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Age-Based Differences in Habitual and Cognitive Drivers of AI Tool Adoption in Purchasing

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Introduction

Artificial intelligence (AI) is gaining momentum in the consumption sector as consumers use these systems to search for information and support their buying decisions (Allal-Chérif et al., 2021). Generative AI apps have gained popularity, and users interact with them by posing questions and providing prompts (Bright et al., 2025; Hermann & Puntoni, 2024). This adoption of AI is evolving relatively faster than in the case of previous digital technologies (Dwivedi et al., 2023), and it could be attributed to the anthropomorphic nature of generative AI that allows human-like communication (Gursoy et al., 2019; Li & Sung, 2021; Obrenovic et al., 2024).

Anthropomorphism distinguishes AI from the majority of other digital systems (Roesler et al., 2021; Wu et al., 2025). Because traditional adoption models (TAM, UTAUT) lack human-like elements, researchers rely on the Artificial Intelligence Device Use Acceptance (AIDUA) model proposed by Gursoy et al. (2019). The AIDUA framework describes AI adoption as a multi-process in which anthropomorphism affects performance and effort expectancy, which, in turn, determine attitudes and adoption intentions (Ma & Huo, 2023; Wang et al., 2025).

However, as generative AI tools become available in everyday activities, their use shifts from novelty-driven interaction to routinized behaviour (Wu et al., 2025). In this context, habit may emerge as an additional mechanism influencing adoption (Venkatesh et al., 2012; Wu et al., 2025). Research evidence shows that when customers form a routine of using a technology, it becomes a habit that influences purchase decisions (Kašparová, 2024; Tak & Panwar, 2017). However, consumer responses to AI may vary across demographic groups (Alkadi, 2025), since younger and higher-socioeconomic-status consumers generally show more positive views and higher adoption (Gantulga & Baljinnyam, 2025; Méndez-Suárez et al., 2023).

Based on this, the current study explores whether the effects of habit and cognitive evaluation on intention to use AI tools differ between younger and older consumers. Using structural equation modelling and multi-group analysis, we examine these relationships within an extended AIDUA framework.

Hypotheses and Methodology

Anthropomorphism influences performance expectancy and effort expectancy (Gursoy et al., 2019), which then shape cognitive attitude and ultimately intention to use (Ma & Huo, 2023). Performance expectancy, effort expectancy, and cognitive attitude mediate the relationship between anthropomorphism and adoption intentions (Balakrishnan & Dwivedi, 2021; Martin et al., 2020). Therefore:

H1: Anthropomorphism has a positive indirect effect on intention to use an AI tool through the serial mediation of performance expectancy and cognitive attitude.

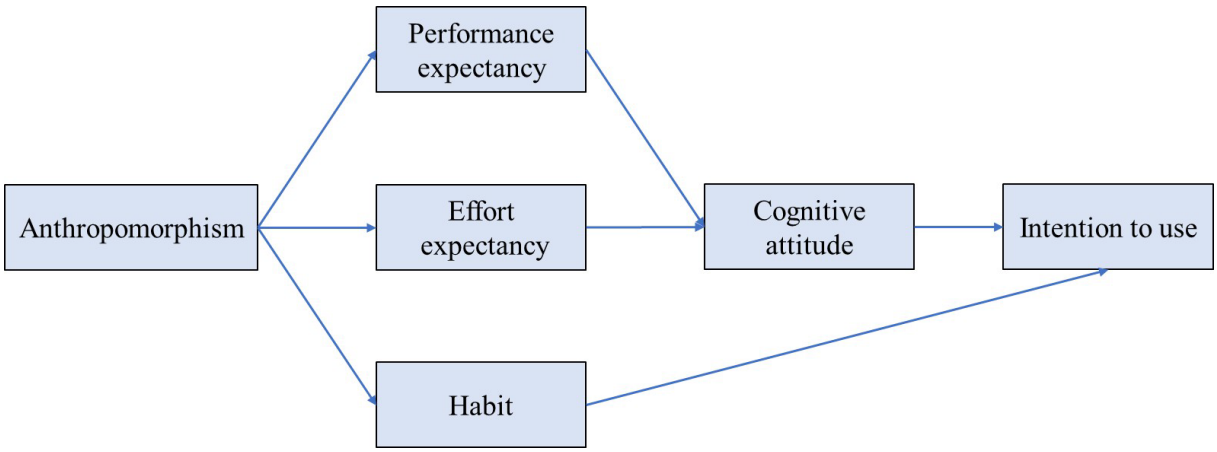
H2: Anthropomorphism has a positive indirect effect on intention to use an AI tool through the serial mediation of effort expectancy and cognitive attitude.

While anthropomorphism positively affects adoption intentions through mediators like usefulness and trust (Blut et al., 2021; Lee & Chen, 2022), habit remains underexplored. However, when customers form routines around technology, habit exerts significant influence on behaviour (Kašparová, 2024; Tak & Panwar, 2017). Therefore:

H3: Anthropomorphism positively influences intention to use AI tools through the mediating role of

habit.
Technology adoption processes vary across age groups (Alkadi, 2025; Gantulga & Baljinnyam, 2025). Younger consumers may rely more on automatic, habitual processes, while older consumers may depend more on deliberate cognitive evaluation. Thus:
H4a: The relationship between habit and intention to use AI tools differs between younger and older consumers, with a stronger effect for younger consumers.
H4b: The relationship between cognitive attitude and intention to use AI tools differs between younger and older consumers, with a stronger effect for older consumers.

Figure 1. Research model



Data were collected in Lithuania via an online survey that included a simulated mobile phone purchase scenario using ChatGPT. All constructs were measured using 7-point Likert scales adapted from validated instruments: anthropomorphism, performance expectancy, and intention to use AI (Gursoy et al., 2019); effort expectancy and habit (Venkatesh et al., 2012); and cognitive attitude (Ma & Huo, 2023). Items were slightly adapted to fit the purchasing context.
The final sample comprised 304 respondents (38.2% male, 61.8% female). Age distribution was 56.3% aged 18–30 years and 43.8% aged 31 years or older. Data were analysed using SmartPLS4, applying a consistent PLS algorithm and multi-group analysis (PLS-MGA) to compare age groups. PLS-SEM was a better fit here than regression-based approaches like PROCESS, since we're working with latent variables and serial mediation.

Analysis and Discussion

The model demonstrated satisfactory reliability with Cronbach's alpha (0.892–0.945) and composite reliability (0.933–0.960). Average variance extracted (0.776–0.858) confirmed convergent validity. Discriminant validity was established as all HTMT values remained below
0.90. Common method bias was not a concern (highest inner VIF among factors = 1.747). Because PLS-SEM is used, traditional covariance-based fit indices (CFI, TLI) are not applicable; SRMR = 0.055 indicates acceptable fit.
To test the hypotheses, bootstrapping (5000 subsamples) was performed. The model explained 62.3% of the variance in willingness ($R^2 = 0.623$). Anthropomorphism indirectly influenced willingness to use AI through performance expectancy and cognitive attitude (H1: $\beta = 0.147$, $p < 0.001$) and through effort expectancy and cognitive attitude (H2: $\beta = 0.046$, $p = 0.001$). However, the indirect path via habit (H3) was the strongest ($\beta = 0.234$, $p < 0.001$).
To test for age-based differences, a PLS-MGA was conducted. For younger consumers (18– 30), habit exerted a strong effect on willingness ($\beta = 0.469$, $p < 0.001$), while cognitive attitude was also significant ($\beta = 0.449$, $p < 0.001$). For older consumers (31+), cognitive attitude was the dominant factor ($\beta = 0.747$, $p < 0.001$), whereas the impact of habit was weaker ($\beta = 0.186$, $p = 0.011$). PLS-MGA confirmed these differences between groups were statistically significant. The effect of habit on willingness was significantly stronger for the younger group ($\Delta\beta = 0.283$, $p = 0.011$). Conversely, the effect of cognitive attitude on willingness was significantly stronger for the older group ($\Delta\beta = 0.298$, $p = 0.010$). These

support H4a and H4b.

Table 1. Summary of studies, conditions, hypotheses, and results.

Conditions	Hypothesis	Dependent Variable	Proposed Effect	Result
Full sample (N=304)	H1: Anthro→ PE → Cog_Att → Willing	Willingness to use AI	Positive indirect effect	Supported
Full sample (N=304)	H2: Anthro→ EE → Cog_Att → Willing	Willingness to use AI	Positive indirect effect	Supported
Full sample (N=304)	H3: Anthro→ Habit → Willing	Willingness to use AI	Positive indirect effect	Supported
Younger (18–30) vs. Older (31+)	H4a: Habit → Willing	Willingness to use AI	Differs between age groups	Supported
Younger (18–30) vs. Older (31+)	H4b: Cog_Att → Willing	Willingness to use AI	Differs between age groups	Supported

Discussion and Conclusion

This study expands the AIDUA model in two significant ways. First, it identifies habit as a significant mediator between anthropomorphism and the intention to use AI tools. While Gursoy et al. (2019) examined only performance and effort expectancy, the current findings indicate that habit has become a more influential predictor than performance expectancy and effort expectancy. This follows prior research that has determined that habit is a powerful predictor of technology use (Kašparová, 2024; Zhang et al., 2023; Tak and Panwar, 2017).

Second, these relationships are moderated by age. Among younger consumers (18-30), habit and cognitive attitude are equally significant, indicating partly routinized adoption. Among older consumers (31+), cognitive attitude is stronger, whereas habit is less important, indicating that these consumers make more deliberate choices. Both differences are significant.

These results are consistent with those of Zhang et al. (2023), who observed that habit formation depends on demographics. This is elaborated in our study, which demonstrates that both pathways are moderated by age. Whereas AIDUA explains initial acceptance through cognitive appraisals, habit becomes critical for sustained use. This suggests that future studies must include habit and demographic moderators, such as age. Studies may also examine whether cultural factors or gender moderate the link between anthropomorphism and habit formation.

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AI-Enabled Service Recovery in B2B Markets: The Role of Stewardship in Family-Owned and Corporate Firms

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Type of Manuscript: Extended Abstract

Keywords: B2B; Artificial Intelligence; Family Business.

The B2B economy relies heavily on SMEs, many family-owned, competing through relationships, knowledge, and reputation linked to ownership (Murphy & Sashi, 2018). AI is transforming customer care with conversational agents and analytics, promising lower costs and scalable service (McKinsey & Co., 2025). However, communication mode impacts B2B transactions (Ordanini, 2005). AI may boost efficiency but could weaken relational signals, accountability, and discretion crucial for relationship continuation, especially in family firms where relational governance is key (Casoli et al., 2025). Most AI service recovery research focuses on resource-rich firms and B2C, offering limited insights into B2B relations based on trust and norms.

This study develops a stewardship-based framework for AI service recovery in B2B markets. Family-owned firms retain active family control, while corporate firms separate ownership and rely on professional managers (Cirillo et al., 2019; Cheffin, 2018). Service failures increase scrutiny of credibility and governance cues, which are crucial for trust (Akrout et al., 2017).

Building on stewardship and B2B research, we define recovery stewardship assurance (RSA) as a perception with three dimensions: accountable authority, relational sacrifice, and continuity signaling. RSA in post-failure interactions reduces uncertainty, boosts trust, fosters engagement, and supports relationship continuity.

This study tests a framework using a between-subjects vignette design comparing a family- owned and a corporate supplier. U.S.-based respondents with B2B experience were recruited via Cloud Research following quality protocols (Majima et al., 2017; Stagnaro et al., 2024). After screening, CAPTCHA, and attention checks, the final sample included 241 respondents.

Participants read a delivery-delay vignette with organizational form varied but recovery process constant: an automated case number issued via software, then contact with a human representative. Multi-item scales measured RSA (Ivens, 2005; Lumpkin & Brigham, 2011; Casoli et al., 2025), trust (Selnes & Gønhaug, 2000), engagement (Moriuchi & Takahashi, 2022), and relationship continuance (Rauyruen & Miller, 2007). The model was tested with multi-group structural equation modeling. The configural model had acceptable fit, metric invariance was supported, and common method variance was minor (Podsakoff et al., 2003; Fuller et al., 2016).

The results support the proposed framework. RSA positively predicted continuance intention in both organizational contexts, with a stronger effect in family-owned firms ($\beta = .717$, $p = .001$) than in corporate ones ($\beta = .512$, $p = .010$). RSA also strongly predicted trust in both groups ($\beta = 1.118$, $p < .001$ for family-owned; $\beta = 1.100$, $p < .001$ for corporate). Trust, in turn, positively predicted engagement, again more strongly in family-owned firms ($\beta = .781$, $p < .001$) than in corporate firms ($\beta = .704$, $p < .001$). Engagement then positively influenced continuance intention, more so in family-owned firms ($\beta = .653$, $p = .010$) than in corporate firms ($\beta = .395$, $p < .001$). Overall, findings suggest that stewardship serves as a meaningful governance cue across ownership structures, with the trust-to-engagement-to-continuance pathway more pronounced in family-owned B2B relationships. These insights shift the focus of B2B service recovery from AI as merely an efficiency tool to AI-enabled recovery as a relational governance issue. They identify family ownership as a key boundary condition affecting how stewardship cues are interpreted and translated into trust, engagement, and relationship continuity. Managers should recognize that automation is not necessarily relationally neutral; recovery systems should maintain visible accountability and stewardship cues, especially in family-owned contexts where trust-based engagement is critical for relationship continuity.

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AI-Powered Enhancement of Tourist Experiences through Personalization: A Bibliometric Study

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Type of manuscript: Extended abstract

Keywords: artificial intelligence; tourism; personalization.

Artificial intelligence (AI) is increasingly transforming tourism by enabling personalization, operational efficiency, and data-driven decision-making across the customer journey (Samala et al., 2022; Samara et al., 2020). At the same time, the rapid expansion of AI-related tourism research has generated a fragmented knowledge base spanning technical development, customer experience, and governance, which limits synthesis and actionable guidance (Fouad et al., 2024). This study addresses that gap by mapping the intellectual structure of AI-driven personalization in tourism and identifying key themes, maturity patterns, and future research priorities (Doborjeh et al., 2022).

A bibliometric analysis was conducted using peer-reviewed journal articles indexed in Web of Science and Scopus between 2014 and 2024, drawing on the broad coverage and complementary indexing of these databases (Zhu & Liu, 2020). To ensure consistency, comparable keyword combinations and topic fields related to AI, tourism, and personalization were applied (Zhang et al., 2016). After removing duplicates and checking for relevance, the final dataset comprised 185 articles (Samara et al., 2020). Keyword co-occurrence analysis was performed in VOSviewer to identify thematic clusters and visualize conceptual proximity (Doborjeh et al., 2022). To improve comparability, a thesaurus-based standardization procedure was applied to reduce inconsistent terminology (Porter, 2019). In addition to thematic cluster analysis, overlay visualization based on Average Publication Year (APY) was used to interpret thematic recency and maturity, while cross-cluster connectivity was examined to identify fuzzy boundaries and bridging topics (Yan & Zhiping, 2023).

The findings reveal seven thematic clusters that describe how AI-driven personalization is evolving in tourism (Fouad et al., 2024). A Generative AI and Smart Tourism stream emphasizes conversational systems and smart destination support, including the growing role of tools such as ChatGPT in travel planning and interactive assistance (Wong et al., 2023). A Recommender Systems and Personalization stream focuses on machine learning and hybrid architectures that tailor suggestions to tourist preferences while also raising concerns about robustness and fairness in different contexts (Doborjeh et al., 2022). A Data Handling and Predictive Systems stream forms the infrastructure backbone of personalization, underscoring the importance for reliable data pipelines and accountable governance (Gong & Schroeder, 2022). A Social Media and Immersive Technologies stream highlights AR/VR-enabled experience augmentation and digital engagement (Fan et al., 2022). Additional clusters address Customer Experience and Tourism Services, Knowledge Management and Data-Driven Insights, and Hospitality and Innovation, reflecting a shift from isolated tools toward integrated, service-oriented AI ecosystems (Samala et al., 2022).

The APY overlay indicates clear differences in thematic maturity (Yan & Zhiping, 2023). Customer experience and hospitality innovation show the strongest recent momentum, suggesting active experimentation in applied service settings (Samala et al., 2022). Data handling and knowledge management occupy intermediate positions, consistent with the consolidation of infrastructure and governance needed for reliable deployment (Gong & Schroeder, 2022). Recommender systems and generative AI appear more established on average, although they continue to evolve through integration with conversational interaction and experience design (Wong et al., 2023). Cross-cluster links show persistent overlaps between technical and experiential streams, with bridging topics such as

personalization, chatbots, and immersive interfaces connecting multiple themes (Fan et al., 2022).

This study contributes by linking thematic mapping with temporal maturity signals to provide a structured roadmap for future research (Doborjeh et al., 2022). The novelty of the study lies in combining cluster analysis with APY-based maturity interpretation to move beyond static mapping and offer stage-appropriate guidance (Yan & Zhiping, 2023). For emerging areas, future research should prioritize pilot implementations and methodological evaluation in real-world contexts (Doborjeh et al., 2022). For more established areas and the data layer, attention should shift toward governance, benchmarking, and transparency, particularly in relation to privacy and accountability in smart tourism ecosystems (Gong & Schroeder, 2022). Sustainability also remains underdeveloped, and future studies should build measurable frameworks connecting AI adoption to environmental outcomes while exploring transparent reporting approaches such as blockchain-enabled traceability (Erol et al., 2022). These directions can help researchers and practitioners advance more responsible and effective AI integration in tourism (Samala et al., 2022).

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Augmenting Authenticity or Disrupting Tradition? The Dual Effect of Augmented Reality on Food Evaluation

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Type of manuscript: Extended abstract

Keywords: augmented reality; perceived authenticity; gastronomy.

Augmented reality (AR) is transforming restaurant menus by enabling consumers to visualize three-dimensional (3D) models of dishes overlaid onto their real environment before ordering (Barta et al., 2025; Flavian et al., 2019). Prior research confirms that AR enhances food desirability through enriched mental simulation (Fritz et al., 2023), reduces cognitive dissonance (Barta et al., 2023a), and improves decision comfort (Barta et al., 2023b). Despite these documented benefits, two important gaps remain. First, no study has examined how AR interacts with consumers' familiarity with the dish. Second, it remains unknown whether AR enhances or erodes perceived authenticity, a construct central to gastronomy and food tourism (Sims, 2009; Kuo and Helm, 2025). These gaps motivate three research questions: (RQ1) Does AR increase mental simulation and reduce perceived authenticity? (RQ2) Does dish familiarity moderate these effects? (RQ3) Through what mechanisms does AR ultimately shape desire to eat and willingness to pay?

To address these questions, we propose the concept of the technology-authenticity paradox in gastronomy: AR simultaneously activates a sensory enhancement force that increases desire to eat, and an authenticity disruption force that may undermine the perceived genuineness of culturally rooted dishes. Drawing on mental simulation theory (Elder and Krishna, 2012) and authenticity theory (Wang, 1999; Lee et al., 2024), we develop a dual-pathway mediation model in which mental simulation and perceived authenticity serve as parallel mechanisms linking AR exposure to consumer responses, with dish familiarity as the key moderator. The research employs a 2 (visualization format: AR vs. 2D image) x 2 (dish type: familiar vs. unfamiliar) between-subjects laboratory experiment.

The research model proposes a broader set of hypotheses, of which the initial ones are developed here given the scope of this extended abstract (see Figure 1). H1 and H2 formalize the direct effects of AR on the two proposed mediators, replicating and extending prior literature. H3a and H3b, the most novel contributions of this work, introduce dish familiarity as a moderator that shapes the magnitude and direction of those effects. Regarding H1, mental simulation involves cognitively rehearsing a sensory experience before it occurs (Elder and Krishna, 2012). AR is particularly effective at triggering this process: by placing a life-size 3D dish model in the consumer's actual physical space, it bridges the imagination gap between visualization and consumption (Hilken et al., 2022). Unlike static 2D photographs, AR activates cross-modal sensory transfers where vivid visual stimuli trigger gustatory and olfactory anticipation (Petit et al., 2019), heightening food desirability.

H1. AR model (vs. 2D image) increases mental simulation.

Regarding H2, in gastronomy perceived authenticity is an emergent perception shaped by the coherence of contextual signals such as ingredients, preparation methods, and dining atmosphere (Kuo and Helm, 2025). Its perceptual core includes uniqueness, originality, localness, and traditionality (Ab-Latif et al., 2024). A high-technology visualization format may reinforce uniqueness while undermining perceptions of traditionality and localness, consistent with evidence showing that service robots reduce brand trust in traditional restaurants (Cheng et al., 2026) and that technological signals can generate inauthenticity perceptions in culturally loaded contexts (Mackay et al., 2025).

H2. AR model (vs. 2D image) reduces perceived authenticity.

The most novel hypotheses of this work concern the moderating role of dish familiarity. Familiarity implies accumulated experience, rich cognitive schemas, and well-formed expectations about how a dish should look and be presented (Schwarz, 2004). Two complementary mechanisms follow. First,

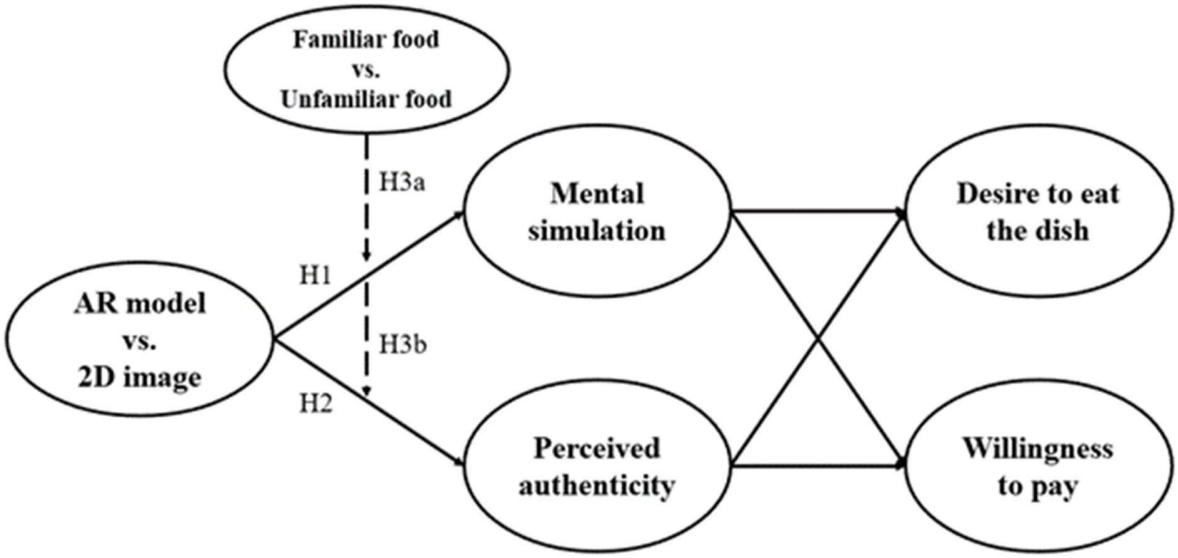
AR's simulation benefit should be especially valuable for unfamiliar dishes, where consumers lack prior mental representations and rely more heavily on external cues to fill the imagination gap (Min and Schwarz, 2022). For familiar dishes, existing representations reduce the incremental contribution of AR to simulation. Second, the authenticity penalty is expected to be stronger for familiar dishes, where the technologized presentation creates a schema-incongruence effect by diverging from established expectations. Unfamiliar dishes lack such consolidated schemas, making authenticity disruption less salient.

H3a. Dish familiarity moderates the effect of AR on mental simulation, such that the positive effect is stronger for unfamiliar dishes than for familiar dishes.

H3b. Dish familiarity moderates the effect of AR on perceived authenticity, such that the negative effect is stronger for familiar dishes than for unfamiliar dishes.

Both mental simulation and perceived authenticity are proposed as parallel mediators linking AR exposure to desire to eat and willingness to pay, constituting a moderated dual-pathway mediation model.

Figure 1. Research model proposed



Notes: solid lines: direct effects; dashed lines: moderation effects.

To test the proposed model, a 2 (AR vs. 2D image) x 2 (familiar vs. unfamiliar dish) between-subjects factorial experiment will be conducted in a controlled laboratory. Stimulus selection follows a multi-phase protocol. Sixteen candidate dishes (eight familiar, eight unfamiliar within participants' cultural context) are identified through expert consultation and gastronomy guides. An independent pre-test (n = 30) assesses familiarity, visual attractiveness, perceived healthiness, and ingredient liking. Three to four dishes per category are selected to maximize external validity.

For the AR condition, high-fidelity 3D models are developed using photogrammetry and displayed through a web-based AR application on a tablet, allowing participants to view life-size dish models superimposed on the table. In the 2D condition, professional photographs of the identical dishes are shown on the same device. Both conditions present identical textual information (name, description, ingredients, price) to isolate visualization format as the sole manipulation.

