Silver Travel in Golden Age: How Virtual Travel Guided by GenAI-enabled Avatars Boost Well-being for Older Adults

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Abstract

This study investigates the impact of virtual travel guided by Generative Artificial Intelligence (GenAI) enabled avatars on the well-being, travel confidence, and intention of older adults, using the experience economy framework and self-determination theory (SDT). The findings indicate that virtual travel experiences enhance the well-being of older adults by satisfying their intrinsic needs, leading to increased travel confidence and intention. This study extends the gerontechnology and virtual tourism literature by integrating SDT with the experience economy framework. The practical implications guide tourism practitioners, technology developers, policymakers, and healthcare providers in leveraging GenAI to satisfy the needs of aging populations.

Keywords: Well-being, Older Adults, Experience Economy, Generative Artificial Intelligence, Virtual Tourism, Psychological Needs, Travel Intention

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Introduction

With the advancements in healthcare, nutrition, and living conditions, life expectancy and the proportion of older individuals have been rapidly increasing worldwide. By 2050, the global population of individuals aged 65 and older is expected to exceed 1.6 billion (United Nations, 2023; WHO, 2022). This demographic shift poses severe challenges, as older adults often face multiple health issues (WHO 2022). Social determinants such as income, education, and living conditions critically influence the quality of life (WHO, 2022). Hence, the WHO emphasizes the need for comprehensive public health actions, policy reforms to promote social inclusion, better access to healthcare, and robust social protection systems (WHO, 2015). The UN's "World Social Report 2023" highlights the need to rethink social protection policies to support the aging population sustainably and ensure that older adults live with dignity and security (United Nations, 2023).

Travel is widely recognized as an effective means of enhancing well-being, particularly among older adults. Travel significantly contributes to older adults' subjective well-being by offering a sense of adventure and escapism, improving mental health and emotional stability, and enhancing overall life satisfaction (Zhang, 2023). Patterson and Balderas-Cejudo (2023) argued that promoting tourism activities enhances the health and well-being of older adults, aligning with Tourism Agenda 2030. However, traditional travel poses barriers to older adults, including physical limitations, mobility issues, and accessibility challenges (Chua et al., 2023). Additionally, psychological barriers, such as lack of travel experience or previous unpleasant experiences, can significantly impact older adults' travel confidence and intention. These obstacles often prevent older adults from thoroughly enjoying their travel. Thus, better solutions, especially technology-enabled ones, are needed to help older adults fully benefit from the positive impacts of travel.

Virtual travel guided by GenAI-enabled avatars has emerged as a promising tool to enhance older adults' travel confidence (Chen et al., 2021) and real-world travel intentions by offering immersive and emotionally engaging experiences (Hao et al., 2024b). These tours, guided by GenAI-enabled avatars, provide older adults with a sense of mastery and control over the travel process, reducing stress and fostering confidence (Fan & Luo, 2022; Hao et al., 2024b). By dynamically addressing individual needs and preferences, these experiences mitigate anxieties associated with travel challenges, making destinations feel more accessible and appealing. Additionally, the sense of presence created in virtual reality (VR) environments during virtual travel guided by GenAI-enabled avatars enhances enjoyment and engagement, encouraging older

adults to explore unfamiliar destinations. These virtual experiences strengthen preferences for specific destinations, foster positive attitude changes, and significantly influence visitation intentions (Tussyadiah et al., 2018). By merging personalization, emotional engagement, and cognitive stimulation, virtual travel guided by GenAI-enabled avatars not only builds travel confidence but also serves as a gateway for older adults to reimagine real-world travel possibilities.

According to the experience economy framework, virtual tourism offers older adults entertainment, esthetic, escapist, and educational experiences, allowing them to explore new destinations from home, which is valuable given their limited mobility (El-Said & Aziz, 2022).

According to SDT, well-being is significantly enhanced when individuals' needs for autonomy, competence, and relatedness are fulfilled (Deci & Ryan, 1985). In the realm of virtual tourism, GenAI holds the potential to meet these needs by transforming traditional virtual experiences into highly interactive, personalized, and adaptable journeys and facilitating a deeper emotional and cognitive connection between the user and the virtual environment, which is critical for the fulfillment of these psychological needs among older adults. While research has established the importance of tourism in contributing to older adults' well-being (Chang et al., 2022; Patterson & Balderas-Cejudo, 2023), there is a significant research gap in understanding how virtual travel guided by GenAI-enabled avatars can specifically satisfy these three psychological needs of older adults. Moreover, the extent to which fulfilling these needs through virtual travel guided by GenAI-enabled avatars contributes to overall well-being remains underexplored.

To address these research gaps, this study investigates how virtual travel guided by GenAI-enabled avatars can enhance the well-being of older adults by satisfying their psychological needs. Specifically, by integrating the experience economy framework and SDT, this study aims to answer the following research questions: (1) How does virtual travel guided by GenAI-enabled avatars satisfy older adults' needs for autonomy, competence, and relatedness? (2) What are the effects of fulfilling these needs on older adults' overall well-being? (3) As a secondary outcome, how might enhanced well-being potentially increase travel confidence and improve real-world travel intention? Data were collected through surveys and analyzed using PLS-SEM. The findings are expected to extend and integrate SDT to explain the role of virtual travel guided by GenAI-enabled avatars in enhancing well-being, thereby adding to the literature on gerontechnology and virtual tourism. The managerial implications of this study are significant for tourism industry practitioners, technology developers, policymakers, and healthcare providers.

Literature review and hypotheses development

Virtual Travel Guided by GenAI-enabled Avatars

Virtual reality (VR) is a transformative technology that creates immersive, computer-generated environments, allowing users to explore and interact with virtual spaces as if they were real. The effectiveness of VR depends on its display technologies, which are crucial for achieving visual immersion. VR systems offer various display methods, each tailored to specific needs and experiences: (1) Stereoscopic VR utilizes two slightly different images—one for each eye—to simulate depth and 3D perception, a feature essential for creating a sense of presence, typically achieved through headsets or glasses (Vince, 2011). (2) Monoscopic VR, in contrast, delivers a single image to both eyes, offering a less immersive but more accessible experience, commonly supported by mobile devices (Jerez-Jerez & Foroudi, 2024). (3) Naked-eye VR employs advanced technologies such as parallax barriers or lenticular lenses to produce 3D effects without the need for headsets or glasses, making it ideal for casual or public use, especially for older adults (Wang & Zhang, 2024). These diverse display forms make VR adaptable to various applications, enhancing its role in virtual travel and beyond.

