integration in promotional campaigns to capitalize on its demonstrated behavioral effects.

Tourism Businesses should invest in VR infrastructure to create competitive, immersive preview experiences.

Technology Partners should collaborate with tourism entities to develop specialized VR content optimized for destination marketing.

Study Limitations & Future Research Agenda

Methodological Constraints:

Sample size restriction (N=120)

Single-destination focus limiting generalizability

Priority Research Directions:

Longitudinal assessment of VR's lasting impact on actual travel behavior

Comparative studies across diverse destination types and cultural contexts

Evaluation of next-generation VR features (haptic feedback, AI personalization) on marketing effectiveness

This restructured version improves academic rigor while maintaining practical relevance, with clearer section transitions and more precise language throughout. The content now flows logically from empirical findings to theoretical implications to concrete applications.

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