This research makes three contributions. First, it establishes dish familiarity as a theoretically grounded boundary condition for AR effectiveness in food contexts, extending prior work on moderators such as product type (Hilken et al., 2022) and brand congruence (Han et al., 2026). Second, it provides the first empirical test of the technology-authenticity paradox in a gastronomy setting, offering a parsimonious account of when and why AR helps or hinders consumer response in culturally loaded contexts (Kuo and Helm, 2025; Cheng et al., 2026). Third, the dual-pathway mediation model captures how AR simultaneously activates sensory and cultural evaluation processes, going beyond prior single-mediator accounts centered on mental simulation (Fritz et al., 2023) or cognitive dissonance (Barta et al., 2023a).

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Co-Constructing the Self: A Conceptual Framework for Consumer–Robot Identity Mirroring

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Type of manuscript: Extended abstract

Keywords: anthropomorphic robots; robotoid humanness; consumer identity; sensemaking; human–robot interaction; service encounters.

Introduction

HRI research has optimized for functional outcomes (efficiency, usability, trust) while neglecting how repeated anthropomorphic robot encounters reshape consumers' self-concept. This paper closes that gap.

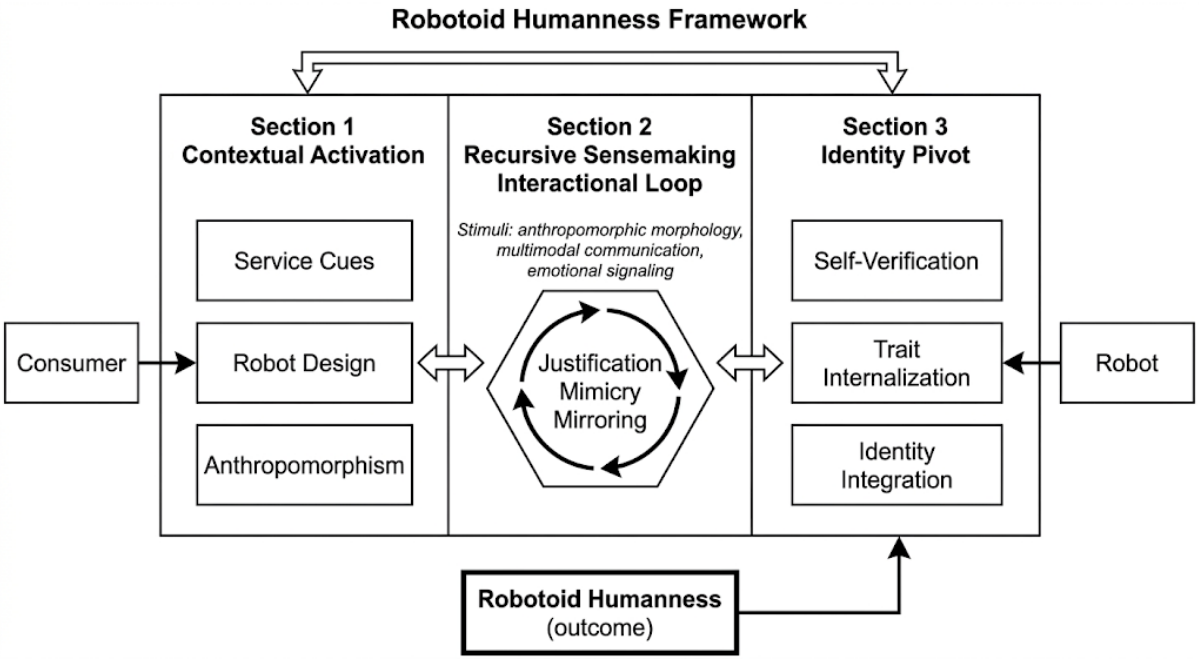
We introduce robotoid humanness, a bidirectional identity-mirroring phenomenon in which consumers internalize robot-associated traits (predictability, efficiency, and emotional regulation) into their self-concept through repeated service interactions and develop a three-phase framework with five theoretical propositions. Applying self-concept, sensemaking, and HRI theory to high-intangibility contexts (hospitality, retail, healthcare, and education), we reposition consumer–robot encounters as dynamic sites of reciprocal identity construction rather than mere functional exchanges.

Theoretical Foundations

The theoretical foundation integrates three primary streams. First, self-concept theory views identity as dynamic, socially constructed, and enacted through interaction with social actors and consumption objects (Belk, 2013; Schouten, 1991). Second, sensemaking theory explains how individuals interpret ambiguity and novelty to maintain narrative coherence, particularly when social roles or scripts are disrupted (Weick, 1995). Encounters with anthropomorphic robots often cause such disruption, prompting consumers to engage in identity-relevant interpretation and role negotiation. Third, HRI and anthropomorphism research shows that human-like appearance, social presence, and adaptive behaviors lead consumers to attribute intentionality and relational meaning to robots (Nass & Moon, 2000; Breazeal, 2004; Song & Kim, 2022). *Figure 1* illustrates how these three theoretical streams feed into the framework's three phases.

This study's abductive conceptual model development approach is particularly suited for theorizing emerging phenomena where empirical observation outpaces theory. Following three abductive steps: (1) identifying recurring HRI patterns in the literature (mimicry, personalization, and emotional simulation); (2) mapping these against self-concept and sensemaking theory; and (3) iterating until theoretical saturation, we derived five propositions with clear empirical scope.

Figure 1. The robotoid humanness framework (Source: Developed by the authors)



Conceptual Framework

The robotoid humanness framework conceptualizes the service encounter as a recursive identity-mirroring space comprising three interrelated phases. *Contextual Activation* involves service environment cues and robot design features establishing conditions for consumers to interpret robots as social agents rather than tools. *Recursive Sensemaking* captures the interactional loop where consumers interpret adaptive robot behaviors (e.g., mimicry, personalization, empathetic feedback) as socially meaningful signals. *The Identity Pivot* phase involves mirroring as a self-verification mechanism: when robots reflect consumer traits, competencies, or emotions, they validate self-meanings. Through repeated encounters, these reflections are incorporated into the consumer's self-concept, producing robotoid humanness as a blended identity where human and robot traits converge.

The framework applies to high-intangibility service environments featuring anthropomorphic robots in repeated social interaction. Integrated machines and task-oriented technologies where identity effects are minimal are excluded from the framework's scope. The framework applies exclusively to fully anthropomorphic robots in high-intangibility, repeated-interaction service contexts; task-oriented or integrated technologies where identity effects are minimal are excluded. This boundary sharpens conceptual clarity and facilitates empirical operationalization.

Propositions

Drawing on self-concept, sensemaking, mimicry, and anthropomorphism theories, five propositions examine the relationship between consumers and humanoid robots in service settings.

P1: *Humanoid robots act as mirrors that intensify the salience of consumers' self-concepts through adaptive interaction* (Belk, 2013). This proposition is most testable via longitudinal survey: measure self-concept salience before/after repeated robot encounters.

P2: Human–robot interaction activates sensemaking processes that prompt consumers to reinterpret their self-roles in robot-mediated service contexts (Weick & Weick, 1995).

P3: *Adaptive robot personas drive reciprocal identity construction through ongoing adjustment between consumer and robot* (Chang et al., 2023). This proposition is most testable via longitudinal survey: measure identity congruence across multiple robot interaction sessions.

P4: Identity mirroring has ethical and psychological consequences, as robotic affirmation may reinforce or destabilize self-esteem depending on consumer vulnerability (Mende et al., 2019; El Halabi & Trendel, 2024). This proposition's vulnerability boundary conditions merit priority in experimental work.

P5: Robotoid humanness emerges as consumers internalize robot-like traits through mimicry, resulting in a hybrid self-concept (Wykowska, 2021).

Conclusions

This conceptual model advances HRI and consumer research by reframing service robots as active relational agents in consumer identity work, extending beyond traditional functional outcomes. Robots' anthropomorphic cues and social presence can affirm consumers' competence and digital fluency, fostering empowerment. However, this identity-mirroring process also raises ethical concerns related to overdependence, reduced autonomy, and identity echo chambers, particularly for vulnerable individuals. Consumers with fragile self-esteem may become overly reliant on robotic validation, potentially destabilizing their identity. Responsible service robot design must therefore balance personalization and mimicry with safeguards that protect consumer well-being and autonomy. Robotoid humanness offers a foundation for future empirical work examining identity formation in human–robot service encounters. This framework reframes service robots as active relational agents in consumer identity work, a contribution that extends well beyond conventional functional outcomes. The ethical dimension is its sharpest differentiator: identity mirroring can empower consumers by affirming digital fluency and competence, but it can equally destabilize those with fragile self-esteem, foster overdependence on robotic validation, and create identity echo chambers that insulate consumers from human social feedback. Responsible robot design must, therefore, build in safeguards (transparency cues and autonomy-preserving interaction limits) proportionate to consumer vulnerability. Of the five propositions, P1 and P3 are most immediately testable via longitudinal survey designs, while P4's vulnerability boundary conditions merit priority in experimental work. Robotoid humanness offers both a theoretical foundation and a concrete research agenda for identity formation in human–robot service encounters.

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Coloring the Future: Social Media and the Emotional Construction of a Non-Existent City

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Type of manuscript: Extended abstract

Keywords: smart city branding; social media communication; visual storytelling.

How do you tell the story of a city that has no memories, no people, and no physical presence, only a project waiting to become a reality? Unlike existing cities, which must navigate communication strategies intertwined with physical constraints, urban heritage and socio-political narratives, non-existent cities have the unique opportunity to craft their identity from scratch. This offers unprecedented possibilities for strategic storytelling, branding and emotional positioning, unconfined by the limitations of material reality.

In the era of social media, this process has gained even more momentum. Digital platforms have evolved beyond mere promotional tools to become active spaces where places are continuously constructed, negotiated, and experienced (Kietzmann et al., 2011; Yuan et al., 2020a). Rather than simply representing cities, social media enables the translation of visions, projects, and future developments into accessible and emotionally engaging narratives (Marchesani et al., 2026; Marchesani & Testa, 2026; Molinillo et al., 2019). In doing so, communication increasingly shifts from the city as a physical entity to the ways in which people interpret, imagine, and emotionally connect with it. Through images, aesthetics, and storytelling, social media communicate what a city is, but also what it could become, shaping expectations, meanings, and symbolic associations even before any physical experience takes place (J. Yu & Egger, 2021; Yuan et al., 2020b).

While existing research has explored how actual cities use social media to shape and promote their image (Giglio et al., 2019; Molinillo et al., 2019; Mossberger et al., 2013; Zhou & Wang, 2014), little attention has been directed towards how a city that does not yet exist communicates itself to the world. To fill this gap, this chapter examines NEOM, a smart city project in Saudi Arabia, planned with a 2030 timeline. NEOM combines a structured digital presence with symbolic physical elements such as a professional football team and a university. However, it is not a city in the traditional sense; its "place" is primarily constructed through images and imagination.

Building on this perspective, this study shifts attention from what is communicated to how it is visually experienced, by focusing on the role of color as a fundamental driver of perception. Colors represent one of the most immediate and powerful visual cues in digital communication, capable of influencing how places are perceived even before conscious interpretation occurs. According to color-in-context theory proposed by Elliot & Maier (2007), the meaning and psychological impact of colors are not fixed but depend on the context in which they are embedded. In the case of destinations, and particularly non-existent ones, colors acquire symbolic meaning by interacting with narratives of innovation, sustainability, and future-oriented imaginaries. To understand how these visual cues translate into emotional responses, this study draws on the valence–arousal model of affect (Russell, 1980), which conceptualizes emotions along two core dimensions: valence (positive versus negative) and arousal (high versus low activation). In this perspective, colors function as pre-cognitive affective stimuli that position a destination within an emotional space, shaping how it is felt rather than simply how it is understood (Plutchik, 1980).

Despite the growing body of research on visual communication and destination image, little attention has been paid to the role of color as a structured, pre-cognitive driver of place perception (Kumari et al., 2020; C. Yu et al., 2020; J. Yu & Egger, 2021), particularly in contexts where the destination does not yet exist. This study addresses both a theoretical and a practical gap. From a theoretical perspective, it extends existing frameworks by applying color-based emotional processing to the construction of

"non-places" moving beyond traditional analyses focused on experienced destinations. From a practical perspective, it examines one of the first large-scale urban projects that is being communicated before being built, offering a unique opportunity to understand how visual strategies can be deliberately designed to shape perception, expectation, and emotional engagement in advance. In doing so, this research provides insights into how emerging and future destinations can strategically leverage color to organize their identity and influence how they are imagined by global audiences.

We analyzed a dataset of 200 of the most engaging Instagram posts from NEOM's official account to investigate how the city's identity is visually constructed through color. To support this analysis, we developed and trained an Artificial Intelligence-based tool called AI Detect_Color, which integrates DALL·E image generation with automated visual analysis. The tool systematically extracts dominant color palettes from each image, identifying the relative presence and distribution of colors based on a predefined classification scheme grounded in color–emotion literature. Building on color-in-context theory (Elliot & Maier, 2007), the valence–arousal model of affect (Russell, 1980), and Plutchik's (1980) theory of basic emotions, colors are mapped according to their emotional positioning, enabling the interpretation of visual content in terms of valence and arousal. This approach allows us to move beyond descriptive visual analysis and to capture how color functions as a pre-cognitive mechanism shaping perception.

Our preliminary findings reveal that NEOM's communication relies on a strategically curated color palette combining cool tones such as blue and green with neutral and desaturated hues including beige, white, and gray. These configurations evoke emotional responses associated with calmness, sustainability, futurity, and controlled innovation. The visual narrative is characterized by a balance between minimalism and aspiration, positioning NEOM not only as a future city but as a symbolic space of possibility. Rather than being presented as a destination to be experienced, NEOM emerges as an idea to be imagined and emotionally embraced.

This study contributes to the literature on social media communication, visual storytelling, and smart city branding by introducing a color-based analytical framework to understand how urban futures are constructed before their physical realization. It demonstrates that color operates as a key organizing mechanism in shaping how non-existent destinations are perceived. Ultimately, the findings suggest that social media does not simply represent cities but actively participates in building them through emotionally charged visual narratives.

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Color Psychology in AI Advertising: Emotional Impact and Inclusivity for Color Vision Deficiency

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Type of manuscript: Extended abstract

Keywords: AI advertising; color vision deficiency; emotional response; emotional response.

Color plays a central role in shaping consumer perception, emotional response, and behavior in advertising. It is often the first element people notice and use to interpret a brand or message. While color psychology has been widely studied in traditional advertising, less attention has been given to how color functions in AI-generated advertisements. At the same time, how individuals with color vision deficiency (CVD) experience advertising visuals remains largely overlooked.

This study builds on the Color-in-Context theory (Elliot & Maier, 2014), which suggests that the meaning and impact of color depend on its context. In this study, context is reflected not only in the design itself, but also in how it is produced and perceived, including whether the advertisement is AI-generated or human-designed, and whether it is viewed by individuals with typical color vision or with color vision deficiency. The study examines how color in AI-generated and human-designed advertisements shapes consumer perception and emotional response, while also exploring inclusivity for individuals with red-green color vision deficiency.

An exploratory qualitative design was adopted using in-depth interviews. The study included two groups: 15 advertising and design experts and 25 consumers, including 10 individuals with CVD. Participants were exposed to AI-generated and human-designed versions of the same advertisement, followed by open-ended questions on emotional response, brand perception, and interpretation. The data were analyzed using thematic analysis.

The findings show that color functions as a key communication cue, shaping attention, meaning, and emotional response. AI-generated advertisements were often perceived as visually clearer, with stronger contrast and more distinct color palettes. This made them easier to interpret, particularly for individuals with CVD. However, these advertisements were also described as less authentic and less emotionally engaging. In contrast, human-designed advertisements were more emotionally impactful and relatable, mainly due to storytelling and human presence.

These findings highlight a clear trade-off between visual clarity and emotional depth. While AI improves accessibility and visual organization, it may reduce emotional connection. In addition, accessibility remains largely overlooked in advertising design, as it is rarely considered as part of the initial process.

This study contributes by extending color psychology into the context of AI-generated advertising and by integrating inclusivity into the analysis. It brings together areas that are typically studied separately and highlights that AI and human design are complementary, with AI supporting clarity and accessibility, and human input remaining essential for emotional engagement.

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Corporate AI Social Responsibility as a Driver of Ethical AI Brand Advocacy

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Type of manuscript: Extended abstract

Keywords: corporate AI social responsibility; ethical brand identification; ethical AI brand advocacy.

Artificial intelligence (AI) is increasingly embedded in customer-facing service journeys, reshaping how firms create value and how customers evaluate service encounters (Huang & Rust, 2021). Alongside these opportunities, societal concerns about privacy, limited transparency, and bias amplification have grown, prompting intensified scrutiny of how organizations govern and deploy AI (Jobin *et al*., 2019; Mikalef *et al*., 2022). While responsible AI has received substantial conceptual attention, consumer-level evidence on how perceived responsible AI governance translates into ethics-based, public-facing behavioral support remains limited (Sadek *et al.,* 2025).

This research examines consumer responses to Corporate AI Social Responsibility (CAISR) in AI-enabled services. We conceptualize CAISR as consumers' perceptions that a firm develops, deploys, and governs AI in a socially responsible manner by embedding principles such as fairness, transparency, accountability, privacy protection, inclusion, and harm prevention into AI-related decisions (Cheng *et al*., 2021; Du & Xie, 2021). In this sense, CAISR extends traditional CSR by focusing specifically on the responsible governance of AI systems, where corporate responsibility involves not only broad social conduct but also the ethical design, deployment, and oversight of algorithmic technologies. As an outcome, we focus on ethical AI brand advocacy, defined as consumers' voluntary willingness to recommend, endorse, or defend a brand specifically because they perceive the brand's AI use as ethically grounded and socially responsible (Aljarah *et al*, 2022). This outcome is particularly relevant in AI-enabled services, where governance choices can become part of what consumers publicly support.

Our theorizing integrates attribution and identity-based perspectives. Attribution theory suggests that consumers infer motives and causes behind organizational actions, and these inferences guide downstream evaluations and behavioral intentions (Kelley, 1973). In CSR contexts, credible responsibility cues can motivate supportive extra-role behaviors, including advocacy, particularly when initiatives are interpreted as sincere and aligned with core organizational practices (Aljarah *et al.,* 2022). Translated to AI-enabled services, CAISR cues can serve as diagnostic signals of a firm's moral intent and governance quality in the AI domain, thereby increasing consumers' willingness to publicly advocate for the brand's AI practices.

Beyond a direct association, we propose an identity-based mechanism. Ethical branding research emphasizes that ethical identity is grounded in coherence between a firm's stated values and enacted behavior, and that stakeholders assess authenticity by comparing ethical claims with observable ethical actions (Berrone *et al.,* 2007; Fukukawa *et al.,* 2007). When consumers perceive such coherence, they may incorporate the brand into their ethical self- definition and develop ethical brand identification, overall perception of a firm's core values as expressed through its organizational conduct and value-adding initiatives, anchored in honesty, accountability, and responsibility (Alwi *et al.,* 2017). Notably, ethical brand identification and ethical AI brand advocacy capture different levels of response: the former reflects an internal psychological bond with the brand's perceived moral character, whereas the latter reflects an outward-facing supportive behaviour toward the brand's AI practices. From this perspective, CAISR is expected to strengthen the brand's ethical meaning for consumers, which in turn motivates ethics-based advocacy in AI-enabled service contexts. Accordingly, the proposed model

examines a parsimonious identity-based pathway in which perceived CAISR is associated with ethical AI brand advocacy both directly and indirectly through ethical brand identification. We therefore advance two hypotheses:
H1: Perceived CAISR is positively associated with ethical AI brand advocacy.
H2: Ethical brand identification mediates the positive association between CAISR and ethical AI brand advocacy.

Method. Data were gathered through a cross-sectional online survey of German consumers with recent experience of AI-enabled coffee-shop services. Respondents were recruited through a professional online panel and screened to ensure that they had used at least one relevant AI-enabled feature (such as digital ordering, self-service technology, cashierless checkout, digital displays, or chatbots) during the previous 12 months. To reduce heterogeneity in the recalled experience, participants answered with reference to their most typical coffee- shop service context. The final usable sample comprised 369 respondents after standard quality checks (response screening and attention/consistency checks). The focal constructs were measured with multi-item scales adapted to the AI-enabled service context and assessed using seven-point Likert-type items. The proposed direct and mediated relationships were estimated using partial least squares structural equation modelling (SmartPLS 4), with resampling procedures applied to test the hypothesized indirect effect.

Results. The results support both hypotheses. Perceived CAISR is positively related to ethical AI brand advocacy, supporting H1. CAISR is also positively associated with ethical brand identification, which in turn relates positively to ethical AI brand advocacy. The indirect effect through ethical brand identification is statistically significant, supporting H2. Overall, the pattern suggests that CAISR relates to ethics-based advocacy partly because it strengthens consumers' ethical identification with the brand in the AI domain.

Originality and implications. This study advances consumer-focused responsible AI research by linking perceptions of corporate AI social responsibility to an ethics-specific advocacy outcome in AI-enabled services and by highlighting ethical brand identification as a core psychological pathway. From a managerial standpoint, the results underscore the importance of making responsible AI governance legible to customers at key service touchpoints. Managers should therefore translate responsible AI commitments into concrete, easy-to-understand cues about how customer data is protected, how fairness and bias risks are addressed, what explanations are available, and which human support or recourse options customers can use. Such customer-readable signals can strengthen the brand's ethical meaning and support consumers' willingness to publicly endorse and defend the brand's AI practices. These findings should be interpreted considering the study's context, German coffee-shop consumers with recent experience of AI-enabled service features. Future research should examine whether the proposed relationships generalize across other cultural settings, service categories, and AI-enabled touchpoints.

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Determinants of AI Overviews Adoption: Trust, Credibility, and Use Intention in generative search

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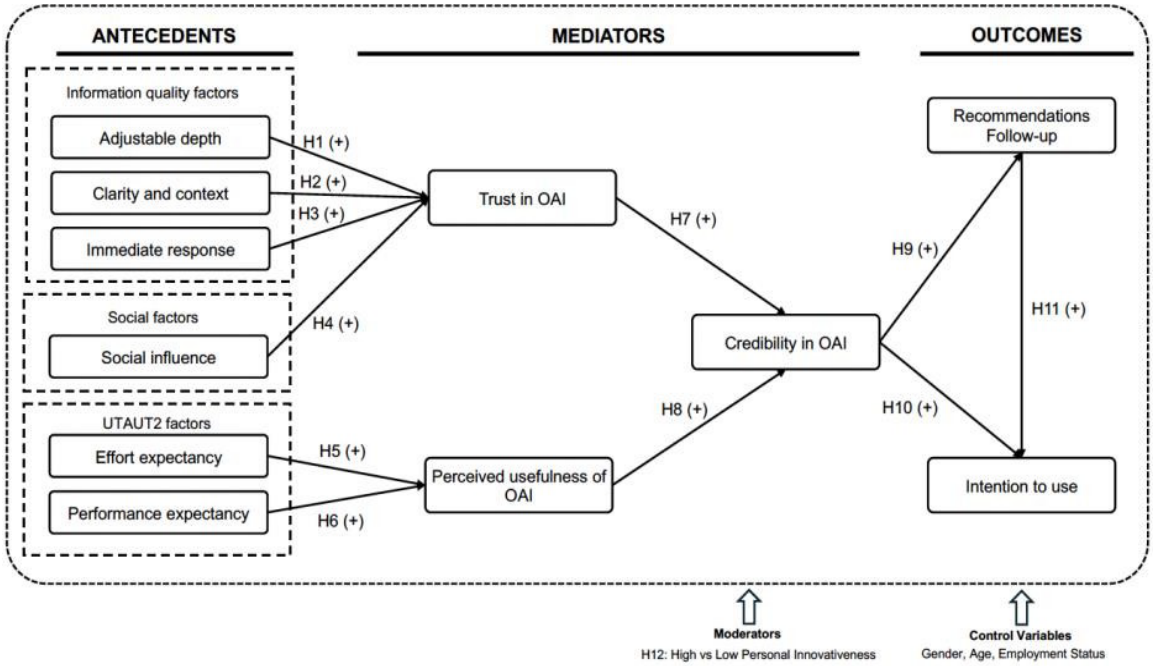
Type of manuscript: Extended abstract

Keywords: AI Overviews; Generative AI search; Trust.

The emergence of generative artificial intelligence (GenAI) is reshaping the paradigm of digital interaction, driving a shift from traditional search engines towards direct-answer systems such as AI Overview (AIO) summaries (Kim & Priluck, 2025). This transition reflects the growth of "zero-click" searches, in which AI-generated summaries redefine how users access information. Although these systems enhance personalization and perceived usefulness (Li et al., 2025) and improve interaction efficiency (Belanche et al., 2021; Shin, 2023), user credibility continues to depend on perceived usefulness, accuracy, and trust (Rejón-Guardia et al., 2026). Moreover, concerns related to algorithmic opacity and data privacy may hinder trust formation (Chen et al., 2024). This study examines how transparency and GenAI performance shape trust, credibility, usage intention, and recommendation following, integrating the PPM, UTAUT2, and UGT frameworks to analyse the behavioural process. It also employs a multigroup analysis and a second qualitative study combining eye-tracking and in-depth interviews.