The integration of GenAI with avatars represents a significant advancement in virtual travel experiences, especially for older adults. An avatar, defined as a virtual human representation, serves as a visual and interactive interface, simulating the role of a tour guide in virtual environments (Hao et al., 2024; Sylaiou et al., 2020). When combined with GenAI, a technology capable of reasoning and adapting to user input (Wong et al., 2023; Miao & Yang, 2023), the avatar becomes a GenAI-enabled guide. This system processes user inputs to provide personalized, real-time responses, dynamically adjusting content and interactions to suit individual preferences. This combination enhances virtual travel experiences by offering unparalleled levels of interactivity, realism, and adaptability (Li & Lee, 2024). Such experiences are especially valuable for older adults, who often face mobility limitations and technological challenges, as they foster engagement, alleviate barriers to traditional travel, and promote psychological well-being (Hao et al., 2024b; Sylaiou et al., 2020).

Virtual travel guided by GenAI-enabled avatars has diverse applications that cater to older adults' needs. These include immersive virtual tourism experiences that allow exploration of distant destinations from home, fostering a sense of adventure and reducing isolation (Hao et al., 2024b; Li & Lee, 2024). In destination marketing, these avatars offer interactive previews that boost travel

confidence and engagement (Talawar et al., 2024). Beyond tourism, GenAI-enabled avatars are utilized in real estate virtual tours to create personalized, interactive property showcases (SnapLogic, 2024). Furthermore, they play a therapeutic role in healthcare, providing virtual visits to meaningful locations to stimulate cognitive and emotional well-being (McMaster University, 2023). By integrating personalization, adaptability, and emotional engagement, these technologies not only make virtual travel accessible to older adults but also create enriching and transformative experiences tailored to their unique requirements.

Experience Economy Framework

The experience economy framework (Gilmore & Pine, 1998; Pine & Gilmore, 2011) conceptualizes customer experiences into four key dimensions: education, escapism, esthetics, and entertainment, collectively known as the 4Es. These dimensions are organized along two axes: customer participation (passive to active) and customer engagement (immersion to absorption). Active participation involves 'tourists' direct impacts on an event, whereas passive participation does not. Immersion refers to being enveloped by the environment, whereas absorption involves mental engagement.

This framework emphasizes the crucial role of interactions between tourists and service providers in creating experiential value. It has been widely applied in tourism and hospitality, including Airbnb accommodations (Bao et al., 2022), robotic restaurants (Ma et al., 2023), theme parks (Lee et al., 2020), and art-performance tourism (Zhang et al., 2021). These studies highlight the 4Es' role in enhancing tourist satisfaction and engagement, reinforcing the applicability of the model across diverse tourism sectors.

The 4Es of the experience economy—entertainment, esthetics, escapism, and education—have been widely utilized in research to comprehensively understand various experiential contexts, including VR and augmented reality (AR) experiences for senior tourists (Yu et al., 2023), AR applications in cultural heritage tourism (Chung et al., 2018), and festival guest experiences (Manthiou et al., 2014). These studies demonstrate that the 4Es provide a robust and comprehensive framework for analyzing the key dimensions of experiential offerings, including those in virtual tourism.

Virtual travel guided by GenAI-enabled avatars is modeled as a higher-order construct, with the 4Es serving as its foundational dimensions. The entertainment dimension is characterized by passive engagement, where users derive mental and physical pleasures without directly influencing

the activities being observed (Ji & Yang, 2022; Talwar et al., 2023; Zhang et al., 2022). In the context of virtual travel guided by GenAI-enabled avatars, this dimension is fulfilled through visually and emotionally appealing content designed to captivate users. The esthetic dimension immerses users in sensory-rich environments that simulate real-world perceptions of sight, smell, sound, taste, and touch, all while minimizing physical strain (Lu et al., 2022; Lv & Wu, 2021; Shin & Jeong, 2022). These environments create an authentic sense of presence, enabling users to experience virtual destinations as though they were physically there.

The escapist dimension involves active participation, allowing users to engage dynamically within the virtual environment by exploring alternate pathways or interacting directly with a GenAI-enabled avatar guide. This dimension provides users with an opportunity to temporarily disconnect from their everyday lives and fully immerse themselves in the virtual experience (Lee & Lee, 2021; Wei et al., 2023; Zhang, 2023). Finally, the educational dimension engages users' minds by delivering informative and enriching content about destinations, fostering curiosity and intellectual growth (Wong et al., 2022). Through the integration of GenAI, virtual travel elevates this dimension further by offering personalized and context-aware educational experiences tailored to individual preferences.

SDT

SDT, proposed by Deci and Ryan in the 1980s, is a fundamental psychological theory that explains human motivation and behavior (Deci & Ryan, 1985). Central to SDT is the fulfillment of three innate psychological needs: autonomy, competence, and relatedness. Autonomy involves feeling in control of one's behavior and goals. Competence refers to the need to master tasks and develop various skills. Relatedness encompasses the need for a sense of belonging and connection to others. Together, these needs drive intrinsic motivation, emphasizing the role of internal factors over external rewards in motivating behaviors (Ryan & Deci, 2000).

Virtual travel guided by GenAI-enabled avatars offers a transformative approach to traditional virtual tourism by integrating advanced algorithms that enhance the experience through heightened interactivity, personalization, and real-time adaptation. These technological advancements facilitate immersive environments that simulate real-world sensations, thereby enriching the virtual experience with hedonic qualities such as freedom and escapism (Shin & Jeong, 2022). By doing so, GenAI fosters a deeper emotional and cognitive connection between the user and the virtual environment, which is critical for the fulfillment of these psychological needs among older adults.

The immersive nature of virtual travel guided by GenAI-enabled avatars helps simulate a presence that bridges the physical distance, making users feel connected to the virtual world and to other individuals within it. The enhanced realism and interactivity allow users to experience social presence and engagement, which are key to satisfying the psychological need for relatedness (Ahn et al., 2019; Tussyadiah et al., 2018). Additionally, the emotional bond between older tourists and their avatars, which serve as companions offering more natural and responsive interactions and real-time emotional support, further enhances their sense of connectedness (Sylaiou et al., 2020). Thus, we propose the following hypothesis:

H1: Virtual travel guided by GenAI-enabled avatars positively influences older travelers' needs for relatedness.