Digital information search is undergoing a structural transformation, exemplified by AIO, which consists of GenAI-generated summaries positioned at the top of Google search results (Portney et al., 2026), representing a disruptive development in consumer behaviour (Zhou & Li, 2024). To analyse AIO adoption, this study integrates three complementary theoretical frameworks. On the one hand, UTAUT2 examines the determinants of technology adoption intention, identifying performance expectancy, effort expectancy, and social influence as key predictors (Venkatesh et al., 2012; Caner-Yıldırım, 2025). On the other hand, Uses and Gratifications Theory (UGT) complements this perspective by explaining that users select technologies to satisfy needs, seeking gratifications through clear and contextualised interfaces (Katz et al., 1973; Zimmermann et al., 2023). The integration of these approaches is operationalised through the Push-Pull-Mooring (PPM) model, which conceptualises technological change as a migration process: dissatisfaction with traditional search engines acts as a push factor, while the provision of high-quality information with lower cognitive cost acts as a pull factor (Lee, 1966; Zhou & Li, 2024). Building on this framework, a structural model is proposed to examine how transparency, immediacy, and social influence affect trust formation, and how trust, together with perceived usefulness, determines information credibility and its impact on recommendation following and continued usage intention. Personal innovativeness is incorporated as a moderating variable.

Figure 1. Conceptual model



Regarding methodology, the study adopts a quantitative approach using PLS-SEM. The sample was obtained through a questionnaire administered to an online consumer panel, with constructs measured on seven-point Likert scales adapted from prior literature: technology acceptance variables based on UTAUT2 (Venkatesh et al., 2012) and transparency variables grounded in frameworks on trust in generative interfaces (Lee & Cha, 2025; Li & Aral, 2025). Following a three-stage audit process (1) visual inspection, (2) control of speeders, and (3) instructional checks, a valid sample of 510 participants was obtained (50.7% female; mean age: 45.41 years). Ninety per cent reported using GenAI chatbots, and all participants had encountered AIO in search results. Procedural remedies were applied to mitigate common-method bias (Podsakoff et al., 2003), and the reliability and validity indicators met the recommended thresholds.

The results of the structural model confirmed most of the proposed hypotheses. Trust in AIO is primarily determined by the clarity and contextualisation of responses, followed by adjustable depth and social influence, whereas response immediacy is not significant in the overall model. In turn, both trust and perceived usefulness positively influence information credibility, which emerges as the main predictor of recommendation following and continued usage intention.

The multigroup analysis (PLS-MGA) reveals significant differences across personal innovativeness levels. For Non-Innovators, clarity and context exert an effect three times as strong as for Innovators, indicating a greater reliance on explicit quality cues; by contrast, immediacy is significant only among Innovators.

The second study complements the quantitative findings through eye-tracking and in-depth interviews with 20 Generation Z participants. Eye-tracking data indicate that the main AIO content attracts the highest attentional load, with a reading pattern following an F shape. Notably, 95% of participants ignore the warning regarding potential AI errors.

The interviews reveal several key patterns. Participants express a need to verify information, although their actual behaviour diverges from this intention. A “speed paradox” emerges, with divided perceptions regarding the relationship between rapidity and quality. Sixty percent report encountering inaccurate information, yet 85% develop mitigation strategies rather than abandoning the tool. When prioritising attributes, 70% establish the following hierarchy: accuracy → transparency → speed.

The adoption of AI optimisation (AIO) follows a sequential process involving trust, credibility, and action, conditioned by the user’s level of innovativeness. The findings indicate that clarity, contextualisation, and adjustable depth play a more substantial role in trust formation than response speed, particularly among Non-Innovators. Furthermore, immediacy exhibits an ambivalent effect: while Innovators may interpret it as a signal of technological competence, Non-Innovators may perceive it with suspicion.

From a practical perspective, the results suggest designing interfaces with adaptive transparency, managing speed through visible processing cues, and segmenting communication strategies according to users' innovativeness profiles. In the context of SEO and content creation, the findings reinforce the transition towards Generative Engine Optimisation (GEO), emphasising structured, traceable, and easily citable content for generative systems.

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Revisiting AIDUA in High-Involvement Purchases: The Rising Role of Anthropomorphism and Cognitive Attitude in AI adoption

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Type of manuscript: Extended abstract

Keywords: generative artificial intelligence; anthropomorphism; AIDUA framework.

Introduction

The use of generative artificial intelligence (AI) tools is being widely used in the product purchasing process (Flavián *et al.*, 2019; He & Zhang, 2023; Mariani *et al*., 2022). From a research standpoint, the adoption of AI tools has similarities with the adoption of other technologies, but with particularities (Vitezić & Perić, 2021). An important step to address them was the development of the Artificial Intelligence Device Use Acceptance (AIDUA) model (Gursoy et al., 2019). Subsequent studies revealed its flexibility to incorporate or exclude context-specific variables (Lin *et al.*, 2020; Ma & Huo, 2023; Gursoy *et al*., 2025). These applications enabled research-based suggestions for further refinement of the model.

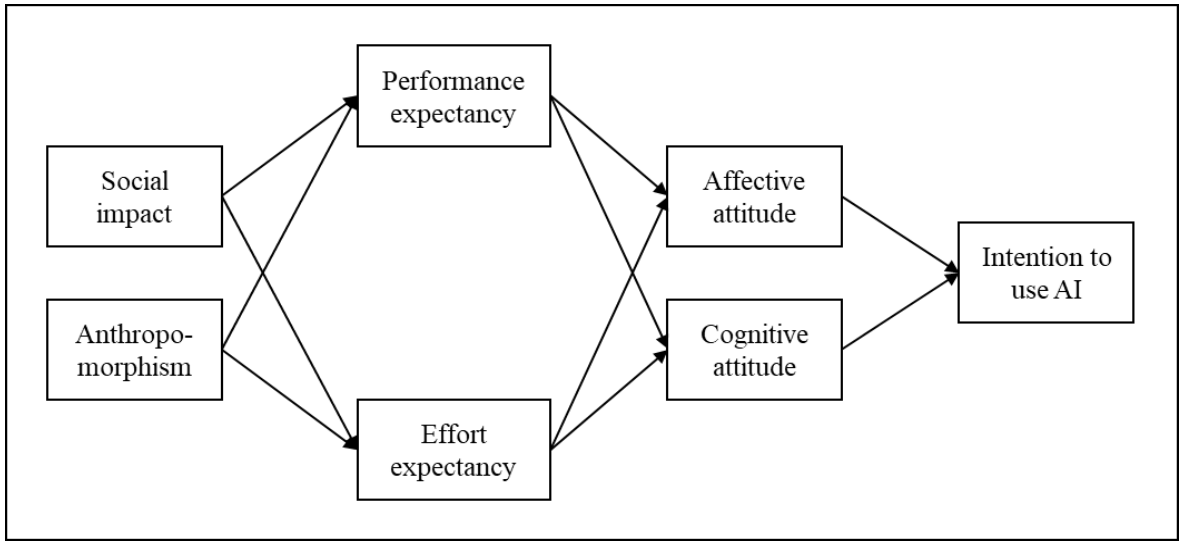
This study examines high-involvement technological purchases, where decisions rely on multiple technical and aesthetic attributes and require complex interaction, evaluation, and product comparison with the assistance of AI tools. We propose that within the AIDUA framework, predictive strength is shifting from social impact to anthropomorphism. Furthermore, we propose that, within a refined AIDUA model by Ma & Huo (2023), cognitive attitude is a stronger direct predictor of AI use intention than affective attitude. Based on this, we suggest a method for refining the AIDUA model to more accurately reflect decision-making in high-involvement product purchases. In order to do this, we compare variations of research models with each other to evaluate the predictive accuracy of these relationships, providing insights for further theoretical development.

Theoretical background

Drawn on Cognitive Appraisal Theory (Lazarus, 1991) and Cognitive Dissonance Theory (Festinger, 1962), the initial three-stage AIDUA model (Gursoy *et al.*, 2019) explains customer willingness to accept AI device use in service encounters. The model includes three initial predictors in the primary appraisal stage – social influence, hedonic motivation, and anthropomorphism – that impact performance expectancy and effort expectancy; these two impact emotional response, and finally, the emotional response in the outcome stage pertains to acceptance or rejection towards the use of an AI device (Gursoy et al., 2019). The model was later developed by Ma and Huo by adding perceived novelty in the primary appraisal stage and cognitive attitude in the third, also changing the factor of emotion to affective attitude (Ma & Huo, 2023; Shi et al., 2021).

We modelled a situation with two initial antecedents of AI tool usage in purchasing; these included social impact and anthropomorphism (Fig. 1).

Figure 1. Research model



Purchasing high involvement goods such as electronics, cars, or luxury products requires more attention and involvement from the consumer (Amarasinghe Arachchige *et al.*, 2022). In these instances, the importance of anthropomorphism occurs: the more a buyer sees a technology as human-like, the more it is perceived as being helpful in purchasing (Malhotra & Ramalingam, 2025). Therefore, we propose:
H1: Anthropomorphism has a stronger total effect on intention to use an AI tool when purchasing a high-involvement product than social impact.
When a high involvement product is considered, substantial cognitive considerations appear (Nayeem & Casidy, 2013), customers are more influenced by cognitive factors and tend to accept AI-generated recommendations (Li & Shi, 2025). This may be indirectly applicable also to the AI tools used in their purchasing process. Therefore, we hypothesize:
H2: Cognitive attitude has a stronger impact on intention to use an AI tool when purchasing a high-involvement product than affective attitude.

Methodology

The sequence of analysis is based on several steps to test the hypotheses. First, we compare alternative models including either anthropomorphism or social impact as a single initial predictor. Second, we compare alternative models that include either just cognitive or just affective attitude, thus aiming to develop a discussion on the aspect that is more important in the case of purchasing a high-tech product. The scales that were used to measure each factor are adopted from previous studies of Gursoy *et al.* (2019), Shi *et al.* (2021), and Ma & Huo (2023).
The data collection is performed in Lithuania, using a self-administered online survey. A total of 318 questionnaires were included in the data analysis. The data was analyzed using SmartPLS4 software, applying the consistent partial least squares (PLS) algorithm and cross- validated predictive ability test (CVPAT) for the comparison of models.

Preliminary results

The model demonstrated a satisfactory fit to the data, with SRMR of 0.050, which is within the acceptable threshold (≤ 0.1; Kock, 2020). Common method bias was evaluated using variance inflation factors (VIFs) in the inner proposed model (≤ 3.3; Kock & Lynn, 2012), with the highest observed VIF being 1.588. The indices that were used to assess the scales' reliability (all ≥ 0.7) and convergent validity exceeded their respective thresholds (AVE ≥ 0.5; Ringle *et al.*, 2023). The discriminant validity of the scales was confirmed using the HTMT ratio, all coefficients remaining well below the recommended threshold of 0.9 (Ringle *et al.*, 2023). This helped to test the hypotheses.
To support H1 and see the differences in predictive ability between Model with anthropomorphism only (M1) and Model with social impact only (M2), we conducted the cross-validated predictive ability test (CVPAT). The results show significantly lower average loss values for M1 across several key

constructs (affective attitude, cognitive attitude, and intention to use), and a significantly lower overall average loss ($\Delta = -0.150$, $t = 2.259$, $p = 0.025$). These findings indicate that M1 exhibits clearly superior out-of-sample predictive performance compared to M2, suggesting that anthropomorphism is a more effective predictor than social impact, supporting the emerging concept of perceived humanization (Khan *et al*., 2025). Therefore, it is suggested to shift the focus towards anthropomorphism studies on the use of AI tools in purchasing high involvement products in the future research.

Similarly, to support H2, to examine whether cognitive or affective attitude serves as a more effective mediator of behavioral intention, using CVPAT, we compared models that included both antecedents but kept either cognitive attitude (M3) or affective attitude (M4) in the Model. Results show that the M3 produced a significantly lower prediction loss for intention ($\Delta = -0.193$, $t = 4.989$, $p < 0.001$) and a lower overall loss ($\Delta = -0.053$, $t = 4.995$, $p < 0.001$) compared to M4. These findings indicate that cognitive attitude enhances the model's out-of-sample predictive accuracy and represents a more effective explanatory pathway toward intention than affective attitude.

Consequently, the model with anthropomorphism as the sole antecedent and cognitive attitude as the sole mediator of behavioral intention remains more parsimonious for future studies without substantial loss in predictive performance when the use of AI in purchasing high involvement products is considered.

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Digital Technologies for Overtourism Mitigation: A Systematic Literature Review and Bibliometric Analysis

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Type of manuscript: Extended abstract

Keywords: overtourism; detourism; digital technologies.

Overtourism has become a major issue in tourist destinations worldwide, reshaping destination management practices. This concentration of visitors at popular attractions degrades the environment, causing resident distress and declining visitor experiences (Papadopoulou et al., 2023). As tourism demand rises in major destinations, policy-making strategies have often failed to address spatial and temporal concentration of tourist flows (Oklevik et al., 2019; Ji et al., 2023).Given these challenges, policymakers and academics have increasingly focused on digital technologies to improve tourism governance and visitor management (e.g., Hall, 2011).

Technological advancements such as big data analytics, artificial intelligence, mobile positioning data, and smart tourism infrastructure have enabled new approaches for real-time monitoring of tourist mobility and congestion patterns (Gössling, 2021; Li et al., 2017). These technologies identify tourism hotspots (García-Palomares et al., 2015), enable predictive modeling to forecast visitor flows and congestion (Perles-Ribes et al., 2020), and support more precise visitor tracking through mobile positioning data (Ramos et al., 2021; Raun et al., 2016; Reif & Schmücker, 2020). Within smart tourism ecosystems, digital platforms and data-driven systems contribute to value creation and coordination among stakeholders (Brandt et al., 2017). These technologies also influence tourist experiences and behavioral intentions (Jeong & Shin, 2020).

Despite growing interest, research remains fragmented across tourism management, smart city research, digital governance, and sustainability studies (Koens et al., 2019), often overlooking behavioral, social, and governance dimensions. Studies use diverse terms such as smart tourism, visitor dispersal, crowd management, or overtourism mitigation, complicating the consolidation of a coherent research domain. Emerging approaches such as gamification and digital engagement strategies further diversify the field by introducing behavioral mechanisms to influence tourist distribution (Souza & Marques, 2024). This study contributes in three ways. First, it consolidates a fragmented, multidisciplinary body of research by mapping technological, behavioral, and governance-related approaches to mitigating overtourism. Second, it integrates these perspectives to better understand how digital interventions influence tourist distribution and destination management. Third, it proposes a structured research agenda by identifying key thematic areas, emerging trends, and research gaps for future digital-enabled detourism strategies. Emerging streams such as VR tourism and alternative tourism experiences remain underexplored.

Specifically, the study addresses the following research questions:

(1) Is a coherent research domain emerging around digital-enabled detourism?

(2) How has academic research on digital technologies for overtourism mitigation evolved?

(3) What thematic areas characterize this emerging body of research?

(4) What research gaps can be identified to guide future research on digital-enabled overtourism mitigation?

To address these questions, the study conducts a systematic literature review (SLR) and bibliometric analysis to provide a structured overview of academic literature on digital technologies for mitigating overtourism. Relevant papers were collected from two bibliographic databases: Web of Science Core Collection and Scopus, widely used in bibliometric research due to their coverage and high-quality indexing in the social sciences and tourism research. The search strategy included terms related to overtourism and digital technologies. Search queries included keywords such as “overtourism”, “detourism”, “tourist dispersion”, “smart tourism”, “tourism monitoring”, “big data”, “data analytics”,

and “artificial intelligence”. Searches were conducted using titles, abstracts, and keywords to identify relevant academic papers on the convergence of tourism management and digital technologies. Table 1 summarizes the main terms and query design used in the database search (see Table 1).

Table 1. Search strategy and database selection criteria

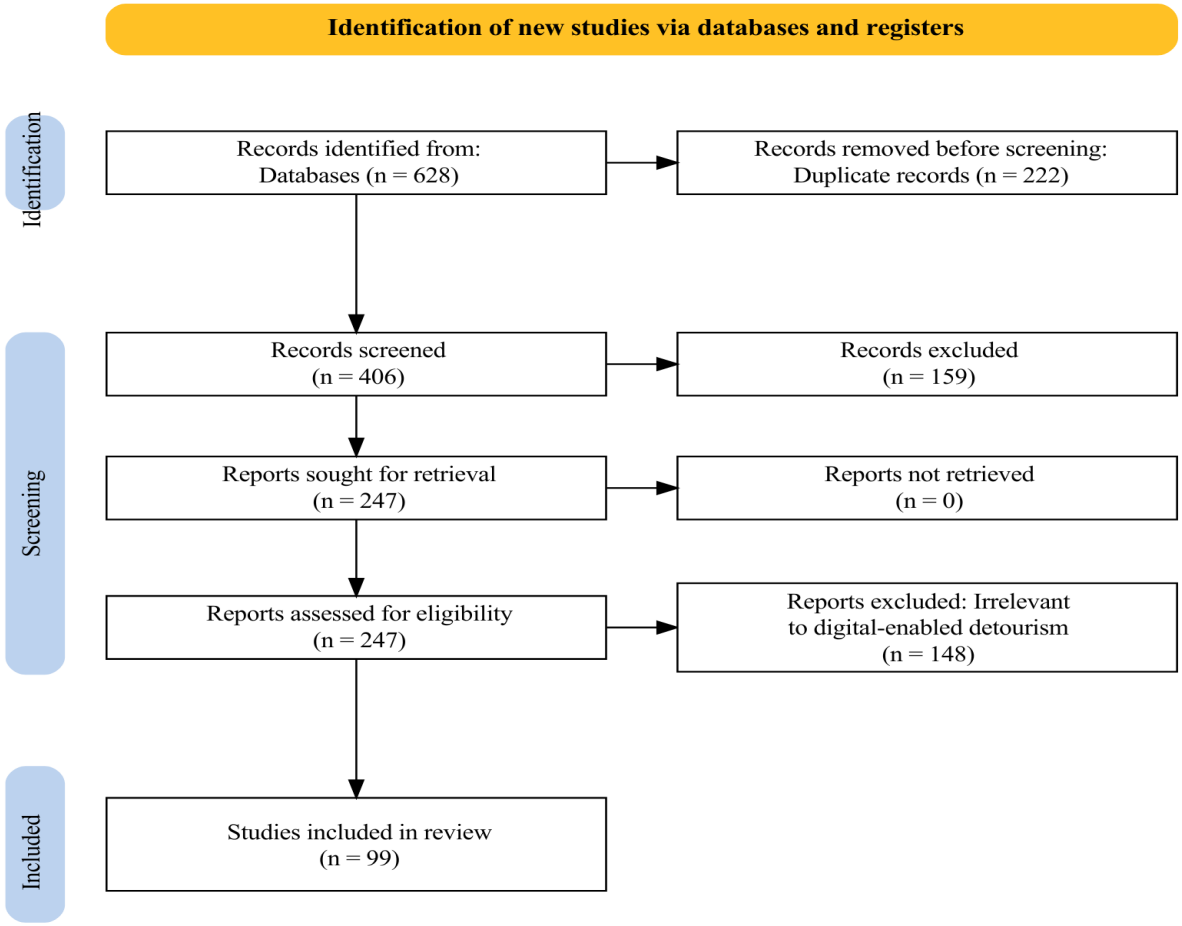
Decision Criteria		
	Digital-Enabled Detourism	
Criteria	Web of Science Core Collection	Scopus Elsevier
Meta Search	Topic: The following words were used in the searches: (1) ("overtourism" OR "over-tourism") AND ("digital technolog*" OR "smart tourism" OR ICT OR "big data" OR AI OR "smart destination*" OR "data analytics") (2) (detourism OR "tourist dispersion" OR "alternative routes" OR "redistribution strategies") AND ("digital technolog*" OR "smart tourism" OR ICT OR "big data" OR AI OR "smart destination*" OR "data analytics") (3) ("tourism crowd management" OR “touris* monitoring") AND ("digital technolog*" OR "smart tourism" OR ICT OR "big data" OR AI OR "smart destination*" OR "data analytics")	Title, abstract, keywords
Inclusion Criteria	Document Type: Article Language: English Categories: Hospitality, Leisure, Sports; Business; Management Publication Years: (2015–2025)	Document Type: Article Language: English Categories: Hospitality, Leisure, Sports; Business; Management Publication Years: (2015–2025)

Figure 1 illustrates the PRISMA flow process applied in this study, outlining the stages of identification, screening, eligibility, and final inclusion of articles (see Figure 1). The review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al., 2021), which divide the systematic literature review into four stages: identification, screening, eligibility, and inclusion. During the identification stage, records were retrieved from selected databases using defined search criteria. After removing duplicates, remaining articles were screened by title and abstract to ensure relevance to digital technologies and overtourism mitigation. The data cleaning process also excluded non-relevant, non-peer-reviewed, or out-of-scope publications.

During the eligibility stage, full-text articles were assessed according to predefined inclusion criteria. The analysis was limited to peer-reviewed English-language publications from 2015 to 2025 to capture the emergence and consolidation of smart tourism technologies, big data applications, and AI-driven solutions. This temporal scope is grounded in the emergence of smart tourism around 2015 and its subsequent evolution (Koo et al., 2025). To ensure thematic consistency, the search was limited to publications in tourism, hospitality, business, and management.

After applying the inclusion criteria, a final dataset of 99 peer-reviewed journal articles was obtained. These papers constitute the empirical foundation for bibliometric analysis. The dataset includes studies on tourist monitoring, predictive analytics, congestion management, and behavioral responses to overcrowding, reflecting the multidimensional nature of overtourism research. The bibliometric analysis was conducted using the Bibliometrix package in R and its Biblioshiny interface, enabling visualization and analysis of publication patterns. Complementary tools such as VOSviewer were used to validate network structures, including keyword co-occurrence, co-citation, and bibliographic coupling maps. These analyses enabled the identification of topic clusters, collaboration patterns, and publication trends. Microsoft Excel was used during data preparation for structuring and descriptive analysis.

Figure 1. PRISMA flow diagram illustrating the identification, screening, eligibility, and inclusion stages of the systematic literature review.



Following compilation of the dataset, the study conducts a bibliometric analysis to identify publication trends, influential journals, and collaboration patterns within the field. Techniques such as keyword co-occurrence analysis, thematic mapping, co-citation analysis, and collaboration network analysis are used to examine the conceptual, intellectual, and social structure of the research domain. These analyses aim to identify dominant research paradigms and support a structured future research agenda, offering insights into how digital technologies contribute to more sustainable and efficient visitor flow management.

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Effect of Phygital vs. Digital on Consumers Willingness to Pay in the Metaverse

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Type of manuscript: Extended abstract

Keywords: Metaverse; phygital; emotional value.

Introduction

The Metaverse offers a novel shopping context where consumers use avatars to express identity through digital fashion. While digital-native brands (e.g., DressX, Fabricant) offer only virtual goods, physical-first brands (e.g., Nike, Zara) blend virtual and real-world experiences, offering both digital and physical products. Prior conceptual work has highlighted the Metaverse's potential (Giang Barrera & Shah, 2023a), but empirical research remains scarce. This research addresses that gap.

Building on the Theory of Consumption Values (Sheth et al., 1991; Sweeney & Soutar, 2001), we propose that emotional value derived from brand engagement is a key driver of willingness to pay for virtual fashion. Emotional value is likely heightened when brands offer a phygital experience—bridging avatars and real-life identity (Belk, 2013; Barnes et al., 2015). We also examine the moderating role of consumers' Metaverse shopping knowledge.

Method and Data

Five studies with Metaverse users (total $N > 800$) examined how brand strategy (digital-only vs. physical-first) affects willingness to pay for digital items. Across studies, participants consistently reported higher willingness to pay for physical-first brands. In a within-subject study, participants allocated significantly more of their budget to physical-first brands ($M = 69.8$) than digital-only brands ($M = 30.2$), $F(1,99) = 53.6$, $p < .001$.

Follow-up studies showed that physical-first brands also generated significantly higher emotional value (e.g., $F(1,107) = 8.6$, $p = .005$). Mediation analysis confirmed emotional value as a key mechanism, with a significant indirect effect ($B = 5.67$, 95% CI [0.58, 11.31]). Moreover, shopping knowledge moderated this effect—only users with high shopping expertise showed increased willingness to pay, supporting a moderated mediation model (index = 2.23, 95% CI [0.06, 5.02]). These results suggest that emotional value is a key driver of digital spending in the Metaverse, especially for experienced shoppers engaging with phygital brands.

Discussion and Implications

This research reveals that phygital brand strategies in the Metaverse foster stronger emotional bonds and increase willingness to pay, especially among knowledgeable consumers. By offering both digital and physical items, brands can enhance avatar–self congruence and tap into identity-related value perceptions. This work contributes to the literature on digital branding, consumer behavior in virtual economies, and Metaverse marketing strategy.