GenAI's capability to adapt tours according to user preferences and responses enables a highly personalized experience. Older travelers can navigate these virtual environments independently, making choices that reflect their interests and pace, which contributes significantly to their sense of autonomy. This self-directed, self-managed, and personally endorsed engagement ensures that the experiences feel personally endorsed and intrinsically motivated, enhancing their overall enjoyment and satisfaction (Deci & Ryan, 2000; Liu & Tian, 2024). This sense of control and independence is especially significant for older travelers, as it empowers them to explore at their own pace and tailor their travel experiences according to their preferences and capabilities (Yu et al., 2024). Consequently, we propose the following hypothesis:

H2: Virtual travel guided by GenAI-enabled avatars positively influences older travelers' needs for autonomy.

Through personalized and educational content, virtual travel guided by GenAI-enabled avatars meets the older adults' need for competence by providing opportunities to learn and master new information and skills. These tours are designed to be intellectually engaging, offering insights into history, culture, and geography that are tailored to the user's level of knowledge and interest, thereby fostering a sense of achievement and intellectual growth (Kondja et al., 2024; Leite et al., 2024). Thus, we propose the following hypothesis:

H3: Virtual travel guided by GenAI-enabled avatars positively influences older travelers' needs for competence.

Well-being

Tourist well-being encompasses emotional pleasure and personal development experienced by fulfilling sensory desires and achieving travel objectives (Singh et al., 2023). SDT highlights the significant impact of fulfilling psychological needs on well-being. Recent studies in hospitality and tourism emphasize that fulfilling the intrinsic psychological needs of autonomy, competence, and relatedness enhances well-being. This is evident among various groups, including spiritual tourists (Buzinde, 2020), nature-based tourists (Çiki & Tanriverdi, 2023), wellness facility guests (Kim et al., 2024), integrated resort customers (Ahn et al., 2019), and women guides in adventure tourism (Houge Mackenzie et al., 2020).

The fulfillment of older travelers' need for relatedness, defined as the desire for a sense of belonging and connection with others (Ryan & Deci, 2000), emerges as a critical precursor to well-being. Chang et al. (2024) demonstrated the influence of social connectedness on tourist well-being. Similarly, Kondja et al. (2024) found that relatedness to people and the natural environment contributes to psychological well-being. Research has shown that relatedness across various travel phases strongly influences overall tourist satisfaction (Cheung et al., 2021), which enhances their life satisfaction and fosters a sense of well-being. Thus, we propose the following hypothesis:

H4: Satisfying older travelers' need for relatedness positively influences their well-being.

The satisfaction of older travelers' need for autonomy, defined as the desire to be in control of one's actions and goals (Ryan & Deci, 2000), is another crucial factor influencing psychological well-being. A sense of control significantly enhances tourist engagement (Lin et al., 2022), directly impacting psychological well-being (Fan & Luo, 2022). Research has shown a direct relationship between tourists' autonomy in trip planning and overall satisfaction (Fernández-Herrero et al., 2018). Autonomy can also lead to a sense of immersion, thereby enhancing travelers' satisfaction (Lunardo & Ponsignon, 2020), which, in turn, contributes to their well-being. Consequently, we propose the following hypothesis:

H5: Satisfying older travelers' need for autonomy positively influences their well-being.

The fulfillment of the need for competence, which emphasizes the desire to master tasks, skills, and knowledge (Ryan & Deci, 2000), is identified as a key determinant of well-being (Kondja et al., 2024). Thal and Hudson's (2019) research on wellness tourism effectively demonstrates the connection between increased competence and enhanced psychological well-being. Research has revealed that a sense of accomplishment brings happiness to travelers by helping them build self-confidence throughout their journeys (Shin et al., 2024). Sie et al. (2021) found that older tourists' self-determined motivations for educational packaged tours have a positive impact on their memorable experiences, emotions during the trip, perceived benefits, and overall life satisfaction. These findings highlight the integral role of fulfilling the need for competence in enhancing older tourists' psychological well-being. Hence, the following hypothesis is proposed.

H6: Satisfying older travelers' need for competence positively influences their well-being.

Travel Confidence and Travel Intention

Research has shown that higher well-being directly influences travel confidence (Chang et al., 2022). Travel confidence, defined as the assurance of one's ability to successfully plan, navigate, and enjoy travel experiences, is crucial for older travelers facing challenges such as deteriorating health, financial constraints, mobility issues, and lack of a travel companion (Huber et al., 2018). Research demonstrates that psychological well-being can improve various mental abilities (Huppert, 2009), including the capacity to travel with confidence (Mackett, 2017). Positive virtual travel experiences provide a sense of mastery and control, increase well-being (Fan & Luo, 2022), reduce anxieties related to travel challenges (Tussyadiah et al., 2018), and enable older travelers to feel that travel is more approachable. Consequently, we propose the following hypothesis:

H7: Well-being positively influences older travelers' travel confidence.

Travel intention, defined as the likelihood or willingness to engage in future travel activities, reflects the motivational state that leads to travel planning and undertaking (Liang et al., 2024).

Well-being significantly influences travel intention among older adults. When their psychological needs for autonomy, competence, and relatedness are satisfied, older travelers experience higher overall well-being, enhancing their motivation to travel (Chang et al., 2022). Research has also revealed that increased life satisfaction, a key determinant of well-being, positively affects individuals' motivation to engage in future travel activities (Prayag et al., 2024). Therefore, we propose the following hypothesis:

H8: Well-being positively influences older travelers' travel intention.

Travel confidence directly affects travel intention (Huber et al., 2018). For older travelers, higher travel confidence alleviates health, mobility, and companionship concerns, making them more likely to pursue travel opportunities (Huber et al., 2018). Virtual travel experiences boost confidence by fostering a feeling of empowerment and easing concerns (Tussyadiah et al., 2018). Thus, as older travelers' confidence in their ability to travel increases, their desire to travel also rises. Therefore, we propose the following hypothesis:

H9: Older travelers' travel confidence positively influences their travel intention.

The proposed conceptual model is shown in Figure 1.

(Insert Figure 1 here)

Methods

Prototype Development

The initial phase of prototype development involved the creation of immersive scenes and scripts focusing on Paris, selected due to its popularity and cultural richness, which preliminary research indicated was particularly attractive to older adults. This choice allowed for potential generalization to other culturally significant destinations. We incorporated a female avatar, proven to engage users more effectively in virtual environments (Hao et al., 2024a; Liu & Hao, 2024). The Metaverse Lab at our university's Department of Computing produced the initial prototypes with the virtual avatar, integrated with ChatGPT 3.5 via an API and managed through Discord, which enabled real-time interactions.

Expert Review and Iteration

Ten external experts—six tourism professors and four experienced tour guides—provided critical feedback on these initial designs, focusing on realism, user engagement, and cultural accuracy. Their insights led to several revisions to enhance educational and entertainment value, culminating in prototypes that were pretested with 35 older participants to ensure clarity and engagement. Figure 2 presents a snapshot of the final prototype.

(Insert Figure 2 here)

Participant Recruitment

Participants were selected using purposive and convenience sampling methods, targeting individuals aged 60 years or older, familiar with technology, proficient in English, and with basic physical mobility. A US-based survey company managed recruitment, ensuring a balanced sample of previous travel experiences. After completing the virtual travel guided by GenAI-enabled avatars, participants answered a structured questionnaire that included content-related screening questions to verify engagement, realism checks to gauge perception, and attention checks. IRB approval was obtained from the university, which ensured that all ethical guidelines and standards were strictly followed. The data were collected during the 1st quarter of 2024. A pilot test with 50 participants (excluded from the final analysis) was conducted to refine the questionnaire and ensure its reliability and validity through iterative feedback and adjustments. To accommodate older participants, a virtual travel guided by GenAI-enabled avatars was displayed on a computer screen using monoscopic VR instead of wearable devices to avoid discomfort as the pretest showed that older adults experienced dizziness and anxiety with headsets. The participants navigated the virtual environment at their own pace, guided by an avatar, providing detailed explanations and highlighting significant sites.

Data Collection and Instruments

Eventually, 559 eligible responses (93.01%) were collected after excluding those who failed the attention check questions or submitted low-quality responses (Table 1). As shown in Table 2, measures for entertainment, esthetic, escapist, and educational experiences were adapted from prior research (Yersüren & Özel, 2024). Relatedness, autonomy, and competence measures were sourced from established studies (Ahn et al., 2019; Hong & Ahn, 2023; Zhang et al., 2019). This study employed the WHO-5 Well-Being Index, a validated and reliable tool widely used to assess

psychological well-being in older adults (Topp et al., 2015). To assess travel intention, four items were drawn from previous studies by Tussyadiah et al. (2018) and Lacka (2020). Travel confidence measures were adapted from previous studies (Vichiensan et al., 2021). All survey items were rated on a 7-point Likert scale, with item loadings near or above 0.708, indicating strong correlations. Age, gender, income level, health status, and previous travel experience were employed as control variables to ensure the robustness of the findings.

Results

Data analysis

The data analysis was conducted using PLS-SEM with bootstrapping using SmartPLS 4 software. PLS-SEM merges principal component analysis with ordinary least squares regression, effectively handling complex models and exploring established theories (Mateos-Aparicio, 2011; Hair et al., 2019). It performs well when the skewness and kurtosis are within small to moderate ranges (up to skew=|1.1| and kurtosis=|1.6|). However, highly skewed data (skew=|1.8| and kurtosis=|3.8|) can significantly reduce statistical power (Goodhue et al., 2012). An examination of skewness and kurtosis (Table 2) shows that most measured items were within a moderate range, making the data suitable for PLS-SEM analysis.

Assessing measurement models

The proposed measurement models were evaluated for internal consistency, reliability, indicator loadings, convergent validity, and discriminant validity. Internal consistency reliability was assessed using Cronbach's alpha (α), Jöreskog's rho (ρ_C), and composite reliability (Dijkstra & Henseler, 2015; Jöreskog, 1971). The thresholds for these measures are 0.60, 0.70, up to 0.90 for acceptable, satisfactory, and good reliability, respectively (Hair et al., 2019). From Table 2, all the constructs exceeded these thresholds, indicating acceptable internal consistency and reliability.

Indicator loadings were reviewed, with all indicators showing loadings above 0.7 (except ESC1 and TIN1), suggesting that they explained more than 50% of the variance in the indicator (Hair et al., 2019). Convergent validity was assessed using the average variance extracted (AVE). All the AVE values were above 0.5, indicating that each construct explained more than 50% of the variance in its indicators (Table 2). Discriminant validity was evaluated using the Fornell–Larcker criterion (Fornell & Larcker, 1981). The results showed sufficient discriminant validity, confirming that all constructs were empirically distinct in the proposed model (Table 3).

Assessing a higher-order model

Virtual travel guided by GenAI-enabled avatars is conceptualized as a higher-order construct comprising the dimensions of entertainment, esthetics, escapism, and education. A higher-order confirmatory factor analysis was conducted to determine whether the virtual travel experience could be explained by the substantial variance across its four dimensions. Using the manifest variables of all first-order factors directly could lead to artificially correlated residuals owing to repeated indicator computations. To address this, a two-stage approach was adopted to estimate the hierarchical constructs (Van Riel et al., 2017), as detailed in Table 4.

In the first stage, the higher-order construct was excluded, focusing solely on evaluating the first-order constructs to derive the scores for the latent variables. In the second stage, these scores were used as manifest variables for the higher-order construct. This approach prevents multicollinearity among the indicators and eliminates redundancy, thus simplifying the analysis by reducing the first-order constructs to single-item constructs. The analysis showed that esthetics (0.895) and education (0.871). were the most influential dimensions in virtual travel guided by GenAI-enabled avatars, followed by escapism (0.869) and entertainment (0.849).

Assessing structural models

As self-reported surveys may suffer from common method bias, we employed the technique recommended by Kock (2015) to mitigate this risk. Our analysis revealed no common method bias, as indicated by the collinearity statistics of the inner model, which did not exceed the threshold value of 3.3. Henseler et al. (2014) introduced the standardized root mean square residual (SRMR) as a measure to assess the model fit and avoid model misspecification. The SRMR value was 0.073, which was below the commonly accepted thresholds of 0.08 or 0.10, indicating a good model fit. Additionally, the R^2 values for well-being, travel confidence, and travel intention were 0.757, 0.543, and 0.320, respectively, indicating that a substantial amount of variance was explained by the model.