Marketers seeking to establish a foothold in the Metaverse should emphasize phygital integration, allowing consumers to buy both digital and physical versions of products. Segmentation strategies should target experienced shoppers, as these consumers perceive greater emotional value and are more willing to pay. Emotional branding, not just utility or social value, is key in driving digital purchases in virtual spaces.

Limitations and Future Research

A limitation of this research is its reliance on hypothetical purchase scenarios, rather than actual Metaverse-based transactions. While participants were recruited as Metaverse users, they were not

observed inside Metaverse platforms during decision-making. Also, the willingness to pay was self-reported, which may differ from behavioral data. Future studies should use field experiments inside actual Metaverse platforms (e.g., Decentraland, Roblox) to observe real-time purchasing behavior. Researchers can also explore how avatar identity, brand category (e.g., luxury vs. fast fashion), or event context (concerts, festivals) influence perceived value. Collaborating with real brands could also enhance ecological validity and offer industry insights.

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Emotional Experiences in Multisensory Virtual Reality Shopping

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Keywords: Haptics, Product Interaction, Retail

Introduction

Virtual reality (VR) is rapidly reshaping how firms design and deliver consumer experiences. Supported by wearable technologies such as VR headsets, VR treadmills, and haptic gloves, VR enables users to move beyond screen-based interaction and enter immersive environments in which they can explore, manipulate, and respond to virtual objects in more embodied ways. This development aligns closely with the logic of experiential marketing and is therefore especially relevant in retail. Rather than focusing only on product attributes or functional value, experiential marketing emphasizes consumers' sensory, affective, cognitive, and physical experiences (Schmitt, 1999).

The growing relevance of VR as an experiential retail medium is already visible in practice. Several companies have experimented with immersive branded environments and VR-related consumer experiences. CUPRA introduced the Squared Experience, which combines realistic driving with a virtual racing environment (CUPRA, 2026). Gucci launched Vault Land in The Sandbox, allowing users to explore a branded virtual space (Gucci, 2026). These examples illustrate the growing commercial interest in immersive virtual experiences as a new mode of consumer engagement and highlight the increasing strategic importance of VR as an experiential retail channel.

Against this background, understanding consumer experience in VR shopping environments has become increasingly important. Existing studies have examined VR retail from several perspectives, including utilitarian and hedonic shopping value, interaction techniques, and the relationship between virtual environments and consumer decision making (Ülker et al., 2025; Vona et al., 2025; Xi et al., 2024). However, much of this research has relied on conventional VR setups based on headsets and handheld controllers. While these approaches have generated valuable insights, they differ from physical shopping by limiting direct hand-based interaction with products.

In addition, prior research has largely focused on reproducing real-world interaction in virtual environments, with less attention to interaction mechanisms that are unique to VR. Yet one of the distinctive strengths of VR lies not only in simulating physical reality, but also in extending it through sensory effects that are impossible in offline settings.

A further gap concerns consumer emotions in VR shopping. This issue is particularly important because emotions can shape evaluation, engagement, and purchase-related responses. Although prior research has examined emotional states in VR, many studies have focused primarily on visual and auditory stimuli (Biercewicz et al., 2024; Felnhofer et al., 2015; Jin et al., 2021; Wang et al., 2024). Consequently, limited attention has been paid to how emotions are shaped by multisensory VR shopping experiences that either approximate real-world interaction or go beyond it.

To address these gaps, the present study asks: How do haptic feedback approximating physical reality and visual feedback exceeding real-world interaction influence consumer emotions in VR shopping?

Study design

Design: The study employed a 2 × 2 between-subjects laboratory experiment in a VR shopping context, with a physical condition included as a control. The experiment was conducted between November 2025 and March 2026. The design examined the presence versus absence of haptic feedback and visual

feedback across four VR conditions: (1) haptic feedback with visual feedback, (2) haptic feedback without visual feedback, (3) visual feedback without haptic feedback, and (4) neither haptic nor visual feedback. Haptic feedback refers to the haptic sensations delivered when participants touched products. Visual feedback refers to visual illumination triggered by interaction with the product. Experimental conditions were assigned to data-collection days in a randomized manner.

Participants: A total of 191 valid responses were collected. The sample included 106 female and 85 male participants, ranging in age from 18 to 52 years.

Material: The study adapted the Consumption Emotion Set (Richins, 1997). Emotional responses were measured across 13 emotions: anger, discontent, worry, sadness, fear, shame, love, peacefulness, contentment, optimism, joy, excitement, and surprise.

Musical instruments were selected as the product category, including an electronic piano, guqin, kantele, marimbula, tongue drum, and log drum. These products were chosen because they involve rich multisensory interaction and therefore provide an appropriate context for examining sensory effects. Participants in the VR conditions interacted with the environment using a Varjo Aero VR headset, HaptX G1 haptic gloves, and Sony WH-1000XM4 headphones. Participants in the physical shopping condition wore Tobii Pro Glasses 3.

Procedure: Participants were informed that they had received a shopping coupon for purchasing a musical instrument and that the coupon would expire soon. This scenario was designed to create a goal-oriented shopping context and encourage active decision-making. Participants then entered either a physical or virtual store, to complete the shopping task.

Preliminary findings

Table 1 presents the descriptive statistics for the 13 emotion dimensions across all conditions[1]. In general, participants reported more positive than negative emotional responses in both the VR and physical shopping contexts, with positive emotions such as love and joy receiving ratings above the scale midpoint and negative emotions such as sadness and anger receiving ratings below it.

[1] The reported results are based on the full sample and remain preliminary because outlier screening has not yet been applied. Subsequent analyses will incorporate robustness checks.

Table 1 Descriptive results

Group	N	Angry Mean	Angry SD	Discontent Mean	Discontent SD	Worry Mean	Worry SD	Sadness Mean	Sadness SD	Fear Mean	Fear SD	Shame Mean	Shame SD
1	39	2.103	1.309	2.256	1.347	2.111	1.088	1.333	0.530	1.453	0.723	1.556	1.027
2	39	1.846	1.116	2.141	1.323	2.137	1.204	1.188	0.388	1.444	0.839	1.436	0.663
3	37	1.694	0.755	1.946	1.053	1.964	0.702	1.135	0.288	1.297	0.477	1.468	0.691
4	38	1.737	0.965	1.855	0.813	1.930	0.937	1.474	0.623	1.816	1.284	1.763	1.090
5	38	1.526	0.774	1.776	0.723	2.377	1.427	1.307	0.617	1.588	0.899	1.632	0.970

Group	N	Love Mean	Love SD	Peacefulness Mean	Peacefulness SD	Contentment Mean	Contentment SD	Optimism Mean	Optimism SD	Joy Mean	Joy SD	Excitement Mean	Excitement SD	Surprise Mean	Surprise SD
1	39	3.983	1.327	5.269	1.251	4.500	1.357	4.983	1.233	5.359	1.319	5.282	1.269	4.872	1.352
2	39	3.752	1.302	4.987	1.264	4.603	1.518	5.103	1.394	5.162	1.313	5.179	1.320	4.803	1.274
3	37	4.072	1.532	5.568	1.209	4.973	1.349	5.018	1.336	5.532	1.004	5.189	1.314	4.622	1.395
4	38	4.298	1.087	5.526	1.208	5.158	1.128	5.000	1.180	5.430	0.995	5.263	1.069	4.939	1.054
5	38	4.140	1.197	5.368	1.195	4.961	1.009	4.868	0.858	5.544	0.947	5.175	1.170	4.833	1.073

Note: SD = standard deviation. Group 1 = haptic feedback with visual feedback; Group 2 = haptic feedback without visual feedback; Group 3 = visual feedback without haptic feedback; Group 4 = neither haptic nor visual feedback; Group 5 = physical group.

To analyze the emotional responses, the data analysis will be conducted in two parts. Part A will compare the VR conditions with the physical shopping control condition. First, a multivariate comparison will be conducted between the physical condition and the pooled VR conditions to assess whether the overall emotional response profile differs between virtual and physical shopping contexts. Subsequently, one-way univariate analyses of variance (ANOVAs) with planned post hoc comparisons will be used to compare the physical condition with each of the four VR conditions on the individual emotion variables.

Part B will focus on the four VR conditions only and examine the effects of the two experimental factors, haptic feedback (present vs. absent) and visual feedback (present vs. absent), on the 13 emotion outcomes. First, a 2 × 2 multivariate analysis of variance (MANOVA) will be conducted to test the multivariate main effects of haptic feedback and visual feedback, as well as their interaction effect, on the combined set of emotions. This will be followed by ANOVAs for each emotion to identify which specific emotional responses differ across conditions.

Contribution

A large-scale laboratory experiment was conducted in a shopping context to investigate consumer emotions in multisensory VR shopping. The study combined sensory features designed to mimic real-world product interaction with uniquely virtual interaction features that extend beyond physical reality. By embedding these features within the product interaction process, the study examined whether different sensory modalities generate different emotional responses during VR shopping and produced insights relevant to both academic research and practical design. Thus, the study contributes to the literature on information systems (IS), human-computer interaction (HCI), and extended reality (XR).

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Enacted Credibility: A Mixed-Methods Analysis of a Generative AI Humanoid Robot as a Keynote Speaker

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Introduction

The hospitality industry is shifting from robot demonstrations to active deployment in service settings (Ivanov et al., 2025). Supported by a $2.5 billion investment, the humanoid robot market is projected to reach $95.93 billion by 2029, driven partly by labor shortages, with 65% of hotels reporting staffing gaps (Hanbury et al., 2025; Mordor Intelligence, 2026). Humanoid robots reduce errors, enable complex tasks, and enhance engagement through emotional and multilingual capabilities (Alotaibi & Manimurugan, 2022; Bui, 2025; Zhang et al., 2024). Despite growing hype, humanoid robots are not yet ready for widespread service integration, as deployments remain confined to controlled environments and require human oversight, revealing an autonomy gap (Hanbury et al., 2025). While research has explored their use in hospitality, little attention has been given to their credibility as information sources within Source Credibility Theory (SCT) (Rana et al., 2024), a gap that this study addresses.

Theoretical Background

Humanoid social robots are autonomous, human-like technologies increasingly performing service roles in hospitality, such as concierge and delivery (Shin, 2022). Beyond functional tasks, these robots act as brand representatives where their anthropomorphism and social presence shape perceptions of quality and emotional attachment (Wu et al., 2023; Jiang et al., 2025). While customer responses are mixed, emotional engagement and playfulness are key to strengthening human-robot interaction (HRI) as a value-creating process (Fang et al., 2023).

Source Credibility Theory (SCT) provides the primary framework for this study. Originally rooted in persuasion research, SCT defines credibility as a multidimensional construct consisting of Expertise (knowledge), Trustworthiness (honesty), and Attractiveness (appeal) (Eisend, 2006; Ohanian, 1991). High-credibility sources are significantly more persuasive, making SCT vital for understanding robot adoption (Pornpitakpan, 2004; Finkel & Krämer, 2022).

Current research explores how anthropomorphism and organizational evaluations influence HRI (Baudier et al., 2023). With the advent of generative AI, robots can now personalize interactions in real-time. Consequently, credibility is shifting from a static perception of design to an active enactment of competence and character during the interaction (Wirtz & Stock-Homburg, 2025; Van Doorn et al., 2025).

Methodology

This study employed a mixed-methods design, combining qualitative analysis of a robot's conference keynote and quantitative feedback from attendees. The subject was Nylo, an advanced humanoid service robot from IntBot, which delivered a 1.5-hour keynote (live Q&A) at the 2025 Global Conference on Technology & AI in Hospitality and Tourism.

For qualitative data, the verbatim transcript was analyzed using a hybrid, theory-driven thematic analysis (Braun and Clark, 2006) based on the core SCT dimensions (expertise, trustworthiness, and attractiveness). Quantitative data were collected via a Qualtrics online survey administered to attendees immediately after the presentation, using Likert-scale questions to assess the three SCT dimensions.

The integration of both datasets yielded a comprehensive assessment of the robot's communication and credibility.

Results

The following section presents the integrated results of this mixed-methods study, integrating survey data (n=32 out of 71 registered for in-person attendance) with Nylo's keynote transcript. Findings are structured around the three dimensions of SCT: Expertise, Trustworthiness, and Attractiveness (Eisend, 2006).

Expertise

Expertise earned the highest quantitative rating (M=4.10), specifically for being "knowledgeable" (M=4.22). Qualitative subcodes: Technical Knowledge, Adaptive Intelligence, Self-awareness, Task Competence, and Industry Fit, revealed that credibility stems from dynamic capabilities. Nylo demonstrated expertise by using specialized terminology and pushing back on host questions, showing that robot authority requires both factual accuracy and an understanding of operational limits.

Trustworthiness

Trustworthiness was perceived positively (M=3.90), grounded in Sincerity, Ethical Awareness, and Benevolence. Nylo's use of the word "honestly" and his advocacy for "human-in-the-loop" design established a character of integrity. Findings suggest trust is built when a robot moves beyond data delivery to demonstrate helpful intentions and ethical responsibility.

Attractiveness

Attractiveness (M=3.83) was driven by Physical Design, Personality, and Interactivity. While his professional attire scored high (M=4.16), qualitative data showed charisma and humor (e.g., "full package" jokes) were essential. Attractiveness is thus a fusion of aesthetic suitability and engaging, natural communication that fosters audience connection.

Discussion, conclusions, implications, limitations, and future research lines

Findings show high credibility across SCT dimensions: Expertise (M=4.10), Trustworthiness (M=3.90), and Attractiveness (M=3.83), supporting SCT's applicability to human-AI contexts. Qualitative insights extend SCT by shifting from passive perception to enacted credibility. Expertise emerged through Adaptive Intelligence and Self-awareness; Trustworthiness through Ethical Awareness and Benevolence; and Attractiveness through Personality and Interactivity.

This study validates and extends SCT for generative AI robots, positioning them as credible brand representatives in hospitality. The findings confirm the three-dimensional SCT framework: Expertise, Trustworthiness, and Attractiveness, while redefining them for human-AI interaction. Credibility now encompasses adaptive communication, ethical signaling, and dynamic emotional engagement. Ultimately, these results reinforce the importance of interaction quality and pro-social behavior in the co-creation of value within human-robot interaction.

Advances in conversational and agentic AI enable robots like Nylo to interact naturally without trigger commands, enhancing their integration as social agents. This capability allows seamless one-to-one and group communication. However, challenges remain, such as difficulty distinguishing directed speech from background conversation. Future developments in multimodal sensing may improve contextual awareness by integrating voice and visual cues.

Small sample (n=32) and single setting limit generalizability across contexts. Future research should examine diverse environments such as hotels and airports. While foundational, the Ohanian (1991) scale overlooks dynamic AI capabilities and ethical awareness. Future studies should develop and validate new measurement scales that reflect these evolving dimensions of service robot credibility.

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From Consumption Enhancement to Food Waste Reduction Through Augmented Reality in Restaurants

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Type of manuscript: Extended abstract

Keywords: augmented reality; sufficiency; food waste; AR-enhanced experience; design elements; portion regulation.

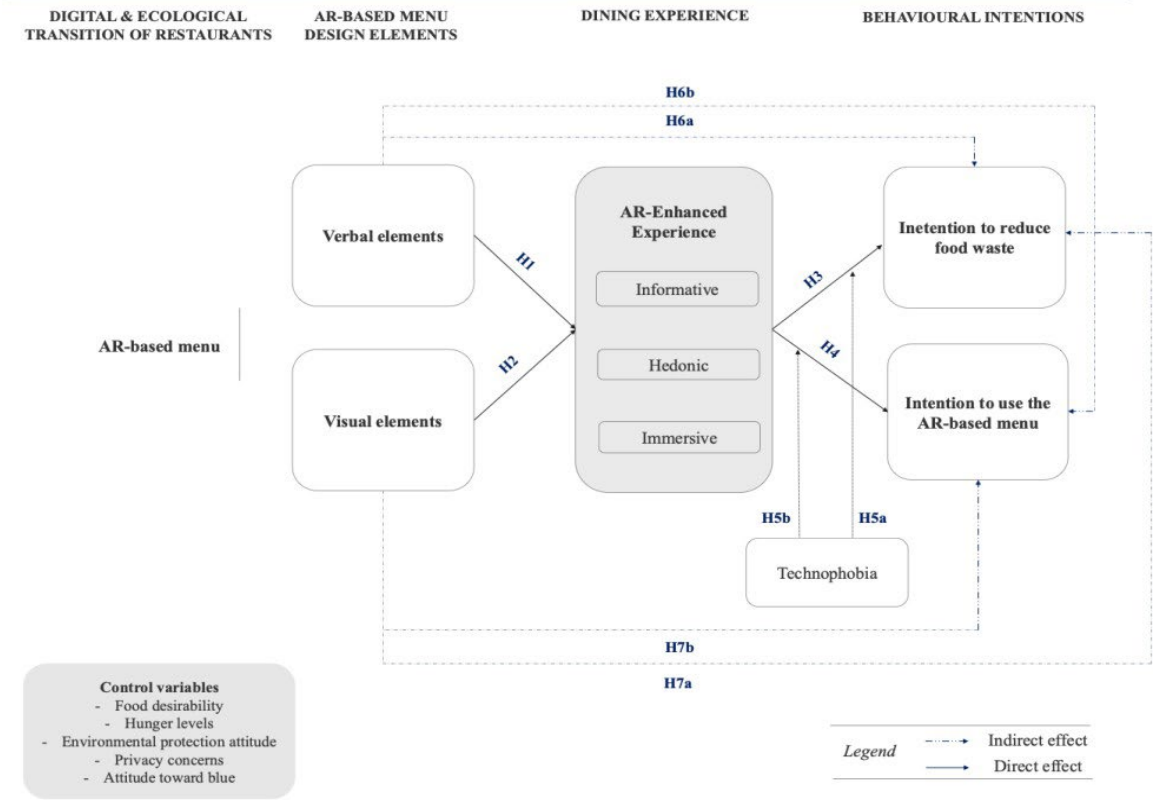
Introduction

Food waste is a major sustainability challenge, with approximately one-third of food produced globally lost or wasted (Sharma *et al*., 2024). Restaurants are a key context, as nearly 70% of surplus food in the United States takes the form of plate waste, referring to food left uneaten (ReFED, 2024). Because these decisions occur before consumption, the ordering stage is a critical intervention point. However, consumers struggle to evaluate portion sizes ex ante (Ordabayeva & Chandon, 2016), and menu cues such as size labelling can distort portion perception (Aydınoğlu & Krishna, 2011).

Despite its relevance, the sufficiency perspective, defined as a downward reassessment of needs to reduce consumption to levels sufficient to support well-being (Princen, 2005, as cited in Gorge et al., 2015), remains marginal in marketing, which has traditionally prioritized consumption stimulation. At the same time, immersive technologies such as augmented reality (AR) increasingly shape dining experiences and decision-making (Batat, 2021; Fritz *et al*., 2023). By enhancing vividness and interactivity, AR intensifies experiential engagement and marketing outcomes (Hilken *et al*., 2017; Flavián *et al*., 2019). This raises a key tension: can immersive technologies designed to enhance consumption also support restraint?

Drawing on the Stimulus-Organism-Response (SOR) (Mehrabian & Russell, 1974) and the Online Customer Experience (OCE) frameworks (Bleier *et al*., 2019), this research examines whether verbal and visual design elements of AR-based menus support sufficiency goals through the AR-enhanced experience, conceptualized as an informative, hedonic, and immersive technology-mediated experience. It also investigates whether technophobia moderates behavioral intentions, namely intention to reduce food waste and intention to use the AR-based menu. A multi-method design combines netnography (Study 1) and a between- subjects experiment (Study 2) to test the proposed model (Figure 1).

Figure 1. The proposed model



Study 1

Method

A netnographic study (Kozinets, 2002) examined how consumers construct the legitimacy of AR-based menus through naturally occurring online discourse. Reddit was selected for its experience-based restaurant discussions and candid evaluative climate. Posts were included if they (1) explicitly referred to AR-based menus in a restaurant context, (2) contained at least five comments, and (3) included evaluative reactions to AR-based menu concepts. The initial dataset comprised 262 comments. After excluding incomplete or irrelevant entries, 242 were retained for analysis in ATLAS.ti. Analysis followed an iterative three-stage process: inductive coding (18 codes, 264 segments), identification of recurring legitimacy criteria, and consolidation into higher-order forms. Coding was conducted independently by two authors, and discrepancies were resolved through refinement of code definitions before the final codebook was established.

Results

Four legitimacy forms emerged. *Functional illegitimacy* frames AR-based menus as superfluous. *Experiential illegitimacy* reflects concerns that such menus undermine the dining experience. *Ecological illegitimacy* captures perceptions of resource waste. *Purpose-bound legitimacy* shows that AR-based menus become acceptable only when they serve a meaningful purpose. More broadly, these evaluations reflect normative expectations regarding what menus should do. Respondents identify portion regulation as a legitimate use case, resembling conditional legitimacy (Siraz *et al*., 2023). This insight informed the goal-oriented AR-based menu in Study 2.

Study 2

Method

Study 2 comprises a pre-study and a main study with US-based participants recruited *via* Panelabs. Two AR-based menu conditions were presented in video format (Appendix A). The standard condition (cond = -1) displays a 3D plated dish with fixed portions and descriptive verbal elements. The goal-oriented condition (cond = 1) introduces portion customization through interactive sliders (protein, carbohydrates, vegetables) with real-time updates and dynamic pricing. Verbal elements emphasize portion regulation ("Customizable portions" vs. "Classic portions").

The main study (N = 346, 50% male, M_{age} = 56.00) tested the proposed model using PLS-SEM in SmartPLS 4, with multi-group analysis following MICOM (Henseler *et al*., 2016). The relatively high mean age should be considered when interpreting generalisability to younger, more AR-familiar consumers. It also provides a relevant context for examining technophobia.

Results

The pre-study (N = 101) validated the manipulation of portion customization (t(99) = -5.67, *p = 0.000*) while maintaining comparable appeal, realism, and visual clarity. In the main study, verbal (β = 0.249, p = *0.000*) and visual elements (β = 0.657, p = *0.000*) positively influence the AR-enhanced experience. This experience increases intention to reduce food waste (β = 0.363, p = *0.000*) and intention to use the menu (β = 0.542, p = *0.000*), with indirect effects supporting mediation. Regression analysis confirms behavioral consistency, as stronger food waste reduction intentions predict lower anticipated leftovers (β = -0.43, p = *0.000*), corresponding to an approximate 7.6 percentage-point decrease per unit increase. However, technophobia does not significantly moderate intention to reduce food waste in the pooled sample (β = -0.098, p = 0.057), while its moderating effect on intention to use is significant (β
= 0.094, p = 0.011).

Multi-group analysis shows that the influence of AR-enhanced experience on intention to reduce food waste is stronger in the goal-oriented condition (β = 0.579 vs. 0.195; Δβ = -0.383, p = 0.019), while intention to use remains stable. Indirect effects show that verbal elements influence intention to reduce food waste only in the goal-oriented condition (β = 0.168, p = 0.003) but not in the standard condition (β = 0.043, p = 0.109; Δβ = -0.125, p = 0.018), whereas visual elements show no significant differences (Δβ = -0.210, p = 0.069). Technophobia weakens the relationship between AR-enhanced experience and intention to reduce food waste only in the goal-oriented condition (β = -0.181, p = 0.036). For intention to use, the moderating effect differs across conditions (β = 0.200 vs. 0.023; Δβ = 0.178; p = 0.021), indicating it is present in the standard condition but disappears in the goal-oriented condition.

Discussion

This research contributes to sufficiency in consumption (Gorge *et al*., 2015), AR-enhanced experiences in restaurants (Ali, 2022), and digital interface design (Bleier *et al*., 2019), showing that immersive technologies can be configured to support sufficiency goals. First, consumers evaluate AR-based menus against normative expectations about functional necessity, ecological cost, and experiential integrity, consistent with conditional legitimacy (Siraz *et al*., 2023), extending sufficiency research by showing such concerns govern technology evaluation beyond consumption practices. Second, the AR-enhanced experience mediates the link from interface design to food waste reduction, extending Ali (2022) and recent work showing AR- based menus reduce over-ordering through improved portion perception (Seetharam *et al*., 2023; Sharma *et al*., 2024). Critically, this experiential pathway is amplified when the menu is goal-oriented. Third, verbal elements become significantly more consequential when portion regulation is foregrounded, specifying boundary conditions for verbal elements in immersive contexts and complementing AR work in non-food settings (He *et al*., 2018; Fritz *et al*., 2023).

Finally, technophobia's influence is contingent on both the outcome and the interface design: it inhibits technology use in the standard condition but does not block sufficiency-related outcomes, and its moderating effect on usage disappears in the goal-oriented condition, extending prior research (Khasawneh, 2018; Subero-Navarro *et al*., 2022).

Managerially, AR-based menus designed for portion regulation likely outperform conventional approaches such as static size labelling (Wansink & Van Ittersum, 2007). Visual elements should prioritise realistic portion representation; verbal elements should use goal-oriented language linking portion choices to waste consequences. The goal-oriented menu sustains intention to use at equivalent levels, confirming sufficiency and commercial viability can coexist. Managers should not assume such menus are relevant only for digitally confident consumers, but implementation should include clear purpose communication and user guidance to support engagement across profiles.