Hypotheses test

To test hypotheses H1–H9, a bootstrapping procedure with 5,000 subsamples was employed (Chin, 1998). The results are presented in Table 5. For H1, the positive relationship between virtual travel guided by GenAI-enabled avatars and relatedness (β=0.808, T=38.613, p<0.001) confirms that virtual travel guided by GenAI-enabled avatars fosters a sense of connection and belonging among older adults. This finding supports previous studies that highlighted the role of social interactions in enhancing relatedness (Ahn et al., 2019; Sylaiou et al., 2020). Our study incorporates an avatar

guided by GenAI, enhancing real-time interactions and personalizing experiences, thus deepening the sense of relatedness.

For H2, the positive effect of virtual travel guided by GenAI-enabled avatars on autonomy (β=0.769, T=32.455, p<0.001) highlights that virtual travel guided by GenAI-enabled avatars helps satisfy the need for autonomy among older adults (Liu & Tian, 2024). Our study extends this by showing how virtual environments can be tailored to offer experiences that respect the physical limitations of older adults, thereby broadening the scope of their autonomous experiences. H3 reveals that virtual travel guided by GenAI-enabled avatars positively impacts competence (β=0.773, T=28.922, p<0.001), suggesting that virtual travel guided by GenAI-enabled avatars helps older adults master new skills and knowledge. This aligns with research indicating that educational and interactive experiences enhance competence (Kondja et al., 2024; Thal and Hudson, 2019).

H4 shows a significant effect of relatedness on well-being (β=0.298, T=4.058, p<0.001), highlighting the importance of social connections for psychological health, consistent with studies on belonging and social support (Prayag et al., 2017; Cheung et al., 2021). H5 demonstrates the influence of autonomy on well-being (β=0.352, T=5.48, p<0.001), reinforcing that control over one's actions enhances psychological health (Fan & Luo, 2022; Lin et al., 2022). Similarly, H6 indicates that competence positively impacts well-being (β=0.28, T=3.758, p<0.001), as mastering new tasks and knowledge benefits older adults' psychological health (Shin et al., 2024; Sie et al., 2021).

H7 reveals a strong effect of well-being on travel confidence (β=0.737, T=27.568, p<0.001), consistent with studies showing that well-being boosts confidence in travel activities (Tussyadiah et al., 2018). Our study shows that virtual travel guided by GenAI-enabled avatars significantly enhances travel confidence by providing safe and engaging environments for older adults to build travel skills and knowledge. H8 demonstrates that well-being does not significantly influence travel intention (β=-0.03, T=0.421, p=0.674), which is contrary to previous research linking well-being to travel intention (Chang et al., 2022; Prayag et al., 2017). Hence, while well-being may improve travel confidence, it does not directly translate into an increased intention to travel.

H9 highlights that travel confidence significantly impacts travel intention (β=0.581, T=9.704, p<0.001), indicating that confidence in travel abilities encourages older adults to plan and undertake travel experiences. Based on the results for H8 and H9, travel confidence has a full

mediating effect on the path between well-being and travel intention, which indicates that the influence of well-being on travel intention is transmitted entirely through travel confidence. This finding aligns with studies emphasizing the critical role of confidence in shaping travel behaviors among older adults (Huber et al., 2018).

Conclusions

Addressing the well-being of older adults is a critical social issue, particularly as the proportion of the aging population continues to increase globally. This study investigates the impact of virtual travel guided by GenAI-enabled avatars on older adults' psychological well-being and travel intention by providing timely and impactful insights. Using the experience economy framework and SDT, our research highlights how virtual tourism fulfills the essential psychological needs for relatedness, autonomy, and competence, offering a significant and original contribution to the field.

The findings of this study highlight the significant impact of virtual travel guided by GenAI-enabled avatars on enhancing the well-being of older adults by satisfying their psychological needs for autonomy, competence, and relatedness, aligning with SDT. By offering highly interactive and personalized experiences that enhance the dimensions of the experience economy framework, GenAI technologies empower older individuals to engage with virtual environments that effectively simulate real-world interactions. This not only boosts their sense of control and self-efficacy but also enriches their social connections, significantly improving their overall psychological well-being (Chang et al., 2022). Crucially, the enhanced well-being achieved through these virtual tours has been shown to increase the travel confidence of older adults, which in turn, positively affects their intention to engage in physical travel, in line with the findings of Ahn et al. (2019) and Tussyadiah et al. (2018).. This enhanced sense of well-being fosters a stronger belief in their ability to undertake new travel experiences, essential for overcoming psychological barriers to travel. Consequently, virtual travel guided by GenAI-enabled avatars acts not merely as an enriching standalone activity but also as a catalyst, motivating older adults to consider and plan real-world travel, thereby offering them a dual pathway to enrich their lives through leisure.

The significance of this study lies in its interdisciplinary approach, which combines gerontechnology and virtual tourism to address the unique needs of aging populations (Huber et al., 2018). The implications for tourism industry practitioners, technology developers, policymakers, and healthcare providers are profound, suggesting that virtual travel guided by GenAI-enabled avatars can significantly enhance the quality of life of older adults. This research

paves the way for future studies to explore the integration of advanced technologies in enhancing the travel experiences of diverse populations.

Theoretical Implications

This study makes significant theoretical contributions to our understanding of older travelers' well-being in virtual travel guided by GenAI-enabled avatars.

First, this study extends SDT by examining its relevance to virtual travel guided by GenAI-enabled avatars among older adults as a novel context (Ryan & Deci, 2000; Deci & Ryan, 1985), enhancing our understanding of age-related motivational changes in tourism. It demonstrates that virtual travel guided by GenAI-enabled avatars can effectively fulfill the psychological needs of autonomy, competence, and relatedness, promoting well-being among older adults (Buzinde, 2020).

Second, this study integrates the experience economy model with SDT to provide a comprehensive theoretical framework that captures the full complexity of virtual travel guided by GenAI-enabled avatars. By aligning the four dimensions of the experience economy—entertainment, aesthetics, escapism, and education—with the psychological needs identified in SDT, we illustrate how GenAI enhances each dimension to satisfy these needs and improve the well-being of older adults, highlighting the value of virtual travel guided by GenAI-enabled avatars as unique and comprehensive tourism products, showcasing their potential to be valuable tourism products in their own right (El-Said & Aziz, 2022).

Third, this study elucidates how the well-being derived from virtual travel guided by GenAI-enabled avatars can stimulate the demands of physical travel among older adults (Kim et al., 2023), filling a gap in the literature that often focuses on younger or general populations (Sohn & Yoon, 2016; Xu & Zhang, 2016).

Practical Implications

The findings have significant implications for various stakeholders in the senior tourism market, including tourism industry practitioners, technology developers, policymakers, and healthcare providers.

Our study reveals that engaging, accessible virtual travel experiences significantly enhance the well-being and intentions to travel in the real world of older adults. Tourism industry practitioners can consider a GenAI-enabled virtual travel guide that can offer personalized physical travel destination recommendations at the end of each virtual tour, based on users' preferences and behaviors. Such personalized recommendations can bridge the gap between virtual and physical

travel, potentially converting virtual experiences into real-world travel plans. Marketing professionals can leverage this feature to emphasize how virtual travel serves not only as an end in itself but also as a gateway to physical travel, enhancing the overall tourism experience.

Technological developers should focus on creating virtual travel guided by GenAI-enabled avatars that deliver a comprehensive and enriched experience. By prioritizing features like easy navigation, high-quality graphics, real-time rendering, and personalization options, developers can ensure the virtual travel experience is not only accessible but also highly enjoyable for older adults (Yu et al., 2024). Moreover, different VR display technologies should be considered for different customer segments according to their needs and comfort, for example, monoscopic VR is suitable for older adults so that they don't need to wear bulky headsets or experience any dizziness.

Policymakers can promote social sustainability and inclusivity by supporting virtual travel initiatives among older adults. Advocating the inclusion of virtual travel guided by GenAI-enabled avatars in community programs and healthcare settings, providing funding and resources, and creating public awareness campaigns can help ensure that older adults have access to enriched travel experiences despite physical or financial constraints, and enhance their well-being.

Healthcare providers can incorporate virtual travel guided by GenAI-enabled avatars into therapeutic and recreational programs for older adults to provide cognitive stimulation, reminiscence therapy, and social interaction. By utilizing headset-free VR technologies, such as monoscopic VR, in virtual travel guided by GenAI-enabled avatars instead of other headset-dependent VR technologies, healthcare facilities can minimize physical discomfort and reduce the costs associated with traditional VR hardware, facilitating easier integration into senior care programs. This approach not only enhances the accessibility and affordability of virtual travel experiences for older adults but also promotes their overall well-being by addressing cognitive, emotional, and social needs in a practical and innovative manner.

Limitations and Future Research Directions

This study has several limitations that present opportunities for future research. First, the specific sample of older adults limits the generalizability of the findings to other demographic groups or cultural contexts. Future studies should include larger and more diverse samples to ensure broader applicability and strengthen the validity of the results across varied populations.

Second, this research examines the holistic effect of virtual travel guided by GenAI-enabled avatars without isolating the individual contributions of its components—namely, the virtual tour,

GenAI technology, and avatars. While this integrated approach provides valuable insights into the overall impact of the system, it constrains our ability to understand specific influences, such as the role of female avatars in enhancing user engagement or the degree of personalization enabled by GenAI.

To address these gaps, future research should employ experimental designs to disentangle the individual effects of each component, providing a clearer understanding of their respective contributions to outcomes like well-being, travel confidence, and travel intentions. Additionally, longitudinal studies are needed to examine the sustained impact of virtual travel guided by GenAI-enabled avatars on older adults' psychological and behavioral outcomes over time. These studies would offer critical insights into the long-term benefits and potential of this technology, particularly in fostering increased travel confidence and real-world travel engagement.

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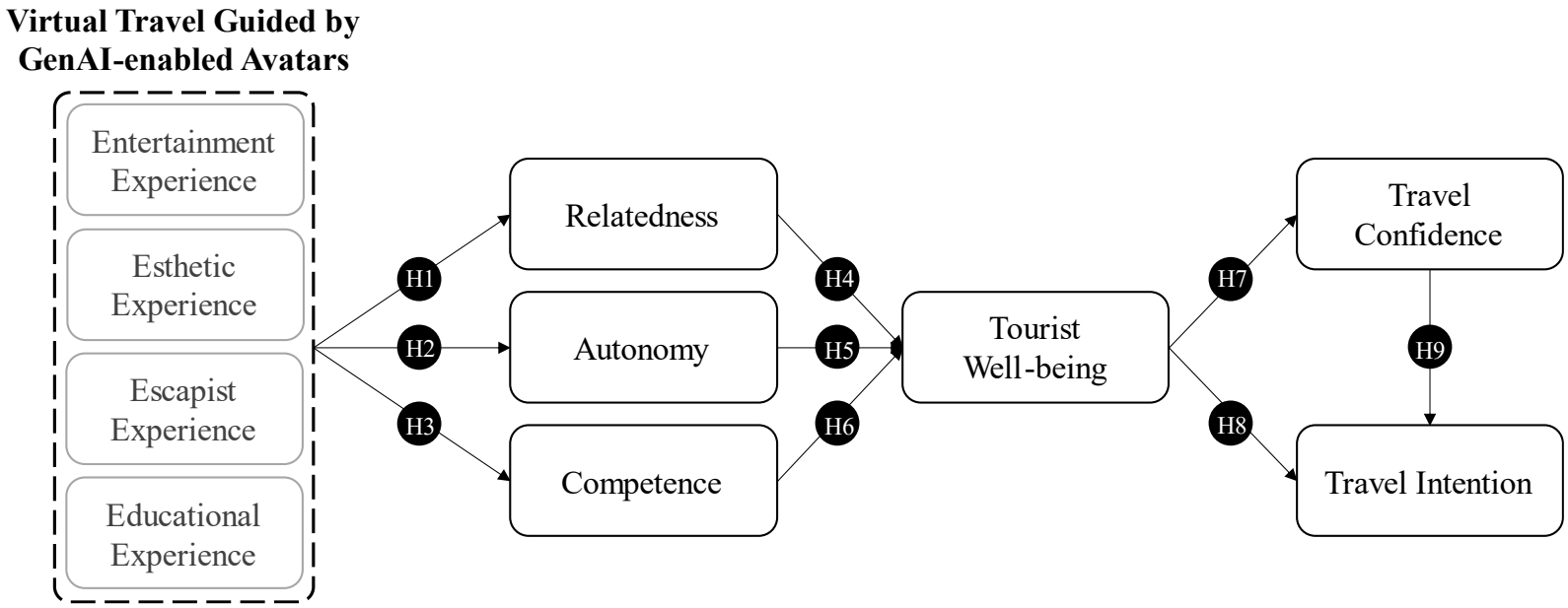