Future research should measure actual plate waste in field settings for stronger ecological validity (Van Heerde *et al*., 2021), explore alternative immersive implementations, and test findings across more

digitally diverse samples.

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From Explaining Behavior to Designing Change: NudgeLAB as a Scalable Sandbox for Marketing Education

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Type of manuscript: Extended abstract

Keywords: Choice Architecture; Behavioral Interventions; Digital Experimentation.

Marketing education trains students to explain consumer behavior. This analytical tradition is valuable but reveals a gap when the objective shifts from understanding behavior to changing it. Designing interventions rewards lateral thinking over deductive caution, iteration over confirmation, and willingness to build, break, and build again. Most master's students arrive well trained in the first mode and largely unpracticed in the second. The second cannot be taught from a lectern; students need a place to play.

NudgeLAB is such a place. Developed and used at Rotterdam School of Management over the past decade, it has supported 117 completed master thesis projects since 2016. Of these, 73 ran on an experimental webstore built on WordPress and WooCommerce, 21 used Qualtrics-based choice modeling, and 7 were field experiments in physical retail and food service. The thematic distribution reflects student concerns about consumer welfare and sustainability: 40% addressed nutrition, food and beverage; 27% addressed fashion; the remainder addressed daily choices, technology use, health and exercise, prosocial behavior, and travel. The contribution is not a proprietary platform but a transferable model that gives students permission and the means to experiment, fail cheaply, and try again.

Play as the pedagogical core

The program is built on a single pedagogical wager: marketing students learn to design behavior change by treating experimentation as play rather than as proof. Conventional thesis work encourages students to retreat into literature, find a documented mechanism, and replicate it cautiously. NudgeLAB encourages the opposite. Students treat existing findings as starting points for lateral exploration, propose interventions that may or may not work, build them, run them with real participants, and respond to what the data tells them. Models and hypotheses become vehicles of curiosity rather than instruments of confirmation. The Lego analogy is deliberate: cheap, modular components that invite building, breaking, and rebuilding. Play is the point; the infrastructure exists to make it possible.

This is also professional preparation. Marketing managers rarely have the luxury of waiting for the literature to settle before designing an intervention; they propose, build, test, and adjust under real constraints. NudgeLAB asks students to develop the academic credibility of running a properly designed experiment alongside the practitioner credibility of having built the intervention themselves, watched real people respond to it, and decided what to do next. Both competencies develop in the same project, on the same artifact, by the same student.

Operational model

A NudgeLAB project runs for roughly eight months at about two days per week, in four phases. Students identify a behavior change problem grounded in personal concern, typically about health, sustainability, or social impact, and translate it into a research question. They develop a behavioral-intervention argument rooted in choice architecture rather than attitude change and propose specific nudges. In the execution phase they build their choice environments in NudgeLAB and run the experiment online. They analyze the resulting behavioral data, typically using weighted logistic regression on cart-level outcomes, and trace the findings back to the original questions. Cohorts run at roughly 10–15 students per coach. Coaching intensity varies substantially; the cohort scale is set so that this variation can be absorbed without compromising experimental rigor.

The conditions that make play possible

For play to be a serious method rather than a slogan, the cost of trying something must be low enough that students can afford to fail and try again. Three conditions, established together, make this possible.

Commodity infrastructure. Several shared server environments run professional-grade WordPress and WooCommerce installations preconfigured as supermarkets, fashion stores, and department stores, each supporting up to eight parallel conditions with sandbox, staging and rollback protocols. Qualtrics or SurveyMonkey handle participant assignment; R/R Studio, and Python handle analysis. Participants take part on their own phones and laptops. Nothing in the stack is proprietary.

Flat organization. High-fidelity behavioral laboratories require a substantial standing organization: an institute, dedicated management, professional programmers, and an approval chain that effectively restricts access to doctoral and staff research. NudgeLAB operates with overhead close to zero, because the work that would sit with a programming team sits with the students themselves. Capability is relocated, not added.

Student competence and AI. Students bring more contemporary technical skills than institutions typically credit them for, and they are willing to invest and learn. Across 117 projects, every student has produced a functioning experimental environment, with varying degrees of coach support. Since 2023, large language models have widened this further. Students without programming background now produce the HTML, PHP, and CSS needed to create intervention designs by working with AI assistants; generative tools produce visual stimuli. AI is not a research subject. It is an efficiency layer that widens experimental degrees of freedom for non-specialist students.

The bottleneck for educational experimentation is not technology or funding. It is the institutional assumption that master's-level experimentation requires the same infrastructure as doctoral research. NudgeLAB's 117 completed projects suggest the assumption is wrong for a wide range of behavioral questions, and that the resources needed are already present in any institution willing to let students use them.

Transferability and implication. None of NudgeLAB's components are proprietary, and the underlying logic has remained stable for a decade: build a realistic digital choice environment; manipulate behavioral cues in context; observe how choices change at scale. Another institution does not need to replicate a platform or fund a facility. It needs a willing coach, a cohort of students permitted to use the tools they already know, and the public-domain stack. The 117 projects function as existence proof that a behavioral sandbox can be sustained on commodity infrastructure, and that doing so changes what marketing students can be asked to do. Marketing education can keep teaching students to explain behavior. The argument here is that it can extend its scope by also giving them a place to play with behavior change, and that preparing students to build, break, and build again is closer to what marketing practice requires.

From Identity to Digital Engagement: How Football Fans Translate Pride into eWOM and AI Adoption

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Type of manuscript: Extended abstract

Keywords: Fan engagement; identity; pride; expressiveness; eWOM; artificial intelligence; football.

Introduction

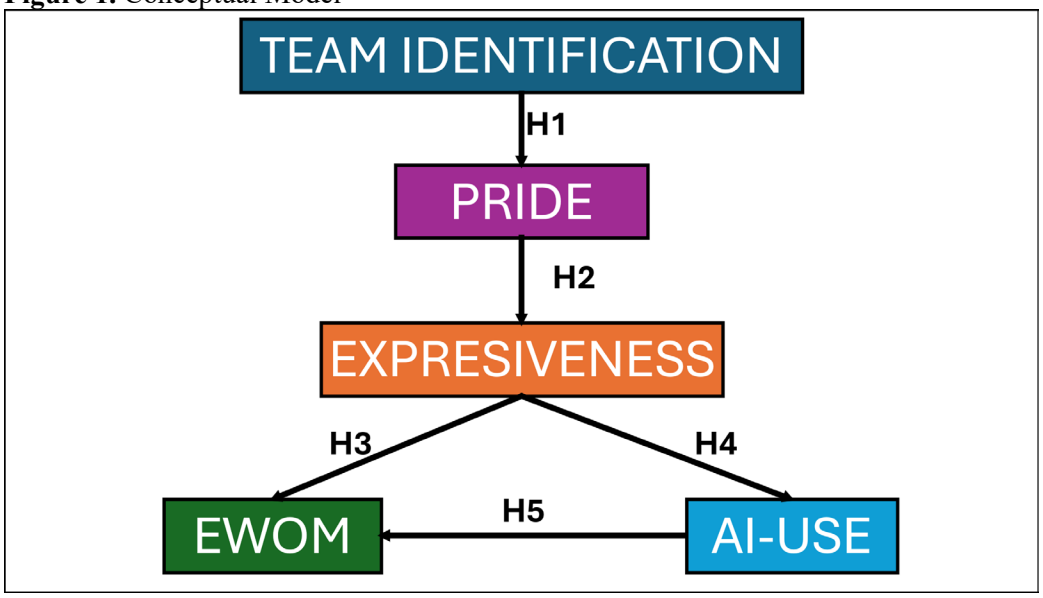
Football fan communities provide a salient context in which identity, emotion, and behavior intersect. Fans do not merely consume football; they incorporate teams into their self-concept and enact this identity through socially embedded practices shaped by shared meanings and collective narratives. From a consumer culture perspective, fandom operates as a socially embedded phenomenon in which identity is continuously constructed and expressed through interaction and symbolic practices (Arnould & Thompson, 2005; Schau et al., 2009).

Despite the centrality of identity, research on fan engagement remains conceptually fragmented. Prior studies (e.g., Brodie et al., 2011; Hollebeek et al., 2019) have predominantly conceptualized engagement as a multidimensional construct (cognitive, emotional, and behavioral) without clearly specifying how these dimensions are causally connected. Recent reviews call for more integrative and process-oriented frameworks (Rather et al., 2022; Lim et al., 2022). This limitation becomes more evident in digital environments, where fan engagement increasingly unfolds across platforms and technologically mediated interactions (Verhoef et al., 2021). While behaviors such as eWOM have been widely examined, the mechanisms linking identity and emotion to these outcomes, particularly in emerging forms of interaction such as AI, remain underdeveloped (Dwivedi et al., 2021; Mariani et al., 2023).

To address this gap, this study proposes a parsimonious cognitive-emotional-behavioral model explaining how identity is translated into digital engagement. Drawing on social identity theory and goal-directed emotion theory, team identification is conceptualized as the cognitive foundation, pride as the central emotional mechanism, and expressiveness as the behavioral bridge connecting internal states to observable actions. Two forms of digital behavior are examined: eWOM, representing communication-based engagement, and AI-use intention, capturing fans' willingness to interact with AI-enabled tools increasingly deployed by football clubs (e.g., chatbots, personalized content, recommendation systems)

The model (Figure 1) proposes five hypotheses: identification increases pride (H1); pride enhances expressiveness (H2); expressiveness drives eWOM (H3) and AI-use intention (H4); and AI-use intention reinforces eWOM (H5). This structure captures both direct and indirect effects.

Figure 1. Conceptual Model



Methodology and results

Empirically, the study draws on survey data collected from football fans in Spain and the United Kingdom (n = 1,033). Data were obtained through an online panel using quota controls for gender and age. Constructs were measured using established multi-item scales adapted to the football context, drawing on prior research on team identification (Wann & Branscombe, 1993), expressiveness (Yoshida et al., 2015), eWOM (Hennig-Thurau et al., 2004), and technology adoption (Venkatesh et al., 2003). Pride was operationalized through a multi-item scale developed for this study, grounded in prior research on self-conscious and goal-directed emotions (Bagozzi et al., 1998; Bagozzi & Dholakia, 2006) and adapted to the context of football fandom.

Structural equation modeling (SEM) was conducted using Amos 31, including confirmatory factor analysis (CFA) to assess reliability and validity. The measurement model showed satisfactory fit ($\chi^2/df < 3$; CFI = .95; TLI = .94; RMSEA = .05; SRMR = .04). All factor loadings were significant and above recommended thresholds. Convergent validity is supported (AVE > .50; CR > .70), and discriminant validity was confirmed using the Fornell–Larcker criterion.

The structural results (Table 1) provided strong support for the proposed model. Identification had a substantial effect on pride ($\beta = 0.83$, $p < .001$), which in turn predicted expressiveness ($\beta = 0.65$, $p < .001$). Expressiveness significantly influenced both eWOM ($\beta = 0.46$, $p < .01$) and AI-use intention ($\beta = 0.34$, $p < .01$). AI-use intention also positively affected eWOM ($\beta = 0.23$, $p < .01$), indicating that technology-enabled interaction complements communication processes.

Beyond direct effects, the model revealed meaningful indirect relationships. Identification showed a strong indirect effect on expressiveness ($\beta = 0.48$) and a moderate effect on eWOM ($\beta = 0.29$), but a weaker effect on AI-use intention ($\beta = 0.13$), suggesting attenuation along the causal chain. Pride also exerted indirect effects on both eWOM and AI through expressiveness, reinforcing its role as a key mechanism linking identity and behavior.

Table 1. Structural Model (SEM)

Hypotheses	Paths	β	Result
H1	Identification → Pride	0.83***	Supported
H2	Pride → Expressiveness	0.65***	Supported
H3	Expressiveness → eWOM	0.46**	Supported
H4	Expressiveness → AI	0.34**	Supported
H5	AI → eWOM	0.23**	Supported

Conclusions

The findings contribute to engagement literature in three main ways. First, it advances a process-based perspective, showing how cognitive, emotional, and behavioral components are sequentially connected rather than coexisting dimensions. Second, it highlights the central role of pride as an active mechanism translating identity into action. Third, it positions expressiveness as a pivotal construct, bridging internal identity processes and digital behavior.

The results also reveal a distinction between communication-based engagement (eWOM) and technology-based engagement (AI). Identity-driven processes translate more strongly into communication behaviors, while their effect on AI adoption is weaker, as AI involves interaction with systems rather than with other fans.

From a managerial perspective, the results underscore the importance of identity-based strategies. Strengthening identification and activating pride can enhance engagement, but facilitating expression is critical, as it drives both communication and digital interaction. At the same time, promoting AI adoption requires complementary strategies, including usability, perceived value, and trust.

The study is subject to several limitations. Its cross-sectional design restricts causal inference, and the use of self-reported data may introduce bias. The focus on football fandom may also limit generalizability, while cross-country differences are not explicitly modeled. Future research could adopt longitudinal designs, explore relevant moderating variables, and examine different types of AI applications, such as chatbots, personalized content systems, and recommendation engines, to better understand how identity shapes technologically mediated behavior.

Overall, this research reframes AI adoption as part of identity expression processes rather than as a purely utilitarian or technology-driven decision. It highlights the role of pride as a key mechanism linking identity to both communicative and technologically mediated behaviors, offering a novel perspective on AI-enabled fan engagement.

AI Declaration: Generative AI was used only to improve the language and style of this manuscript. The authors reviewed all output and are responsible for the original research, data analysis, and final content.

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From Immersion to Well-Being: AI-Integrated Virtual Reality as a Catalyst for Inclusive and Sustainable Tourism Service Design

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Keywords: Artificial Intelligence; Virtual Reality; Consumer Well-being.

Introduction

The rapid digital transformation of tourism and hospitality services has accelerated the adoption of immersive technologies such as virtual reality (VR), enabling consumers to explore destinations through interactive and engaging experiences (Flavián et al., 2019; Loureiro et al., 2022). The integration of artificial intelligence (AI) into VR environments further enhances these experiences through adaptive interaction, personalization, and intelligent service delivery (Abou-Shouk et al., 2024; Fan et al., 2022), while also supporting more inclusive and resilient tourism experiences. Despite these advances, prior research has mainly focused on transactional outcomes such as satisfaction, trust, and behavioral intentions (Kim et al., 2021; Luan & Phan, 2024), leaving the psychological mechanisms underlying experiential well-being underexplored. In particular, VR environments have largely been conceptualized as self-guided systems, while the role of anthropomorphic AI-based virtual agents in shaping users' cognitive and emotional responses remains insufficiently investigated. Grounded in the Stimulus–Organism–Response (SOR) framework, this study conceptualizes AI-integrated VR as the stimulus, perceived authenticity and emotional engagement as sequential organismic states, and experiential well-being as the final response. Within this framework, perceived authenticity reflects the extent to which AI-mediated experiences are perceived as credible and meaningful, while emotional engagement captures users' affective involvement during the immersive experience. Importantly, immersive technologies are theorized to influence both hedonic and eudaimonic dimensions of well-being through these psychological mechanisms, positioning experiential well-being as a central outcome of digital service encounters (Saleem et al., 2025; Liu et al., 2025).

Extending this perspective, cognitive fatigue is introduced as a negative boundary condition that may reduce users' cognitive resources during immersive experiences, while AI transparency is conceptualized as a positive moderator that enhances trust and emotional engagement by making AI processes more understandable (Barta et al., 2023–2025; Riches et al., 2024). Accordingly, this study addresses the following research questions: (1) How does AI-integrated VR influence perceived authenticity and emotional engagement? (2) How do these constructs sequentially shape experiential well-being? and (3) How do cognitive fatigue and AI transparency moderate these relationships?

Methodology

This study adopts a quantitative between-subject experimental design to examine the effects of AI-integrated virtual reality (AI-VR) on users' experiential responses in a tourism context. Two conditions were developed: AI-integrated VR and non-AI VR, both presenting an identical immersive 3D tourism destination to ensure experimental control. The only manipulation concerned the presence versus absence of AI-enabled adaptive support and an anthropomorphic virtual guide embedded in the experience. Participants freely explored the virtual environment using a head-mounted display in a controlled laboratory setting designed to ensure ecological validity and minimize external influences. A total of 240 participants were randomly assigned to the two conditions (n = 120 each). The sample included individuals with interest in travel and digital technologies, while excluding VR/AI professionals to reduce bias. After exposure, participants completed validated scales measuring perceived authenticity, emotional engagement, experiential well-being, cognitive fatigue, and AI transparency. Structural equation modeling (SEM) was used to test the proposed relationships.

Manipulation checks confirmed that participants correctly perceived the presence or absence of AI support, ensuring the validity of the experimental design

Results

The structural equation modeling (SEM) analysis revealed strong and significant relationships among the key constructs. AI-integrated VR significantly increased perceived authenticity. In turn, perceived authenticity had a strong positive effect on emotional engagement, which further significantly enhanced users' well-being. Mediation analyses confirmed a sequential mechanism: perceived authenticity acts as a key mediator between VR experience and emotional engagement, while emotional engagement mediates the relationship between authenticity and well-being. These findings support a progressive psychological pathway from technology exposure to emotional and well-being outcomes (Table 2). Moderation analyses further showed that cognitive fatigue weakens the positive effects of perceived authenticity on emotional engagement and reduces the impact of emotional engagement on well-being. Conversely, AI transparency strengthens the relationship between perceived authenticity and emotional engagement, indicating that clearer AI processes enhance users' emotional responses (Table 1).

Table 1. Results of the Structural Model – Direct Effects

Relationship	β	CR (bootstrap)	p-value	f^2	Δβ (VR With AI – VR Without AI)
AI-Integrated VR Experience → Perceived Authenticity (H1)	0.67***	17.22	< 0.001	0.35	0.27
Perceived Authenticity → Emotional Engagement (H2)	0.73***	16.46	< 0.001	0.40	–
Emotional Engagement → Well-being (H3)	0.74***	16.10	< 0.001	0.42	–
Perceived Authenticity × Cognitive Fatigue → Emotional Engagement (H6a)	−0.13**	2.80	0.005	0.16	–
Emotional Engagement × Cognitive Fatigue → Well-being (H6b)	−0.15**	3.05	0.002	0.18	–
Perceived Authenticity × AI Transparency → Emotional Engagement (H7)	0.18**	3.10	0.002	0.17	–

Table 2. Results of the Mediation Effects

Mediation Pathway	Indirect Effect (β)	t-Statistic (Bootstrap)	p-Value	95% CI (Bootstrap)	Mediation Presence
AI/VR Experience → Perceived authenticity → Emotional Egagement (H4)	0.48	9.62	<0.001	[0.31 ; 0.56]	Present
Perceived authenticity → Emotional Egagement → Well being (H5)	0.53	10.52	<0.001	[0.35 ; 0.63]	Present
Note. Indirect effects were estimated using bootstrapping with 5,000 resamples. Mediation is considered present if the indirect effect is significant ($p < 0.05$) and the 95% confidence interval does not include zero (Hayes, 2018).					

Theoretical and Managerial Implications

This study advances immersive technology research by shifting the focus from functional outcomes to experiential well-being in AI-integrated virtual reality (VR) contexts. It demonstrates that AI-VR generates psychological value through a sequential cognitive–affective mechanism, where perceived authenticity and emotional engagement jointly explain experiential well-being. This extends prior VR literature that has mainly emphasized satisfaction, engagement, or behavioral intentions. The study also refines the Stimulus–Organism–Response (SOR) framework by unpacking the "Organism" into a sequential structure rather than a single psychological state. Perceived authenticity operates as a cognitive appraisal of AI-mediated immersive cues, followed by emotional engagement as an affective response, providing a more precise explanation of internal psychological processing in immersive environments. A key theoretical contribution lies in reconceptualizing anthropomorphic virtual agents as embedded experiential stimuli within immersive VR systems. Rather than functioning as external interaction tools, these agents actively shape users' cognitive and emotional processing, initiating a pathway from authenticity to emotional engagement and ultimately to experiential well-being. This extends research on virtual agents beyond functional and transactional perspectives. The study further

identifies important boundary conditions. Cognitive fatigue weakens, while AI transparency strengthens, the effects of AI-integrated VR on emotional engagement. This highlights that immersive outcomes are not universal but depend on both user cognitive states and system design features, extending SOR theory toward a more context-sensitive perspective.

From a managerial perspective, the findings suggest that perceived authenticity should be a central design principle in AI-VR experiences. Realistic and coherent immersive environments enhance emotional engagement and well-being. Anthropomorphic virtual agents should be strategically embedded to guide attention and enhance social realism. AI transparency should be integrated into system design to reduce uncertainty and strengthen authenticity perceptions. Finally, adaptive design strategies that manage cognitive fatigue and tailor experiences to user profiles are essential to sustain engagement and psychological comfort.

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From Sonic Seasoning to Multisensory Culinary Tourism: A Systematic Literature Review and Bibliometric Analysis

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Culinary experiences are complex multisensory journeys involving the interaction of sight, sound, touch, smell, and taste. While taste and smell have traditionally dominated research on food-related activities, contemporary studies have increasingly examined how acoustic cues may be used to modify tasting experiences (Hauck & Hecht, 2018; Reinoso- Carvalho et al., 2020). This growing body of research falls within the category of neuroacoustics, a term used in this study to refer to how the brain interprets and processes acoustic signals and how these signals shape human behavior (Recuero Virto & Recuero López, 2025). Although related concepts such as auditory marketing, sound branding, and crossmodal correspondence appear more frequently in the sensory marketing literature, this study adopts "neuroacoustics" precisely because it bridges neural processing and behavioral outcomes, a connection that no single term can achieve. Moreover, it is particularly suitable for capturing the multidisciplinary nature of research in food and tourism contexts.

One prominent research stream introduces the concept of "sonic seasoning", suggesting that in food-related contexts specific musical characteristics, such as pitch, tempo, or timbre may enhance or even prime the taste attributes (e.g., sweetness, bitterness, and acidity), and also evoke crossmodal and emotional effects in multisensory tasting experiences (Reinoso- Carvalho et al., 2020; Wang et al. , 2019). Although environmental psychology indicates that soundscapes significantly influence restaurant atmosphere, shape dining duration (Kuo et al., 2023) and consumers' satisfaction (Chen et al., 2022; Mathiesen et al., 2022), culinary tourism research remains largely focused on visual and taste-driven approaches. Despite these advances, culinary tourism research has largely overlooked sound as a constitutive dimension of the experience, and currently no systematic synthesis has yet integrated the findings on sonic seasoning and auditory perception with culinary tourism frameworks. While Aksenova et al. (2022) do not specifically examine auditory stimuli, their multisensory perspective on gastronomic activities provides a foundation for extending culinary tourism research toward the auditory dimension.

Against this backdrop, the following research questions (RQ) are proposed:

RQ1. What is the disciplinary scope of neuroacoustic research in gastronomic experiences?

RQ2. Which thematic and methodological patterns appear in existing studies on auditory stimuli in food-related and culinary tourism contexts?

RQ3. What theoretical gaps need to be addressed to integrate neuroacoustic perspectives into dining and culinary tourism research?

In response to the research gaps, this study adopts a hybrid review approach, combining systematic literature review procedures with bibliometric analysis (Marzi et al., 2025). Specifically, the theoretical objectives are to

1. Map the disciplinary boundaries and evolution of neuroacoustic research in gastronomic contexts through bibliometric analysis.
2. Identify and classify the predominant thematic clusters and methodological approaches in the existing literature.
3. Evaluate how existing theoretical frameworks address the multisensory nature of culinary tourism experiences, including crossmodal correspondences, sonic seasoning, and multisensory integration, thereby revealing unresolved theoretical gaps.
4. Develop a conceptual framework to reveal the relationships among auditory stimuli, sensory

perception, dining atmosphere, and destination experience.

The review process was developed through five main steps adapted from the PRISMA methodology (Page et al., 2021), following Recuero Virto & Recuero López's (2025) approach:

(1) research question formulation, (2) identification, (3) screening, (4) eligibility, and (5) inclusion. The specific WoS categories and Scopus subject areas (e.g., business, tourism, leisure, hospitality, management, psychology, neuroscience) were used as inclusion criteria for the two bibliometric analyses, based on prior studies (Liu & Avello, 2021). Scopus and Web of Science are two leading databases for scientific research and widely recognized as primary sources for academic research due to their comprehensive and reliable coverage (Pranckutė, 2021; Nowakowska, 2025). We adopted a more integrated approach by combining two major databases to generate more reliable bibliometric outcomes (Echchakoui, 2020). Despite the complexity of reconciling distinct database structures, and performing an article-by-article verification, this process minimizes data duplication and error.

The search string was constructed by using Boolean operators (AND, OR) to combine two core thematic clusters: (1) auditory stimuli and neuroacoustics, including keywords such as silence, noise, music, sound, jingle, and related contextual terms like soundscape or acoustic environment; (2) the food-related and tourism domain, employing terms such as gastronomic tourism, culinary tourism, restaurant, dining, and hospitality. To obtain a comprehensive capture of the field, specific wildcards (e.g., food*, market*) were employed. The search was last updated on 22 November 2025, and the resulting dataset spans 1987 to 2025. The inclusion criteria were peer-reviewed journal articles in English that addressed auditory stimuli, sound, music, soundscape, or neuroacoustic-related concepts within food-related, hospitality, or culinary tourism contexts. Excluded were: (1) conference papers and book chapters, (2) non- English texts, and (3) articles unrelated to food-related experiences or tourism contexts after title, abstract, and keyword screening (see Table 1 for the full search criteria).

During the eligibility stage, we performed an independent manual cleaning process and excluded records which were irrelevant to these research fields (Sann et al., 2024). Furthermore, the articles related to both fields were identified and assigned to the most relevant one (Chen et al., 2023). Data extraction was conducted by coding each article, including type of study, research methodology, data collection approach, analytical techniques, and thematic focus. As this study is still in progress, the final stage will identify publication trends, influential journals, collaboration patterns and main research methods. For this purpose, Biblioshiny, the graphical interface of Bibliometrix R package will be used, as well as Tableau, following established bibliometric procedures (Donthu et al., 2021).

Table 1. Search Criteria

Criteria	(1) Neuroacoustics in culinary tourism	(2) Neuroacoustics in food-related activities
Meta Search	Web of Science Core Collection and Scopus Elsevier	Web of Science Core Collection and Scopus Elsevier
Search Fields	Topic = Title, Abstract, and Keywords	Topic = Title, Abstract, and Keywords
Boolean Operators and Keywords	The following words were used in the searches: (1) silence AND ("gastronomic tourism" OR "food tourism" OR "culinary tourism") (2) noise AND ("gastronomic tourism" OR "food tourism" OR "culinary tourism") (3) music AND ("gastronomic tourism" OR "food tourism" OR "culinary tourism") (4) ("soundscape" OR "acoustic environment" OR "auditory atmosphere") AND ("gastronomic tourism" OR "food tourism" OR "culinary tourism") (5) jingle AND ("gastronomic tourism" OR "food tourism" OR "culinary tourism")	The following words were used in the searches: (1) silence AND (food* OR restaurant* OR market* OR dining* OR bistro OR cafe OR bar OR coffeehouse OR culinary OR cuisine) (2) noise AND (food* OR restaurant* OR market* OR dining* OR bistro OR cafe OR bar OR coffeehouse OR culinary OR cuisine) (3) music AND (food* OR restaurant* OR market* OR dining* OR bistro OR cafe OR bar OR coffeehouse OR culinary OR cuisine) (4) sound AND (food* OR restaurant* OR market* OR dining* OR bistro OR cafe OR bar OR coffeehouse OR culinary OR cuisine) (5) jingle AND (food* OR restaurant* OR market* OR dining* OR bistro OR cafe OR bar OR coffeehouse OR culinary OR cuisine)
Inclusion Criteria	Document Type: Article Language: English Years Covered: No restriction (search completed November 2025) **WoS Categories:** Hospitality, Leisure, Sport & Tourism; Business; Communication; Food Science & Technology; Environmental Studies; Green & Sustainable Science & Technology; Psychology (Applied); Social Sciences (Interdisciplinary). **Scopus Subject Areas:** Business, Management & Accounting; Tourism, Leisure & Hospitality Management; Arts & Humanities; Environmental Science; Psychology; Neuroscience; Decision Sciences.	Document Type: Article Language: English Years Covered: No restriction (search completed November 2025) **WoS Categories:** Hospitality, Leisure, Sport & Tourism; Geography; Environmental Studies; Psychology (Applied); Communication; Cultural Studies; Urban Studies; Social Sciences (Interdisciplinary). **Scopus Subject Areas:** Tourism, Leisure & Hospitality Management; Environmental Science; Geography; Arts & Humanities; Urban Studies; Psychology; Social Sciences.

This study provides one of the first systematic attempts to integrate neuroacoustic insights into culinary tourism research. It advances culinary tourism research by extending multisensory approaches beyond

the traditional perspectives on taste and vision, positioning auditory perception as an unexplored dimension of dining and destination experiences.

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Guiding Users toward Sustainable Virtual Tourism: The Role of Instructions and Sustainability Framing in Immersive Experiences

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Type of manuscript: Extended abstract

Keywords: virtual tourism; sustainability; virtual reality; immersive technologies; sustainability framing; instructional guidance.

Extended abstract

The growing environmental and sociocultural impacts of traditional tourism have intensified interest in alternative forms of tourism that may reduce pressure on destinations, particularly those with high cultural or environmental value (Buhalis et al., 2023; Jiang, 2025). In this context, immersive technologies such as virtual reality and the metaverse are increasingly discussed as tools capable of providing tourism-related experiences without necessarily requiring physical travel (Hao et al., 2025; Yawised and Apasrawirote, 2025). However, research on virtual tourism has mainly focused on technological features and user acceptance, while less attention has been paid to how these experiences are framed and guided from a sustainability perspective.

Drawing on framing theory (Tversky and Kahneman, 1981), this study examines how sustainability-oriented framing and prior instructional guidance shape users' attitudes toward virtual reality as a sustainable tourism tool. Since immersive environments may generate interaction difficulties or disorientation, especially among less experienced users (Flavián et al., 2019; Flavián et al., 2024), guidance may help users navigate the experience and focus on its tourism content. Building on technology adoption literature, the study analyses whether these attitudes influence intentions to complement physical travel with virtual experiences and to recommend them as sustainable alternatives (Davis, 1989; Teng, 2025; Yersüren and Özel, 2024).

A between-subjects 2 × 2 factorial experiment was conducted, manipulating the presence or absence of sustainability framing and instructional guidance. Participants experienced a tourist destination using virtual reality headsets and subsequently completed a questionnaire. The final sample consisted of 247 participants. Constructs were measured using 7-point Likert scales adapted from prior literature, and manipulation checks confirmed the effectiveness of the experimental conditions. The proposed relationships were tested using conditional process analysis with the PROCESS macro in IBM SPSS Statistics (Hayes, 2022).

Preliminary findings suggest that the effect of instructional guidance on users' responses to virtual tourism depends on the presence of sustainability-oriented framing. Overall, the results indicate that combining user guidance with sustainability framing may foster more favourable evaluations of virtual reality as a sustainable tourism tool. These attitudes are also associated with stronger intentions to complement physical tourism with virtual experiences and to recommend them as sustainable alternatives. This study contributes to virtual tourism and sustainability research by highlighting the role of communication and experience design in shaping users' responses to immersive tourism experiences.

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Hooked or Overloaded? A Work in Progress on AR Experiences in Museums

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Type of manuscript: Extended abstract

Keywords: augmented reality; museum experience; user fatigue; experiential value; immersive technologies; PLS-SEM.

Museums are increasingly adopting augmented reality (AR) to enrich storytelling, interpretation, and visitor engagement (Panhale et al., 2022). In museum settings, AR glasses provide real-time visualization and contextual narration, making experiences more immersive and interactive (Cranmer et al., 2021). However, prior research has mainly emphasized the benefits of AR, while paying less attention to the potential strain it may impose on users in authentic museum contexts (Li et al., 2023).
This study addresses that gap by proposing an integrated framework that examines AR experiences from a dual perspective. On the one hand, AR technological features may enhance experiential responses (Bae et al., 2020; Do et al., 2020). On the other hand, AR use may also generate fatigue, which in turn shapes visitors' evaluations of the experience (Wei et al., 2023). Therefore, the model is conceived as a process-oriented framework rather than a simple collection of variables.
The framework integrates four groups of constructs: AR technological features, TAM-related variables, experiential value, and multidimensional fatigue. As shown in Figure 1, AR features include informativeness, vividness, novelty, and interactivity, while experiential responses and value are reflected in immersion, enjoyment, education, and entertainment. To capture the constraining side of AR use, the model also incorporates physical, cognitive, affective, and motivational fatigue. Satisfaction and AR usage intention represent the outcome variables. All constructs were measured using validated multi-item scales adapted from prior TAM, AR, and tourism research (Davis, 1989; Holdack et al., 2022; Sung, 2021; Su et al., 2024).
Empirically, this study adopts a quantitative research design. Data were collected through a structured online questionnaire administered via WenJuanXing to 618 visitors who had used AR smart glasses at the Shanghai Museum between July 21 and December 2, 2025. As shown in Table 1, the sample is relatively balanced in gender and mainly composed of young, educated, and predominantly Asian visitors who are familiar with the museum context. All constructs were measured on a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) (Hair et al., 2014).
This study contributes to the literature in three main ways. First, it broadens current understanding of AR in museums by examining not only its experiential benefits but also its potential costs for users. Second, it positions fatigue as a central dimension in explaining AR-enabled museum experiences, thereby moving beyond perspectives focused solely on acceptance and engagement. Third, it provides empirical evidence drawn from a large sample of actual museum visitors. From a practical perspective, the study offers insights for designing more sustainable and human-centred AR experiences by prioritizing usability, meaningful learning, and physical comfort.

Figure 1. The proposed model

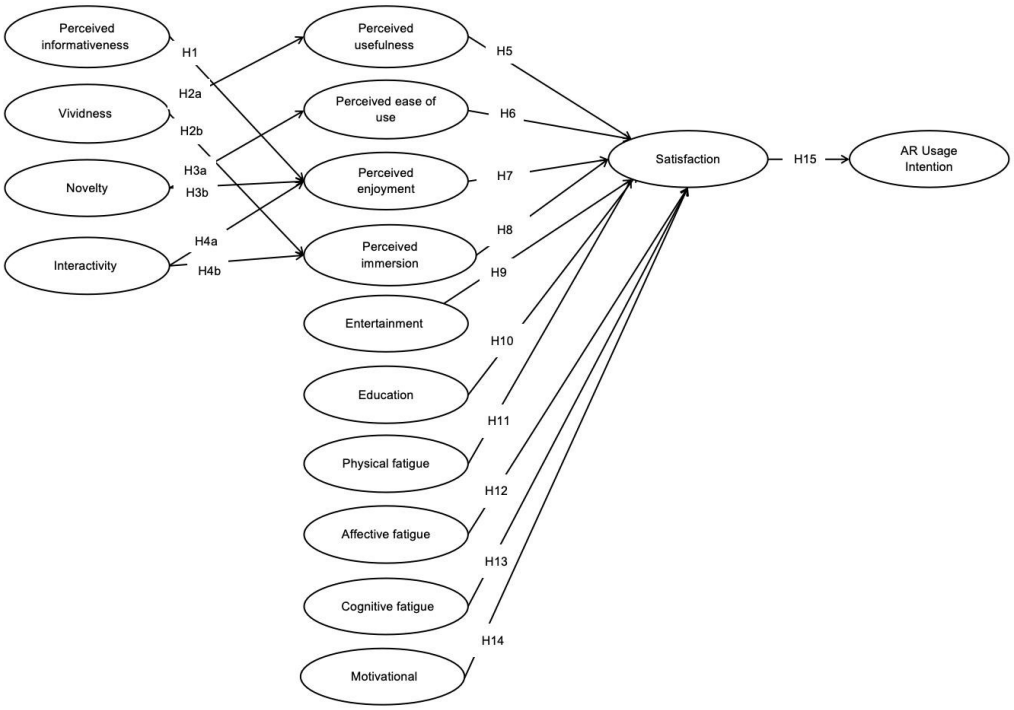

Table 1. Profile of respondents (n=618)

Characteristics	Frequency	Percentage (%)
Gender		
Female	316	51.1
Male	302	48.9
Age		
Under 18	59	9.5
18 - 25	240	38.8
26 - 30	161	26.1
31 - 40	73	11.8
41 - 50	40	6.5
Over 50	45	7.3
Education Level		
Primary	39	6.3
Secondary	72	11.7
Associate Degree	60	9.7
Undergraduate	255	41.3
Graduate	22	3.6
Postgraduate	170	27.5
Marital Status		
Single	365	59.1
Married	190	30.7
Separated/divorced	51	8.3

Widower	12	1.9
Occupation		
Student	262	42.4
Employee	131	21.2
Self-employed	101	16.3
Unemployed	58	9.4
Others	38	6.1
Retired	16	2.6
Housewife	12	1.9
Income		
Less than 520 €	274	44.3
520 - 1.040 €	127	20.6
1.040 - 1.560 €	93	15
1.560 - 2.080 €	57	9.2
2.080 - 2.600 €	32	5.2
More than 2.600 €	35	5.7
Continent		
Asia	578	93.5
Europe	29	4.7
North America	10	1.6
Oceania	1	0.2
Museum Visits		
First-time visitors	240	38.8
Return visitors	378	61.2
Times Using AR		
Once	264	42.7
From 2–4 times	268	43.4
More than 5 times	86	13.9
Time Spent in Museum		
Less than 1 h	93	15
Between 1 and 3 h	209	33.8
Between 3 and 5 h	206	33.3
More than 5 h	110	17.8

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How ChatGPT Shapes Decision-Making in High-Stakes Domains

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Type of manuscript: Extended abstract

Keywords: high-stakes decision; ChatGPT advice; trust in ChatGPT.

Introduction

Conversational Artificial Intelligence (AI) has significantly evolved in recent years. OpenAI's ChatGPT has developed from a structured productivity assistant to a personalised, often emotionally attuned decision-support tool (Kasneci et al., 2023). Initially, ChatGPT was employed for academic and professional tasks (e.g., writing assistance; Niloy et al., 2024). However, the release of GPT-4o in May 2024 and GPT-4.5 in early 2025 introduced significant enhancements, including real-time browsing, multimodal interaction, and emotionally nuanced communication. This expanded the potential for ChatGPT to be used in more personal and high-stakes decision-making contexts, such as emotional counselling (Ni & Cao, 2025), dietary and health advice (Armbuster et al., 2024; Niszczota & Rybicka, 2023), and financial advice (Schlosky et al., 2024).

The lack of empirical evidence on whether and how people actually turn to ChatGPT for high-stakes personal decisions, and what they subsequently do with its advice, is particularly salient given the tool's growing accessibility, increasingly human-like interaction style, and persuasive responses to intimate questions. Furthermore, uncritical reliance on ChatGPT poses tangible risks. ChatGPT can deliver factually incorrect or "hallucinated" (e.g., plausible-sounding but invented information; OpenAI, 2023) answers and provide recommendations misaligned with professional standards.

The risks mentioned above give the present study its practical urgency: if students are already turning to ChatGPT for decisions that affect their health, finances, or mental well-being, it becomes essential to map precisely when advice is trusted, when it is acted upon, and under what conditions it is dismissed. This study aims to investigate the extent to which individuals consult ChatGPT for guidance in high-stakes, life-related situations and the mechanism behind this decision. The four questions below provided the research's direction:

1. In which high-stakes domains do individuals consult ChatGPT for advice?
2. What motivates individuals to consult ChatGPT for advice in high-stakes domains?
3. What influences people's trust in the advice generated by ChatGPT for high-stakes domains?
4. To what extent do individuals report acting on ChatGPT's advice given on high-stakes topics?

Method

To address the four research questions, we conducted in-depth interviews with 20 students (30% female, 70% male) from a Dutch technical university. Recruitment employed a convenience sampling strategy by inviting students from different educational programmes (e.g., technical sciences/engineering, social sciences) to obtain heterogeneous responses.

To be included as interviewees, participants must be older than 18, fluent in English, have used ChatGPT at least once, and be comfortable discussing potentially sensitive life decisions (e.g., health, finances, relationships). For those who had never consulted ChatGPT in high-stakes domains, questions were rephrased to focus on future behaviour to maintain functional comparability across users and non-users.

Results

Results of the interviews reveal that most participants consulted ChatGPT for questions about high-

stakes domains (e.g., academic matters, medical and dietary issues, and finances). Several participants consulted ChatGPT for feedback or guidance to shape their academic and/or career paths, while others used the technology for quick information on symptoms or minor physical injuries. Some interviewees resorted to ChatGPT to obtain information about dietary choices.

In one instance, the technology was used for mental-health-related queries, but the decision was driven by curiosity. Most admitted they will not entertain using the technology for emotional support.

Participants who have not consulted ChatGPT in high-stakes domains still recognised the potential of the technology for at least one high-stakes domain, either for themselves or others who do not have the resources or support system.

Participants indicated various reasons for using ChatGPT for high-stakes questions, such as (a) accessibility and efficiency *(e.g., quick response to a query)*, (b) hassle reduction *(e.g., response is free)*, (c) perceived response breadth and objectivity *(e.g., answers to queries drawn from various sources)*, and (d) confidentiality of the interaction.

The risks of receiving inaccurate information from ChatGPT (Buchanan & Hickman, 2024) amplify the value of trust in the technology. Most interviewees (10 of 20) have conditional trust in ChatGPT, with some (8 of 20) expressing no trust in the technology. The level of trust in ChatGPT as an advice provider depends on the domain (e.g., financial vs career). Interviewees regarded ChatGPT's information on financial matters as not definitive, requiring double-checking.

For advice on career and academic matters, participants' trust is primarily conditional. Specifically, they limited their use of ChatGPT to brainstorming purposes. While a few respondents believed in the technology's ability to act as a career or educational advisor, some prefer to talk to people for career and educational advice.

Interviewees' confidence in ChatGPT's medical and health-related information is markedly low. Interviewees noted that the technology is trained to pick up everything, resulting in some information being unreliable. Hence, as some interviewees indicated, it is preferable to use government-sponsored health websites. A few who admitted to having used ChatGPT for medical matters mentioned using the technology for symptom-related information and tips on how to deal with less severe mental or physical complaints, but not for medical diagnosis.

Some indicated that mental health information from ChatGPT could not be relied upon, as the technology is seen to have no understanding of human emotions. Across the different high-stakes domains, trust levels fluctuate. Trust is high when mistakes are quickly detectable, and trust is low when the potential harm resulting from using inaccurate and ambiguous advice increases.

Interviewees' trust in ChatGPT is hinged on accuracy and verifiability. Depending on the perceived risks of using ChatGPT advice in high-stakes situations, interviewees indicated that they would resort to different behaviours upon acquiring the requested information. For instance, in low-risk scenarios (e.g., simple medical questions), interviewees followed ChatGPT's recommendations.

Many interviewees used ChatGPT to explore possibilities and then corroborated or double-checked information before deciding to use it. Interviewees experienced with using ChatGPT appeared to have a critical stance, considering the technology to prioritise providing satisfying responses over delivering accurate information.

Participants who did not consult ChatGPT for high-stakes questions consistently stated that they all did so deliberately and plan to keep it that way. They just considered ChatGPT to be unreliable enough for high-stakes questions in its current state.

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How Do AI Chatbots Compare to Human Experts? A Systematic Literature Review

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Type of manuscript: Extended abstract

Keywords: AI chatbots; expert knowledge; head-to-head comparison.

Introduction

The arrival of general-purpose large language models as publicly accessible tools has prompted a rapid and wide-ranging set of questions about their place in academic research practice. Since the release of conversational AI systems capable of producing fluent, detailed, and contextually appropriate responses across many domains, practitioners, institutions, and researchers have begun asking how the outputs of these systems compare to those of trained human experts (Bommasani et al., 2022; Thirunavukarasu et al., 2023). The question has obvious practical stakes. If AI chatbots can produce outputs that are comparable in quality to those of physicians, legal advisors, educators, or policy analysts, then their role in professional workflows is likely to expand considerably. If, however, the quality of those outputs falls short in ways that are not always visible to the people receiving them, then the consequences of uncritical adoption could be significant (Beale et al., 2025). Either way, a clear and honest account of what the evidence shows is a necessary starting point.

Research Questions

The inconsistencies documented in the literature raise questions that go beyond simply asking whether AI outperforms humans or vice versa. This review is guided by three research questions that together address both the substantive patterns in the evidence and the methodological conditions under which that evidence is produced.

RQ1: Across clinical and professional domains, under what task conditions do AI chatbots perform comparably to, better than, or worse than human experts?

RQ2: How do evaluation regime characteristics, including blinding procedures, reference standards, and rater expertise, co-occur with the reported patterns of human and AI performance?

RQ3: How is uncertainty handled by AI systems and human professionals in these comparisons, and how does this handling vary across task types and study designs?

Methodological Framework

This study follows the methodological conventions of a systematic literature review, drawing on PRISMA reporting guidelines to ensure transparency in search, selection, and synthesis procedures (Page et al., 2021). The review was designed to identify empirical studies that directly compare the performance of at least one AI chatbot with that of at least one human expert on a shared task, using a measurable performance outcome. Studies were eligible regardless of specialty or professional domain, provided they reported a direct or parallel evaluation of both human and AI outputs on the same or equivalent material.

The search was conducted in Web of Science, combining terms related to AI chatbot, large language models, and human-expert comparison. We screened the titles and abstracts for relevance, and full texts were assessed against the inclusion and exclusion criteria. We excluded several studies as they evaluated AI performance without a human comparator or relied solely on technical benchmarking without a professional reference point, or did not report a performance metric that could be extracted and described in narrative form. Following this process, 72 studies were retained for full data extraction and synthesis.

Preliminary Results

The 72 included studies span a wide range of clinical specialties and, to a lesser extent, non-clinical professional domains such as climate policy and remote sensing. Most of the research is concentrated in medicine (n = 58), with representation from emergency medicine, radiology, ophthalmology, gastroenterology, infectious diseases, otolaryngology, dentistry, psychiatry, and several surgical fields. The corpus predominantly evaluates variants of ChatGPT or GPT models (n = 64), followed by Google Gemini (n = 19) and Claude (n = 8), across tasks ranging from single diagnosis selection and triage to multi-step management planning, patient education, and knowledge assessment. This breadth means that the patterns described below arise from a heterogeneous body of work, and they should be read as descriptive tendencies across studies, not as settled conclusions.

Discussion and next steps

The preliminary findings outlined above point to a body of literature that is active, growing, and methodologically diverse in ways that matter for how its results should be read. Across 72 studies, the evidence does not support a single verdict on whether AI chatbots perform better or worse than human experts. Indeed, the more consistent observation is that reported performance differences are distributed across task types, evaluation regimes, and AI configurations in patterns that are themselves informative. Complex clinical decisions and nuanced diagnostic reasoning tend to favor human experts, structured and standardized tasks show AI systems performing more competitively, and patient-facing communication tasks frequently yield higher lay ratings for AI-generated content, even when specialist evaluators raise factual concerns about the same outputs.

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How Gamified Metaverse Experiences Shape Consumer Brand Evaluation in Hospitality

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Keywords: metaverse; gamified brand experiences; consumer brand evaluation; hospitality.

The metaverse has emerged as a persistent three-dimensional environment that enables users' social and spatial interactions via avatars, immersion, and shared activities (Dwivedi et al., 2022). It has also been found to be an effective channel for shaping consumer brand evaluation (CBE) (Boccalini et al., 2025; Vernuccio et al., 2025). CBE refers to consumers' overall assessment of a brand based on general impressions, brand experiences, and brand-related associations (Ghorbani et al., 2022).

In immersive environments, such as the metaverse, CBE may be influenced by users' motivations, anticipated gratifications, and emotional and cognitive states that emerge before, during, and after a gamified branded metaverse experience (GBME). A GBME refers to the experience emerging from users' interactions with branded virtual environments in the metaverse, where gamification elements (e.g., challenges, rewards, progression mechanics) are embedded to stimulate engagement and interactive participation through avatars (Huotari & Hamari, 2017; Flavián et al., 2021).

Given its experiential and interactive nature, the metaverse is particularly relevant for service industries, where value is co-created through engagement and experience (Hollebeek et al., 2019). Among these, hospitality represents a particularly interesting context, as it is inherently grounded in experiential consumption and customer journeys that unfold across multiple touchpoints, including digital touchpoints (Buhalis et al., 2023; Gursoy et al., 2025). Here, the metaverse enables brands to create virtual environments where users can explore offerings and interact with brands before, during, and after the physical experience, extending and enriching the overall service journey (Flavián et al., 2019), often incorporating gamification elements to foster interaction and experiential engagement (Zhang et al., 2026).

Within this emerging landscape, early implementations by hospitality brands provide a valuable empirical setting to investigate how such experiences influence consumer responses. A particularly relevant case is M Social by Millennium Hotels and Resorts in Decentraland, the first hospitality brand to enter the metaverse through a gamified branded experience in 2023. In this environment, users access a virtual hotel lobby and are invited to complete a game (i.e., climbing stairs without falling) to obtain discounts on future physical stays. As a pioneering and relatively unexplored initiative, this case offers a suitable context to examine how GBMEs shape CBE, especially among users unfamiliar with the metaverse.

In this study, the impact of a GBME on CBE is explained by integrating two complementary theoretical perspectives: Uses and gratifications theory (UGT) and Flow theory (FT). UGT posits that individuals actively select media environments to satisfy specific cognitive, affective, and social needs (Ruggiero, 2000). When these environments fulfill users' expected gratifications, they enhance positive evaluations and increase users' willingness to engage with the environment (Kaur & Kathuria, 2025). In parallel, FT explains that immersive and gamified environments foster deep engagement when users face clear goals, balanced challenges, and a sense of control (Hoffman & Novak, 1996). Within GBMEs, flow states intensify users' cognitive absorption and enjoyment, thereby shaping their real-time brand perceptions.