Figure 1 Caption: Conceptual model for this study

Figure 1 Alt Text: 4-layered conceptual model illustrating the relationships between constructs. From left to right, virtual travel guided by GenAI-enabled avatars, comprised of 4 dimensions, is linked to relatedness, autonomy, and competence. These three constructs connect to tourist well-being, which then connects to travel confidence and intention. Finally, there is a link from travel confidence to intention.

Figure 2 Caption: Snapshot of the research prototype
Figure 2 Alt Text: A sunset scene from the virtual travel experience where the female avatar stands next to the beautiful Pont Alexandre III bridge in Paris.

Table 1. Participants' profile

Categories	f	%	Categories	f	%
Gender			***Marriage***		
Male	323	57.8	Married	530	94.8
Female	236	42.2	Widowed	3	0.5
Education			Divorced	10	2.1
High school	133	23.8	Separated	2	0.4
2-year technical college	38	6.8	Never married	17	3
4-year bachelor's degree	239	42.7	***Living alone***		
Master's degree	134	24.0	Yes	324	58.0
Doctorate degree	15	2.7	No	235	42.0
Employment			***Means of living***		
Employed full time	33	5.9	Salary/wages	242	43.3
Employed part-time	440	78.7	Retirement wages/benefits	169	30.2
Unemployed looking for work	7	1.3	Property income	84	15
Unemployed not looking for work	3	0.5	Spouse/child/relative(s) support	62	11.1
Retired	75	13.4	Government/ community subsidy	2	0.4
Others	1	0.2			
Income			***Travel frequency***		
Less than $10,000	28	5	No Travel experience	242	43.3
$10,000 - $19,999	48	8.6	Rarely (once a year or less)	169	30.2
$20,000 - $29,999	42	7.5	Occasionally (2-3 times a year)	84	15
$30,000 - $39,999	47	8.4	Moderately (4-6 times a year)	62	11.1
$40,000 - $49,999	56	10	Frequently (> 6 times a year)	2	0.4
$50,000 - $59,999	83	14.9			
$60,000 - $69,999	22	3.9	***Technology frequency***		
$70,000 - $79,999	62	11.1	Never	0	0
$80,000 - $89,999	32	5.7	Sometimes	141	25.2
$90,000 - $99,999	54	9.7	About half the time	53	9.5
$100,000 - $149,999	67	12	Most of the time	50	8.9
More than $150,000	18	3.2	Always	315	56.4

Table 2: Measurement scales for the constructs

Indicators	M	SD	SK	KU	VIF	L
Virtual Travel Guided by GenAI-enabled Avatars_Entertainment						
(α= 0.714; rho_C = 0.840, CR = 0.716; AVE = 0.636), adopted from Hosany & Witham (2010)						
ENT1. The virtual tour experience is fun.	5.529	1.014	-0.737	0.663	1.412	0.785
ENT2. The virtual tour experience is entertaining.	5.761	1.062	-0.846	0.742	1.338	0.784
ENT3. The virtual tour experience is captivating.	5.902	0.967	-0.942	1.248	1.469	0.823
Virtual Travel Guided by GenAI-enabled Avatars_Esthetics						
(α= 0.808; rho_C = 0.874, CR = 0.812; AVE = 0.634), adopted from Hosany & Witham (2010)						
EST1. The destination presented in virtual tour was visually quite attractive.	5.369	1.084	-0.827	0.741	1.499	0.744
EST2. The virtual tour destination was esthetically pleasing.	5.557	1.189	-0.885	0.812	1.691	0.801
EST3. The landscape presented in virtual tour was in harmony with the destination.	5.571	1.147	-0.941	0.930	1.751	0.816
EST4. The setting of the virtual tour pays close attention to design details.	5.702	1.117	-1.075	1.427	1.774	0.823
Virtual Travel Guided by GenAI-enabled Avatars_Escapism						
(α= 0.762; rho_C = 0.849, CR = 0.769; AVE = 0.585), adopted from Hosany & Witham (2010)						
ESC1. I felt I played a different character in the virtual tour.	5.429	1.091	-0.791	0.733	1.292	0.675
ESC2. During my virtual tour, I really felt that I was in that environment.	5.718	1.108	-0.783	0.398	1.578	0.790
ESC3. The virtual tour experience allows me to escape from my daily routine.	5.642	1.065	-0.863	1.115	1.577	0.800
ESC4. I felt like I was in a different time or place in the virtual tour.	5.821	1.094	-1.102	1.334	1.552	0.788
Virtual Travel Guided by GenAI-enabled Avatars_Education						
(α= 0.840; rho_C = 0.893, CR = 0.841; AVE = 0.676), adopted from Hosany & Witham (2010)						
EDU1. The virtual tour experience has made me more knowledgeable.	5.299	1.153	-1.032	0.969	1.649	0.790
EDU2. I learned a lot from the virtual tour experience.	5.463	1.241	-0.902	0.770	2.003	0.843
EDU3. The virtual tour stimulated my curiosity to learn new things.	5.499	1.255	-1.086	1.127	1.983	0.844
EDU4. The virtual tour was a real learning experience.	5.546	1.244	-1.074	1.142	1.835	0.809

Relatedness

(α= 0.819; rho_C = 0.880, CR = 0.822; AVE = 0.648), adopted from Ahn et al. (2019) and Hong & Ahn (2023)