Provided this background, extant research has predominantly examined consumer responses to GBMEs at discrete points in time, most often after the experience, relying on scenario-based designs and samples of users already familiar with the metaverse (e.g., Boccalini et al., 2025; Zhang et al., 2026).

This approach provides limited insight into the process through which CBE emerges and evolves across the experience, particularly among users unfamiliar with such environments. Moreover, prior studies (e.g., Dwivedi et al., 2023; Thomas et al., 2023) tend to assume a positive effect of gamified experience on CBE, without critically examining whether these effects align with the motivations driving unfamiliar users to access the metaverse. As a result, the role of gamification in shaping CBE remains only partially understood.

Against this backdrop, this study examines how gamified metaverse experiences shape CBE across different stages of the experience (before, during, and after) among users unfamiliar with the metaverse. Specifically, it investigates how pre-experience expectations, flow during the interaction, and post-experience assessments jointly influence CBE within hospitality contexts.

Given the exploratory nature of the study, a qualitative multi-phase design was adopted to investigate an emerging phenomenon and its complex experiential processes (Elston et al., 2022). Data were collected between March and June 2023 across three sequential phases (Table 1) and analyzed using reflexive thematic analysis (Braun & Clarke, 2006) through an abductive, manual coding approach. Each respondent was treated as a case: the analysis first focused on within-case insights and then progressed to cross-case comparisons.

Table 1. Description of the multi-phase design

Phase	Method	Sample	Purpose	Outputs
Phase 1	Semi-structured interviews (pre-experience)	Gen Y (n = 25); Gen Z (n = 30); unfamiliar with the metaverse	Explore expectations and anticipated gratifications toward hospitality metaverses	Expectations, motivations, and anticipated uses
Phase 2	Narrative diary (before and during experience) while entering the M Social metaverse	Gen Y (n = 25); Gen Z (n = 30); unfamiliar with the metaverse	Capture real-time cognitive, emotional, and behavioral responses.	Experience-based reactions and flow-related conditions
Phase 3	Open-ended questionnaire (after one month)	35 participants (only those who completed all phases were retained for analysis)	Assess post-experience evaluation and sensemaking of the brand	CBE and delayed reflections

Preliminary findings indicate that CBE unfolds as a temporal process throughout the GBME rather than emerging at a single point in time. Before the experience, participants expected the metaverse to enable immersion and enjoyment, provide access to hotel-related information, facilitate social interaction, and offer novel forms of digital leisure, rather than gameplay- oriented activities. These anticipated gratifications generated high expectations toward brands, perceived as pioneering.

During the interaction, these expectations were only partially fulfilled. While avatar creation and initial exploration elicited curiosity and enjoyment, poor navigability, unclear game mechanics, limited social interaction, and difficulties accessing brand information disrupted immersion and prevented the emergence of flow. Participants consequently described the experience as frustrating and repetitive.

Following the experience, CBE became ambivalent: some participants viewed the brand as innovative despite weak execution, whereas others perceived it as confusing and overly promotional. One month later, more positive evaluations emerged among those who actively sought additional brand information, while others reported limited recall and neutral evaluations.

Despite limitations, this study contributes by integrating UGT and FT to explain how GBMEs shape CBE. It shows that CBE is temporally constructed and influenced by the alignment between expected gratifications and experience design. Findings further reveal a misalignment between users' motivations and gamified design, suggesting that poor navigability, unclear tasks, and limited social presence hinder

engagement and disrupt flow. Managerially, metaverse experiences should prioritize navigability, task clarity, and social interaction to effectively engage unfamiliar users.

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Investigating the Acceptance and Continuance Intention of Generative Artificial Intelligence in Digital Tourism

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Keywords: generative AI; technology acceptance; technology anxiety; digital tourism; Grey Systems Theory; hallucination risk.

Introduction

The diffusion of Generative Artificial Intelligence (GenAI) tools such as ChatGPT has reshaped digital tourism, particularly in travel planning and decision-making (Sigala et al., 2024; Stylos et al., 2025). While these technologies enhance efficiency and accessibility, their use has raised concerns regarding algorithmic reliability, trust in AI-generated content, technology anxiety, and GenAI-specific risks such as hallucinations (Kim et al., 2023). Unlike traditional utilitarian systems, GenAI operates through generative, probabilistic mechanisms, meaning users must simultaneously evaluate both utility and credibility. Frameworks developed for deterministic, rule-based systems may therefore inadequately model the cognitive and affective demands of GenAI-mediated travel decisions.

Despite the expansion of GenAI in tourism, understanding how tourists accept, evaluate, and continue using these systems remains limited. Existing research tends to examine isolated determinants rather than integrated behavioral mechanisms (Fakfare et al., 2025; Pham et al., 2024; Xu et al., 2024; Zhou & Ma, 2025). This study addresses this gap by developing a multi-layered acceptance framework in which cognitive utility, affective trust, psychological anxiety, and personalisation quality jointly explain satisfaction and sustained use, rather than merely extending TAM with additional variables.

Background

TAM and UTAUT explain usage intentions through perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989; Venkatesh & Davis, 2000). Tourism studies consistently identify PU as the strongest determinant of technology acceptance, with PEOU exerting both direct and indirect effects through PU (Marangunić & Granić, 2015; Saravanos et al., 2022).

However, these models were designed for deterministic systems and do not account for GenAI's opacity or generative variability. Recent research confirms trust as a parallel structural driver alongside PU, functioning as a risk-reduction mechanism when algorithmic opacity raises credibility concerns (Kim et al., 2023; Xu et al., 2024; Zhou & Ma, 2025). Beyond initial adoption, satisfaction functions as the central affective-cognitive mechanism linking perceptions to behavioral outcomes such as continuance intention and WOM, while technology anxiety can undermine satisfaction even when utility is recognised (Pham et al., 2024; Zhou & Ma, 2025). The framework empirically examines PU, PEOU, trust, personalisation, technology anxiety, satisfaction, continuance intention, and WOM, while acknowledging GenAI-specific contextual concerns such as anthropomorphism and hallucination risk as important directions for future research.

Methodology

A quantitative, cross-sectional survey design was adopted. Data were collected through online and on-site surveys in Italy (n = 241, 35.5%), Germany (n = 219, 32.2%), and Turkey (n = 219, 32.2%), yielding 679 valid responses from tourists who had used GenAI tools (e.g., ChatGPT, Gemini,

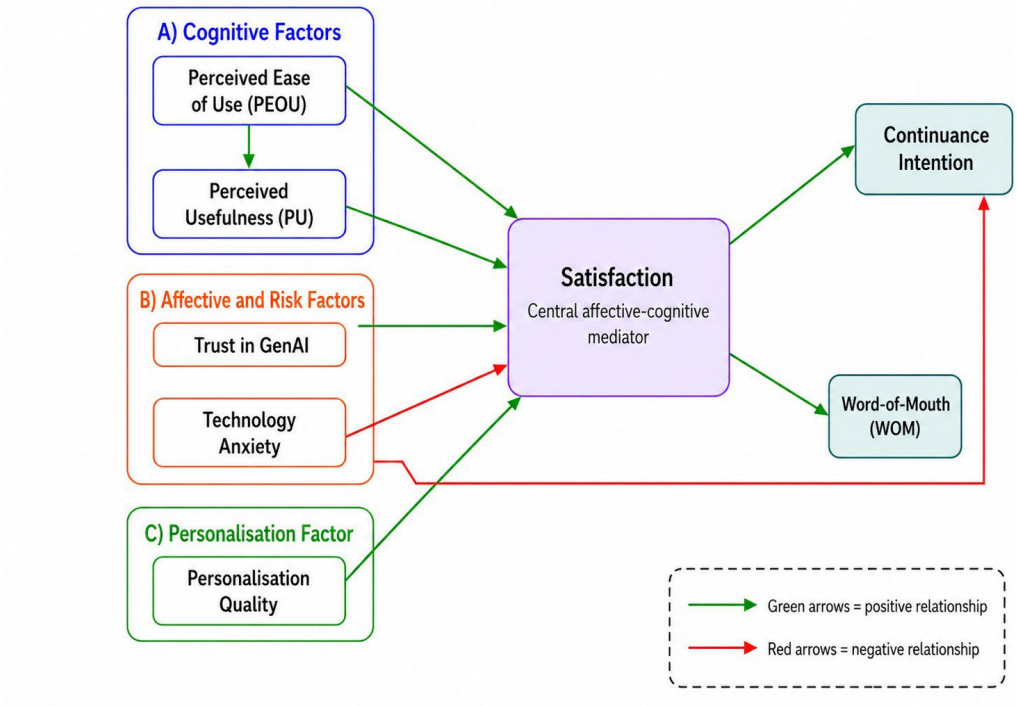
DeepSeek) for travel purposes. These countries were selected to represent distinct market profiles: Italy as a high-inbound Mediterranean destination, Germany as a technologically advanced outbound market and highly digitized destination, and Turkey as a rapidly evolving-digitized destination with a demographically diverse population. A convenience sampling approach was employed. To mitigate sampling bias, multiple distribution channels were used per country and respondents were screened for prior GenAI use; findings should therefore be interpreted as reflecting GenAI-experienced users rather than the general tourist population.

Validated multi-item five-point Likert scales measured all constructs. Analysis proceeded in three stages: measurement model assessment via Cronbach's alpha, Composite Reliability, AVE, and HTMT; structural hypothesis testing using PLS-SEM (SmartPLS) with AMOS robustness checks, bootstrapped mediation, and interaction-based moderation; and Grey Systems Theory methods comprising Grey Relational Analysis (GRA) for variable importance ranking and Variable Weight Grey Clustering (VWGC) for user segmentation. GRA was used because it supports comparative ranking under uncertainty in cross-cultural Likert data, while VWGC reveals behavioral heterogeneity without strong parametric assumptions, complementing the hypothesis-testing logic of SEM.

Results and Discussion

After data screening, 679 valid responses were retained. Common method bias was not detected (Harman's single-factor test = 23.6%). PU emerged as the strongest predictor of satisfaction ($\beta = 0.362$, $p < 0.001$), followed by trust ($\beta = 0.306$, $p < 0.001$) and personalisation ($\beta = 0.166$, $p < 0.001$). PEOU demonstrated a weaker direct effect ($\beta = 0.079$, $p < 0.05$) but a substantial indirect influence through PU ($\beta = 0.404$, $p < 0.001$), consistent with TAM logic. Satisfaction strongly predicted positive WOM ($\beta = 0.555$, $p < 0.001$) and continuance intention ($\beta = 0.551$, $p < 0.001$). Technology anxiety negatively influenced both satisfaction ($\beta = -0.177$, $p < 0.001$) and continuance intention ($\beta = -0.081$, $p = 0.011$), and the model explained 43.3% of variance in satisfaction ($R^2 = 0.433$). GRA confirmed PU as the most influential determinant. VWGC identified three user segments: enthusiastic adopters (81%), cautious users (18%), and reluctant users (1%), indicating that adoption is positive but conditional on perceived utility and psychological reassurance. Cross-cultural differences in segmentation across countries represent an important direction for future multi-group analysis.

Figure 1. Conceptual Framework for GenAI Acceptance, Satisfaction, and Continuance Intention in Digital Tourism



Conclusions and Implications

This study reconceptualises GenAI acceptance in digital tourism as a multidimensional process in which cognitive utility perceptions interact with affective trust and anxiety responses to shape sustainable use. While perceived usefulness remains foundational, trust emerges as a parallel structural driver, and technology anxiety acts as a significant inhibitory force. Theoretically, the findings advance the literature beyond incremental TAM extensions by demonstrating that acceptance in generative AI environments requires integration of affective and risk-based constructs. Methodologically, combining SEM with Grey Systems approaches uncovers both causal pathways and user heterogeneity that hypothesis-testing alone cannot capture.

Practically, sustainable GenAI adoption depends on explainable AI interfaces that communicate confidence levels, data provenance, and the basis of recommendations. Tourism platforms should also include verification prompts for high-stakes travel decisions, human-override options, and transparent guidance on how recommendations are generated. These measures can reduce hallucination-related anxiety and directly support cautious users, who represented 18% of the sample. In AI-driven tourism ecosystems, functional value alone is insufficient; psychological reassurance and trustworthy design are essential for long-term engagement.

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Mediated Curiosity? Augmented Reality and Epistemic Value in An Urban Heritage Walk in Stirling

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Keywords: augmented reality; epistemic value; urban heritage tourism; visitor experience; walk-along method.

Augmented reality (AR) is increasingly used in heritage and urban tourism to enhance on-site experiences. As the technology continues to evolve and attract academic interest, it has been examined in terms of hedonic enjoyment, perceived usefulness, and overall experiential value (Cranmer et al., 2020). Recent empirical studies demonstrate that AR enhances immersion, interpretation, and engagement in heritage tourism (Zhu et al., 2024; Xiao et al., 2026). Tourism studies also highlight the role of learning-related benefits in visitors' evaluations of destinations and services (Mwesiumo & Abdalla, 2022).

This research examines AR as an epistemic medium in urban heritage tourism, focusing on how AR-enabled walks through the Scottish city of Stirling formulate visitors' perceived epistemic value. Building on the Theory of Consumption Value (TCV) and prior work on AR in tourism (Sheth et al., 1991; Cranmer et al., 2020), epistemic value is conceptualised as visitors' perception that AR has deepened their understanding of the city's heritage, enabled knowledge acquisition, and supported the (re)construction of their interpretations of place, while potentially generating tensions between AR-enabled and other forms of exploration. Complementing empirical work on AR value, conceptual discussions in philosophy of technology suggest that AR may reconfigure how users' access, prioritise, and trust information in real-world environments, raising questions about "augmented epistemology" and subtle filtering of reality (Turner, 2022). The study is guided by three questions:

(1) What in situ information seeking practices do visitors apply when engaging with the city's heritage, while having the option of AR use?

(2) How can AR influence the emergence and direction of visitors' epistemic curiosity during an urban exploration of a heritage destination?

(3) How do visitors perceive, describe, and reflect upon the epistemic value of an urban heritage experience enhanced by AR?

TCV conceptualises consumer choice as a function of multiple dimensions of perceived value, such as social, emotional, conditional, functional, and epistemic (Sheth et al., 1991; Tanrikulu, 2021). Epistemic value refers to the perceived utility of an experience in satisfying curiosity, providing novelty, and enabling knowledge acquisition. Tourism research has begun to show that epistemic value contributes to visitors' destination evaluations (Mwesiumo & Abdalla, 2022). Research in heritage tourism indicates that AR can provide cultural-historical and educational value, fostering engagement and perceived learning at heritage sites (Jung & Han, 2014; Xiao et al., 2026). However, most contributions assess value through retrospective evaluations of system qualities and overall experience, leaving the situated, processual construction of epistemic value largely underexplored (Cranmer et al., 2020). Although studies have highlighted the educational and experiential affordances of immersive technologies, and recently theorised their role in cognition and knowledge production (Fisher, 2022; Aguayo et al., 2023; Klippel et al., 2019), little attention has been paid to how AR forms epistemic value in heritage tourism contexts. The paper contributes to discussions of value formation in immersive technologies (Klico & Muhić, 2022; Luan & Phan, 2023) by extending the TCV into AR-mediated tourism experiences and conceptualising epistemic value as situated, processual and emergent during urban exploration.

AR is treated as an epistemic medium, facilitating the trajectory of visitors' epistemic curiosity. The latter

is understood as a situational motivational state, the desire to seek information and resolve knowledge gaps, activated and channeled by technological cues (Litman & Spielberger, 2003; Litman, 2008). In AR-mediated walks, visitors can draw on the affordances of the technology in self-directed ways to seek out information, explore sites, and construct interpretive frames, thereby influencing how epistemic value is produced through the experience (Jung & Han, 2014).

The study employs a mobile walk-along method in the city of Stirling. Walk-alongs have been proposed in tourism studies for capturing experiences and interpretations unfolding in situ, combining observation with in-motion interviewing (Kusenbach, 2003; Skov et al., 2018). The method is considered appropriate for examining AR's influence on information seeking, curiosity, learning and sense-making in the urban environment. Participants, consisting of tourists and short-term visitors recruited through local tourism networks and on-site invitations, will be selected purposively to capture varying levels of familiarity with AR. They will be invited to use AR-enabled smart glasses during a researcher-guided but flexible walk through selected heritage areas of Stirling. The researcher will accompany each participant, encourage real-time reflections and pose open-ended questions about what they notice, important or surprising elements, and participants' understanding and evaluation of the information-seeking and learning opportunities provided by AR. Fieldnotes and audio recordings will document interactions with the AR interface, attention shifts, and cityscape interpretations. Data will be analysed using reflexive thematic analysis, focusing on how participants articulate epistemic value, and how AR appears to activate, direct, facilitate or hinder epistemic curiosity (Braun & Clarke, 2006). Coding and themes will be discussed iteratively between researchers to enhance analytical transparency and reflexivity. Themes will be related back to TCV and discussions about AR's learning implications and value proposition.

Following prior research on AR's experiential and epistemic value (Cranmer et al., 2020), as well as on mobile visitor methods (Kusenbach, 2003; Skov et al., 2018), we aim to provide a situated account of epistemic value in AR-mediated urban heritage tourism. AR's potential will be explored in enriching and channeling epistemic curiosity, with a critical perspective on possible negative implications, thereby offering a balanced view. The findings may offer practical implications for the design of AR-enabled heritage experiences by identifying how technological cues can support urban exploration. Furthermore, we aim to provide a methodological example that informs future research exploring AR experiences among participants with varying familiarity. The contribution of the paper lies in examining epistemic value as a situated, processual construct rather than a retrospective evaluative outcome, and bringing together mobile qualitative methods and AR tourism research in an understudied urban heritage context.

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Mind Over Matter: How Perceived Agency Triggers the Projection of Similarity and Behavioral Engagement with Virtual Influencers

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Type of manuscript: Extended abstract

Keywords: virtual influencers; perceived agency; CASA paradigm and projection effect.

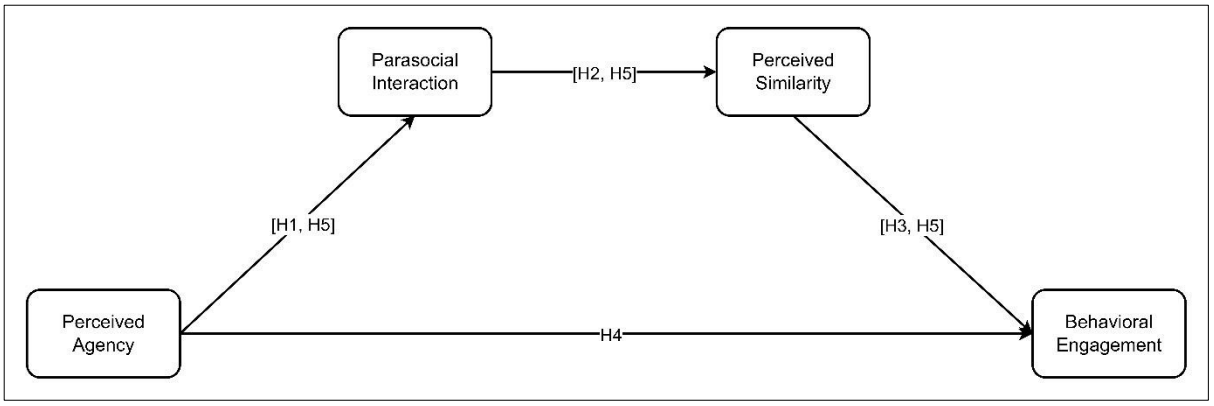
Introduction

Virtual influencers (VIs) have significantly altered the influencer marketing landscape through accelerated growth, challenging the inherent need for human source involvement in brand promotions. As the phenomenon gains traction, the theoretical frameworks have faced a critical theoretical lacuna, wherein the existing literature has focused extensively on the Similarity- Attraction Effect, where social media users are only engaged by VIs if a sense of similarity is felt (de Boissieu & Baudier, 2023; Li & Ma, 2023). This has created a logical contradiction, wherein if human likeness is the only catalyst for engagement, artificial constructs such as VIs should, by extension, be unable to form meaningful relationships. This paper fills the theoretical void by exploring the concept of artificial autonomy as a unique psychological catalyst, building upon the notion that the primary motivator for behavioral engagement, i.e., Perceived Agency (PA), is the degree to which the user perceives the VI as having autonomous intent, regardless of human likeness (Poinsot *et al.*, 2022).

Grounding this inquiry on the Computers Are Social Actors (CASA) perspective and the Mind Perception Theory (Gray *et al*., 2007), the current study argues that humans treat artificial agents in a social manner due to a biological constraint in discriminating between real and simulated social information (Gambino *et al.*, 2020; Zhang & He, 2025). This constraint allows Perceived Agency, distinguished here from general anthropomorphism by its focus on autonomous intent, to grant social identity to the agent, evoking an affective response through Parasocial Interaction (PSI) (Kim & Baek, 2023). Furthermore, we argue that the typical pathway to relationship formation between a user and an artificial agent is reversed in the case of virtual influencers. Thus, rather than Perceived Similarity (PS) between the user and the VI forming prior to the development of a relationship, we argue that PS is projected onto the VI subsequent to the development of an emotional relationship. This is due to the cognitive process wherein users align the VI's characteristics to their own to maintain internal consistency and minimize psychological distance (Kim & Baek, 2023).

Accordingly, we posit the operation of a Dual-Route Model of Behavioral Engagement (BE), wherein BE, such as liking, commenting, and sharing, may occur via a direct novelty route and a mediated affective-cognitive route (see Figure 1).

Figure 1. Hypothesized Conceptual Model



Based on this framework, this study seeks to answer the following research questions:

1. How does Perceived Agency directly and indirectly influence Behavioral Engagement with virtual influencers?
2. Does the affective bond serve as a prerequisite for cognitive assimilation in virtual influencer interactions?

Research Method

For the purpose of the current study, a quantitative research design was utilized, relying on a study of 439 Gen Z social media users who, owing to their digital native status, are considered appropriate to assess the limits of the CASA Paradigm (Audrezet *et al.*, 2025). Participants were exposed to a high-fidelity one-minute video stimulus featuring the virtual influencer Imma openly discussing her digital identity and then responding to a series of questions, including quality control questions. To ensure the integrity of the data gathered, a three-stage screening process was utilized. Participants were eliminated if they do not satisfy social media usage criteria (n = 11), if they are familiar with Imma (n = 9), and if they do not succeed in the video-based attention check (n = 8).

The final sample yielded 439 valid members of Generation Z (M_{age}=22.4; 52% female). The data analysis was performed using SmartPLS, version 4.1.1.6. The measurement model was analyzed to confirm the reliability and validity of the scales, while the structural model was analyzed to test the proposed dual route framework. To confirm the statistical sufficiency of the data, a post-hoc power analysis was performed using G*Power 3.1, setting a medium effect size criterion, which yielded a power level above 0.99.

Results

The results of the measurement model assessment confirmed the reliability and validity of the constructs. The structural model results revealed that all direct and indirect effects were statistically significant, as presented in Table 1. The joint significance of the direct path and the serial indirect path revealed that the model represented a pattern of 'complementary partial mediation.' The model revealed good explanatory power, with a variance of 69% explained in Behavioral Engagement. The robustness of the model was confirmed by making the inclusion of Reward Responsiveness (Marker Variable) and Gender (Control) non-significant, thereby confirming that the model was resistant to common method bias and generalized to the broader Gen Z cohort.

Table 1. Path analysis

Hypothesis	Relationship	Beta (β)	T-Statistic	95% CI [LL, UL]	Result
H1	PA → PSI	0.800	32.641***	[0.749, 0.844]	Supported
H2	PSI → PS	0.748	23.165***	[0.678, 0.808]	Supported
H3	PS → BE	0.411	8.095***	[0.312, 0.514]	Supported
H4	PA → BE	0.481	9.161***	[0.370, 0.577]	Supported
H5	PA → PSI → PS → BE	0.246	6.836***	[0.179, 0.322]	Supported

Note: *** $p < .001$

Originality and Conclusion

This study provides supportive evidence for the Projection Effect, suggesting that human-like similarity can be a cognitive outcome of an affective parasocial bond formed through Perceived Agency. The model's explanatory power indicates that for digital natives, artificial autonomy is a powerful predictor of engagement. The results support the serial mediation model, indicating that the affective bond can precede the cognitive evaluation of similarity in VI interactions.

From a theoretical point of view, the current study extends the CASA Paradigm by showing that users not only attribute a social identity to AI, but also project human likeness onto artificial agents because of the experience of artificial autonomy, in order to achieve a more consistent self-concept. From a practical point of view, the current study suggests that the key for a more effective engagement of Gen Z users with virtual influencers lies in the use of "Mind-to-Heart" storytelling, emphasizing artificial autonomy, rather than human likeness.