REL1. I feel a lot of closeness with some places after the virtual tour.	5.416	1.199	-1.094	1.339	1.518	0.750
REL2. The virtual tour makes me feel a lot of closeness with some places.	5.516	1.217	-0.870	0.635	1.812	0.822
REL3. I feel a lot of closeness with others after the virtual tour.	5.676	1.220	-1.065	0.804	1.813	0.827
REL4. This virtual tour makes me feel very close to others.	5.734	1.143	-1.190	1.824	1.792	0.819

Autonomy

(α= 0.801; rho_C = 0.870, CR = 0.802; AVE = 0.626), adopted from Ahn et al. (2019), Hong & Ahn (2023) and Y. Zhang et al. (2019)

AUT1.I feel that the way I enjoy this virtual tour is an expression of myself.	5.605	1.251	-1.188	1.471	1.665	0.800
AUT2. I feel good when l can make choices in virtual tour.	5.623	1.217	-1.109	1.351	1.629	0.801
AUT3. I feel that l had the opportunity to make choices in virtual tourv.	5.565	1.184	-0.944	0.871	1.628	0.797
AUT4. This virtual tour fulfills my true interests and values.	5.565	1.176	-0.923	0.777	1.521	0.766

Competence

(α= 0.741; rho_C = 0.853, CR = 0.752; AVE = 0.659), adopted from Ahn et al. (2019) and Hong & Ahn (2023)

COM1. This virtual tour makes me feel competent.	5.363	1.142	-0.867	0.653	1.349	0.751
COM2. This virtual tour makes me feel capable.	5.571	1.301	-0.975	0.725	1.584	0.847
COM3. This virtual tour makes me feel effective.	5.697	1.169	-1.150	1.355	1.580	0.835

Tourist Well-Being

(α= 0.835; rho_C = 0.890, CR = 0.839; AVE = 0.669), adopted from (Topp et al., 2015)

WEL1. I have felt cheerful and in good spirits.	0.762	0.762	0.762	0.762	0.762	0.762
WEL2. I have felt calm and relaxed.	0.835	0.835	0.835	0.835	0.835	0.835
WEL3. I have felt active and vigorous.	0.835	0.835	0.835	0.835	0.835	0.835
WEL4. My daily life has been filled with things that interest me.	0.838	0.838	0.838	0.838	0.838	0.838

Travel Confidence

(α= 0.804; rho_C = 0.872, CR = 0.805; AVE = 0.630), adopted from Vichiensan et al. (2021)

TCO1. I feel more confident in my travel decisions after the virtual tour.	5.335	1.155	-0.797	0.756	1.473	0.752
TCO2. This virtual tour has boosted my overall confidence in planning and undertaking trips.	5.427	1.218	-0.737	0.327	1.654	0.796
TCO3. I have a greater sense of assurance and certainty in my travel choices after the virtual tour.	5.441	1.222	-0.747	0.329	1.770	0.820
TCO4. I perceive a significant improvement in my travel confidence after the virtual tour.	5.631	1.171	-0.981	1.049	1.664	0.805

Travel Intention

(α= 0.791; rho_C = 0.865, CR = 0.797; AVE = 0.617), adopted from Tussyadiah et al. (2018) and Lacka (2020)

TIN1. I have a strong intention to travel to Paris in the near future.	5.345	1.117	-0.783	0.591	1.335	0.696
TIN2. I am highly motivated to visit Paris and explore its attractions.	5.540	1.195	-0.744	0.361	1.838	0.825
TIN3. I actively seek opportunities to plan a trip to Paris.	5.578	1.121	-0.787	0.449	1.701	0.817
TIN4. I have a clear intention to engage in travel activities specifically in Paris.	5.629	1.110	-0.755	0.642	1.681	0.797

Notes: M = Mean, SD = standard deviation, SK = skewness, KU = kurtosis, L = loading, α = Cronbach's alpha, rho_C = Joreskog's rho, CR = composite reliability, and AVE = average variance extracted

Table 3. Discriminant validity

	Fornell–Larcker Criterion						
Constructs	VTGA	REL	AUT	COM	WEL	TCO	TIN
Autonomy (AUT)	0.791						
Competence (COM)	0.694	0.812					
Relatedness (REL)	0.724	0.717	0.805				
Virtual travel guided by GenAI-enabled avatars (VTGA)	0.67	0.675	0.709	0.694			
Travel intention (TIN)	0.326	0.325	0.353	0.387	0.785		
Travel confidence (TCO)	0.609	0.606	0.612	0.583	0.458	0.794	
Tourist well-being (WEL)	0.72	0.703	0.716	0.662	0.298	0.637	0.818

Table 4. Higher-order confirmatory factor analysis of Virtual Travel Guided by GenAI-enabled Avatars

Indicators	First-order construct	First-order		Higher-order	
		Loading	t	Loading	t
ENT1	Entertainment experience	0.785	32.359	0.853	39.282
ENT2		0.784	34.227		
ENT3		0.823	44.326		
EST1	Esthetic experience	0.744	28.081	0.892	65.474
EST2		0.801	40.381		
EST3		0.816	38.109		
EST4		0.823	44.999		
ESC1	Escapist experience	0.675	17.137	0.872	47.402
ESC2		0.790	36.369		
ESC3		0.800	37.428		
ESC4		0.788	34.192		
EDU1	Educational experience	0.790	30.324	0.868	49.606
EDU2		0.843	52.382		
EDU3		0.844	52.507		
EDU4		0.809	32.729		

Table 5. Hypotheses test

Hypotheses	Regression Coefficient	SD	T	*p*	Result
H1: VTGA → REL	0.808***	0.021	38.613	0.000	Supported
H2: VTGA → AUT	0.769***	0.024	32.455	0.000	Supported
H3: VTGA → COM	0.773***	0.027	28.922	0.000	Supported
H4: REL → WEL	0.298***	0.073	4.058	0.000	Supported
H5: AUT → WEL	0.352***	0.064	5.48	0.000	Supported
H6: COM → WEL	0.28***	0.075	3.758	0.000	Supported
H7: WEL → TCO	0.737***	0.027	27.568	0.000	Supported
H8: WEL → TIN	-0.03	0.069	0.421	0.674	Not supported
H9: TCO → TIN	0.581***	0.06	9.704	0.000	Supported

Note(s): SD=standard deviation, T=T statistics, *p*=p-value (*P≤0.05, **P≤0.01, ***P≤0.001)