Boundaries and Future Research

While promising, these findings are subject to limitations. The use of a single VI stimulus (Imma), whose explicit disclosure of digital identity may uniquely influence agency perceptions, limits broader generalizability. Future research should utilize diverse VI archetypes and comparative human conditions to further validate the scope of the Projection Effect.

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Navigating the Ethics of AI: Insights from Student Perceptions

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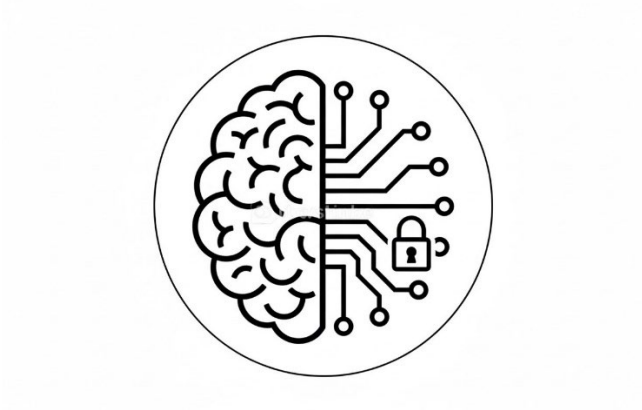
Type of manuscript: Extended abstract

Keywords: business ethics; artificial intelligence; attentive teaching.

The integration of Business Ethics (BE) and AI ethics in management education has accelerated due to legitimacy crises and global governance frameworks, particularly SDG-oriented guidance. Ethics in AI has become a global topic of interest for both policymakers and academic researchers (Khan et al., 2022). At the same time, growing concerns among students and future professionals regarding privacy, responsibility, and the convenience-driven use of AI highlight the need to better understand how younger generations perceive AI-related ethical tensions. The role of the individual decision-maker is often underestimated, even though individuals ultimately underpin all business actions, whether through personal conduct, corporate policy, or technological systems such as AI or algorithms (Kay, 2019). Ethical failure arises less from deliberate wrongdoing than from cognitive and social processes that diminish moral awareness and enable rationalization, including ethical fading, motivated blindness, incrementalism, and moral disengagement (Bandura, 1999; Moore et al., 2012). Accordingly, learning outcomes must extend beyond simply "knowing" ethical principles. Jeong et al. (2020) highlights the importance of emotions in ethical decision-making, showing that moral emotions can enhance ethical judgment among business students. Moreover, Khan et al. (2022) identify lack of ethical knowledge as one of the main reasons that AI ethics in practice is still far from being mature.
Building on this perspective, it becomes essential to examine how new generations interpret and engage with these ethical challenges. Having grown up with constant exposure to social, environmental and digital issues, students bring distinct expectations and sensitivities; as future business leaders and entrepreneurs, their views are particularly consequential. Our work adopts an interactive, mediated approach to explore such topics with students from management studies, called Attentive Teaching (Gal et al., 2023; Schur, 2025). Insights from this analysis can help organizations better align with emerging generational expectations and remain adaptive to the evolving vision brought by future managers.
We engaged 24 students in an interactive, student-centered activity run twice and designed to explore their perceptions, levels of engagement, and feelings toward business ethics, CSR, and sustainability. Drawing on the Attentive Teaching framework, which emphasizes dialogue, visual representation, and the teacher's role as a facilitator building on students' own interpretations and experiences, the activity encouraged participants to externalize their ideas through drawings (created either manually or with AI support) and use them as a basis for collective reflection. Students were first introduced to the themes through a brief exploratory discussion and were then given 20–30 minutes to produce visual representations of ethical issues in contemporary economic systems. Each participant subsequently presented and explained their drawing, which served as the basis for an open, guided discussion with mediated interaction where perspectives were compared, questioned, and further developed. The outputs were analyzed qualitatively through the drawings themselves and detailed written notes of the discussions. Given the relatively small sample, the findings should be interpreted as exploratory rather than inferential, while still offering useful directional evidence.
The activity generated a high level of student engagement, with nearly all participants actively contributing to the discussion. For the students, business ethics is closely connected to individual values and moral frameworks and has great importance. However, organizations are often perceived as showing limited commitment to these principles. A specific area of engagement emerged around artificial intelligence and data-related ethical issues. Students demonstrated awareness of the ethical implications of digital technologies, particularly in relation to privacy, transparency, and over usage.

A concrete example illustrated this engagement: one student initially intended to use an AI tool (ChatGPT) only for inspiration but ultimately relied on it to complete her drawing. Reflecting on this shift, she noted that she had "lost her dilemma," revealing how easily practical convenience can override ethical intentions. This episode prompted a broader discussion among participants about the tension between ethical awareness and actual behavior when interacting with AI systems. Figure 1 reports one of the students' drawings. Although the prompt broadly addressed ethical dilemmas in contemporary business, the student focused specifically on AI in work contexts, portraying it as both useful and potentially harmful. The drawing contrasted human qualities such as empathy and responsibility with AI's functional capabilities and highlighted concerns about privacy and data protection through the image of a "locker." The student ultimately questioned whether current AI usage is "crossing a limit" by increasingly replacing human roles and judgment.

Figure 1. Image chosen by one student in the attentive teaching session about business ethics



The discussion provided evidence that students recognize the ethical trade-offs embedded in the use of digital platforms and AI, even when they consciously accept these compromises. Their reflections indicated an understanding that technological tools can subtly influence decision-making processes, potentially reducing critical engagement or ethical reflection. At the same time, this awareness coexisted with a pragmatic acceptance of such tools, suggesting a gap between ethical principles and everyday practices.

Overall, the activity revealed that when students are actively engaged through interactive methods, they are capable of critically reflecting on the ethical dimensions of AI and data use. Their contributions demonstrate both a sensitivity to key issues, such as privacy and responsibility, and an acknowledgment of the challenges involved in maintaining ethical consistency in technologically mediated contexts. These findings suggest that organizations should support AI adoption not only through technical training and governance mechanisms, but also by creating spaces for ethical reflection, dialogue, and critical questioning. The sessions showed that students often perceive AI-driven business practices as opaque and excessively profit-oriented, while expressing skepticism toward polished narratives around AI and companies' behavior. Managers should therefore communicate AI use more transparently, openly discussing uncertainties, trade-offs, limitations, and the human decisions behind AI systems, rather than presenting AI as neutral or inherently objective. In addition, AI ethics education should not be included only in engineering and computer science curricula (Borenstein and Howard, 2020) but should become part of the education of future professionals across all disciplines, given the growing integration of AI into managerial, organizational, and societal decision-making.

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Preparing the Hotel Industry for the Next Generation of Artificial Intelligence

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Keywords: hotel industry; service design; artificial intelligence; system interoperability.

Introduction

The advent and rapid adoption of AI are fundamentally altering various industries, including hospitality (Sigala et al., 2024). Generative AI (Gen AI) and various subsets of AI are transforming businesses through "continuous enterprise reinvention, real-time intelligence, and synthesizing multiple types of data," thereby influencing the future of work (Naraian et al., 2025). However, as AI continues to expand and penetrate service operations, the established service designs and Standard Operating Procedures (SOPs) will require substantial adjustments (Nanu, 2025).

Further, the core challenge for the hospitality industry is a profound readiness gap: while the progression to Artificial General Intelligence and Artificial Superintelligence promises a fundamental transformation of service delivery, the sector remains constrained by a complex, human-centric operating model and a deeply entrenched, fragmented technological infrastructure of siloed legacy systems. Hence, this paper aims to provide an overview of the expected evolution of AI, discuss the changes that each new generation of AI will bring to the hotel industry, and pave a way for effective technology integration to prepare for the future of AI.

Current State of the Hospitality Industry and Guest Interactions with AI

Existing literature demonstrates that AI adoption spans a continuum from basic automation and analytical systems to more advanced autonomous and agentic systems. Different guest scenarios depending on the use of AI and the guest's outcome can be suggested, such as seamless service delivery with a positive AI outcome, challenges in complex problem resolution with a negative AI outcome and desire for a human agent, or evolving customer expectations with a negative human agent outcome and desire for an AI agent. These scenarios reveal a complex interplay between agent type (human vs. AI) and guest experience (positive vs. negative). This dynamic can be conceptualized within a 2x2 matrix (see Figure 1), where one axis represents the Hospitality Agent (ranging from Human to AI) and the other represents the Guest Experience (ranging from Negative to Positive).

This matrix highlights various options for resolving service failures. Guests who experience frustration with AI systems may desire to transition to a human agent for more nuanced problem-solving. Conversely, guests dissatisfied with human interactions may seek the efficiency and perceived impartiality of an AI agent. The hospitality industry must therefore be prepared for these diverse scenarios, fostering fluidity in service recovery mechanisms and adapting to dynamic customer demands that oscillate between a preference for human and AI assistance.

Figure 1: Service Interaction and Recovery Matrix in AI-Enabled Hospitality

	Guest Experience: Positive	Guest Experience: Negative
Agent: Human	Traditional positive human interaction (e.g., attentive front desk, personalized recommendations).	Dissatisfaction with human agent (e.g., rude, unqualified, slow response) - *leading to desire for AI agent (Situation 3)*.
Agent: AI	Efficient and accurate AI interaction (e.g., quick resolution of routine queries, automated check-in) - (*Situation 1)*.	Frustration with AI limitations (e.g., inability to handle complex issues, repetitive responses) *leads to a desire for a human agent (Situation 2)*.

Background: Understanding AI Classifications

IBM classifies AI into three primary categories, representing a progression in intelligence and autonomy. Artificial Narrow Intelligence (ANI), or weak AI, is the only form of AI currently in existence and is designed and trained to perform a single or a very limited set of tasks (Kuusi & Heinonen, 2022). However, ANI does not extend beyond the programmed function. For instance, virtual assistants such as Siri and language models, such as OpenAI's ChatGPT, fall under the ANI umbrella (Babu & Banana, 2024) and manifests in applications such as chatbots in hotels.

Artificial General Intelligence (AGI), or strong AI, presently a theoretical concept, is envisioned as an AI system capable of understanding, learning, and applying intelligence across a broad spectrum of tasks, mirroring human cognitive abilities (Goertzel, 2014). Unlike ANI, AGI would be able to leverage previously acquired knowledge and skills to successfully tackle new tasks in diverse contexts, without requiring explicit human training for each novel application. (Christou, 2025). Artificial Superintelligence (ASI) is another theoretical concept that represents the pinnacle of AI development. An ASI system would be capable of independent thought, advanced reasoning, continuous self-learning, and judgment-making at a level far exceeding human capacity (Bostrom, 2020; Metz, 2024).

The Impact of AI Stages on Hospitality Operations and Guest Experience

The progression of AI from its current narrow state to AGI and ASI will fundamentally redefine the hospitality landscape, impacting operational efficiency and guest experience. In the present era of ANI, conversational AI handles significant volumes of customer interactions. ANI excels at directing customers to relevant information or initiating simple service requests. However, limitations become apparent when confronted with complex issues requiring cross-system integration. Currently, technology silos and a lack of seamless interoperability between disparate systems limit the ability to provide efficient service, often leading to significant guest dissatisfaction.

The advent of AGI promises a complete transformation by overcoming ANI's limitations. AGI systems would achieve cognitive capabilities comparable to humans, understanding context with depth and navigating information across traditionally disparate systems. AGI would function as a highly capable moderator, intelligently bridging gaps and acting on a comprehensive understanding of the situation. If ASI becomes a reality, it would function as a supreme, well-informed leader, possessing a holistic and instantaneous understanding of all interconnected systems. ASI would anticipate needs and proactively provide solutions before being asked, offering the ultimate solution to the entrenched challenges faced by large hotel chains.

Discussion and Conclusions

This paper explores AI's profound impact on hospitality, tracing its evolution from current ANI to the theoretical horizons of AGI and ASI. The theoretical value lies in conceptualizing AI's transformative trajectory, offering a framework for understanding necessary systemic changes and providing a "Service Interaction and Recovery Matrix" to analyze the interplay between humans and AI. Practically, hotels must prioritize system interoperability to dismantle technological silos, requiring

significant investment in unifying operational technologies. Employee training must evolve to emphasize human-AI collaboration and empathetic service recovery. For educational programs, curricula must include AI literacy and human-centric AI skills such as emotional intelligence and adaptive leadership. Finally, technology vendors must prioritize platform unification and true interoperability. To achieve the potential of AGI and ASI, vendors should develop comprehensive platforms that integrate diverse hotel infrastructures while addressing crucial data privacy and security concerns to build consumer trust.

This paper's insights are theoretical projections, as the unpredictable pace of AI development may alter specific timelines. Future research must empirically validate these predictions through case studies and experiments. Addressing the gap between technological readiness and societal acceptance remains vital for unlocking AI's full transformative potential in the hospitality industry.

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Seeing Me Train: Metaperception and the Acceptance of Digital Human Personal Trainers in Gym Services

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Type of manuscript: Extended abstract

Keywords: AI in service; Digital Human service agents; Metaperception.

Introduction

Customer-facing technologies increasingly reshape how firms design and deliver service encounters. This development becomes particularly relevant when AI no longer remains a backstage support tool but appears as a frontline service actor. Service design research conceptualizes such systems as "Service AI" (Mortati & Freitas, 2025). Digital Humans (DHs) represent a relevant form of such Service AI. We define DHs as AI-powered, visually embodied, human-like conversational agents that combine high form realism and high behavioral realism (Miao et al., 2021; Seymour et al., 2022; Silva & Bonetti, 2021). They differ from disembodied chatbots and voice assistants, as well as from stylized or human-controlled avatars (Nowak & Biocca, 2003; Yusuf et al., 2025). In service settings, DHs may act as AI-based trainers. In this role, they could guide exercises in real time and provide motivational support (Kwok et al., 2021). Extending existing video-based training in fitness studios, DHs could offer virtual interactive coaching on demand. Yet gyms are socially sensitive servicescapes. They combine public visibility, behavioral norms, bodily performance, and customer-to-customer observation. In such settings, technology acceptance depends not only on functionality, but also on the social conditions under which use becomes visible. While prior research has examined the functional potential of DHs (Silva & Bonetti, 2021), less is known about how observable service environments shape their acceptance. Therefore, the study asks:

(1) How do consumers perceive and experience DHs as personal trainers in public, socially sensitive service encounters?

(2) How do social dynamics shape people's experiences with DHs in individual versus group training?

(3) How do gym managers evaluate the strategic and operational feasibility of DH personal trainers, and where do they anticipate value creation or risk?

This study draws on metaperception (Albright et al., 2001; Elsaadawy et al., 2023) and Social Identity Theory (Tajfel & Turner, 1979). In public service encounters, technology use can become socially diagnostic. Customers may evaluate usefulness, but also anticipate how others interpret their visible interaction with it. This is especially relevant in fitness studios, where training is body-related and takes place in front of others. Innovative technologies can evoke social evaluation concerns and anticipated technology embarrassment (Cowan et al., 2017; Chan et al., 2022). Interacting with a DH may therefore create a performer mindset and an overestimation of the attention of bystanders (Argo et al., 2005). Prior research suggests that service robots can reduce discomfort because users perceive them as less judgmental than human employees (Liu et al., 2024; Pitardi et al., 2024). DHs may partly share this advantage. However, their human-like appearance can make the interaction more socially conspicuous. Customers may therefore worry less about being judged by the DH itself. Instead, they may worry about how other gym members evaluate them for interacting with a human-like yet artificial trainer. Social Identity Theory helps explain why these concerns may vary across settings. In one-to-one coaching, the user may become the focal person who visibly deviates from established gym routines. This may create an outgroup position (Tajfel & Turner, 1979) compared with members following conventional gym behavior. In group classes, DH use may become part of a shared service script. Shared participation may support ingroup-oriented normalization (Tajfel & Turner, 1979) and make DH interaction appear more socially acceptable.

The study follows a qualitative, exploratory design based on problem-centered interviews (Witzel,

2000). The consumer dataset consists of 31 interviews with gym members conducted in early 2025. Participants had to train at least twice per week during the previous eight weeks. They also had to regularly engage in individual training or group classes. The sample included 16 women and 15 men. The mean age was 27.97 years. The first fifteen interviews focused on individual DH coaching. During data collection, group classes emerged as an additional relevant setting. Therefore, a second guide was used in the subsequent sixteen interviews, consistent with iterative qualitative research (DeJonckheere & Vaughn, 2019; Srivastava & Hopwood, 2009). To complement the consumer perspective, ten manager interviews were conducted in December 2025 as part of an ongoing managerial dataset, with ten additional interviews planned. Data analysis was conducted in MAXQDA. The consumer dataset yielded 4,142 coded segments and six overarching categories.

Table 1. Study overview

Dataset	Sample	Method	Focus
Consumers	n = 31 gym users	Semi-structured interviews	Acceptance drivers and barriers; setting effects
Managers (WIP)	n = 10 gym managers	Semi-structured interviews	Business value, feasibility, operational constraints

The findings show that consumers do not reject DH personal trainers in general. Rather, acceptance depends on whether the technology is perceived as useful, trustworthy, socially appropriate, and technically reliable. Participants recognized the potential of DHs to provide individualized guidance, real-time correction, motivational support, and more accessible coaching. At the same time, this potential was evaluated against conditions such as realistic but not uncanny design, controllable data use, reliable movement recognition, and a credible price- value relationship. Table 2 summarizes the six acceptance categories from the consumer interviews. The strongest pattern concerns the social context of use. Individual DH coaching on the open gym floor was often perceived as visible and awkward, especially when users imagined talking to a screen or receiving corrections in front of others. This heightened metaperception and anticipated embarrassment. In contrast, group classes were evaluated more positively because shared participation diffused attention and made DH interaction part of a collective training script. Manager interviews reinforce this ambivalence. Managers saw DHs as scalable support systems, but emphasized social feasibility, brand fit, data governance, safety, and the risk of a “robot gym” image.

This paper advances service research by examining DH acceptance in public frontline service contexts where technology use is observable by other customers. DHs as frontline service actors are still insufficiently understood, especially when they are embedded in public and norm-oriented domains. The study shows that acceptance is shaped not only by functionality or design realism, but also by social perception and role legitimacy. The contribution is threefold. First, it develops a grounded category system of acceptance drivers and barriers for DH personal trainers. Second, it theorizes individual and group training as boundary conditions for metaperception and anticipated embarrassment. Third, by integrating the manager perspective, it derives implications for the hybrid design of human-embodied AI interactions that reduce users’ fear of social judgment in public, norm-oriented service settings.

Table 2. Preliminary category system (consumer perspective)

Category	Definition	Example subthemes
Visual Design Perception	Realism, aesthetics, and display format shape first impressions (253).	Avoid self-replica (14); life-sized screen preferred (12); realism praised (15); uncanny mimic (14).
Data and Privacy Concerns	Data collection must feel legitimate and controllable (211).	Headphones/private audio (26/31); fear of misuse (24/90); opt-in and deletion controls (7).
Perceived Functional Benefits	DHs are valued when they improve training quality (139).	Individualized advice (43); support and accessibility (24); feedback and reinforcement (15)
Technology- Related Concerns	Technical immaturity, errors, and recognition doubts hinder acceptance (132).	Lack of physical interaction (39); limited perceptual capability of the DH (29); tech uncertainty (13).
Social Dynamics	Public visibility shapes social acceptability and embarrassment (238).	Metaperception (59); uncertainty due to exclusive DH use (47); group dynamics as a protective factor (51).
General Acceptance Criteria	Price, role congruence, and provider trust condition acceptance (240).	Lower price expectation (13); trialability; institutional trust; hybrid human-DH model.

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Stadiums vs. Sphere: Music Immersion

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Type of Manuscript: Extended Abstract

Keywords: music immersion; Sphere, stadium concerts

Introduction

I presented "The Sphere Happens Here: Immersive Entertainment in Las Vegas" at AIRSI 2024. Since my primary research focus has always involved music, I have thought about the Sphere and immersion with each music artist (U2, Grateful Dead, Eagles, etc.) that has done a residency there. When Kenny Chesney became the first country artist to do so in 2025, I knew it was my chance to compare Sphere to Stadium. I had to opportunity to see him the last time he played a Stadium (Gillette Stadium, Foxborough, MA 8/24/24). I have tickets[1] to see him when he returns to the Sphere on 7/11/26.

Background

Music immersion has gone from being lost in a song to be lost in a venue. The rapid evolution of immersive[2] technologies is reshaping how audiences experience live music. Traditional stadium concerts have long defined large-scale music performance, emphasizing spectacle, collective energy, and mass participation (Holt, 2010). In contrast, emerging purpose-built immersive venues like the Las Vegas Sphere represent a new paradigm in live music, prioritizing multisensory integration, spatialized audio, and technologically mediated environments (Leonardo, 2025).

This extended abstract begins the process of examining how these two venue models differ in their ability to produce immersive musical experiences through a comparative analysis on Kenny Chesney, an artist uniquely positioned between both formats.

Chesney's long-standing reputation for high-energy stadium tours and his more recent immersive Sphere performances offer a rare opportunity to examine how the same artist, repertoire, and fan base are recontextualized across contrasting immersive environments. Positioned at the intersection of performance studies, immersive media, and experiential design, the study aligns with AIRSI's focus on immersive and augmented realities by analyzing physical, large-scale immersive music environments (Auslander, 2008).

[2]

Research Objectives and Questions

The primary objective of this research is to comparatively analyze music immersion in traditional stadium concerts and next-generation immersive venues through the case of Kenny Chesney. By examining how Chesney's performances adapt across these formats, the study seeks to understand how architectural design, sound technologies, visual systems, and audience behavior interact to produce distinct immersive experiences.

The research potentially addresses the following questions:

1. How do Kenny Chesney's stadium concerts and Sphere performances differ?
2. How do these differences influence audience perception of immersion, emotional engagement, and presence (Csikszentmihalyi, 1990)?
3. How does Chesney adapt performance style between stadium and immersive environments?
4. What do these adaptations reveal about the evolving expectations of contemporary live music

[1] When I purchased the tickets, I was required to accept the following: "This event may include immersive elements such as seat haptics, movement sensations, flashing lights, intense lighting, visual effects, loud noises, and atmospheric simulations"

[2] Immersive has been defined as "plunge in the ocean or swimming pool" (Murray, 1997).

audiences (Pine & Gilmore, 1999)?

5. How does Chesney's cross-venue presence challenge or reinforce cultural definitions of liveness (Auslander, 2008)?

Research Methodology

This study will employ a qualitative, comparative research design combining experiential analysis, case study comparison, and audience-centered inquiry. Kenny Chesney's stadium tours and immersive Sphere performances will serve as the primary comparative case, allowing for analysis of immersion across venue types.

Audience perceptions will be analyzed through informal post-event interviews, reflection surveys, and social media discourse related specifically to Chesney's stadium and Sphere performances. This approach captures emotional response, memory retention, and perceived authenticity, reflecting established research on collective audience identification at live music events. Artist intentions and perceptions will also be analyzed if access given.

Preliminary Findings

Initial findings from social media discourse indicate that Kenny Chesney's performances illustrate two distinct but complementary immersion models.

In stadium settings (Figure 1), Chesney's concerts emphasize collective immersion driven by crowd participation. Immersion is generated through large-scale audience interaction, call-and-response moments, and the affective power of mass gathering, consistent with prior research on live music crowd dynamics (Holt, 2010). "*I felt like I was seeing and hearing everything we played in another dimension because I could hear all those lives in their voices*," Chesney said after his last night at Gillette Stadium (Instagram, 2024).

In the Sphere environment (Figure 2), Chesney's performance shifts toward a more technologically mediated immersion. Spatialized audio, continuous wraparound visuals, and cinematic environmental storytelling reposition the artist within an enveloping sensory narrative, aligning with theories of multisensory and spatial immersion. Rather than commanding a crowd from a distance, Chesney becomes embedded within a visual and sonic experience that seems to emphasize presence, intimacy, and sensory transport (Hansen, 2006). *"Sphere forced me to create different neural pathways to get ready to do a show"* he said after his last residency (Mower, 2026).

Audience responses suggest that stadium performances foster nostalgia, communal bonding, and heightened emotional energy ("Thank you for another awesome memory!!!), while Sphere performances elicit excitement and immersion-driven focus ("It is a well-organized and immersive experience with crazy cool graphics all around you").

Originality and Contribution

This Kenny Chesney cross-venue research offers an original contribution to immersive performance scholarship. It will provide insight how a single artist's work can be recontextualized through two different immersive environments, potentially providing empirical insight into how venue technologies actively shape audience perception and artist performance (Auslander, 2008).

This study has the potential to advance immersion theory by distinguishing between socially driven immersion typical of stadium concerts and technologically mediated immersion characteristic of the Sphere, potentially extending existing frameworks within experiential and performance research (Pine & Gilmore, 1999).

Conclusion and Implications

The case of Kenny Chesney illustrates that immersive live music now exists along a spectrum rather than within a singular experiential model. Stadium concerts remain powerful sites of socially driven immersion rooted in collective energy, while immersive venues such as the Sphere redefine musical presence through technological orchestration and sensory integration (Leonardo, 2025). Chesney's successful navigation of both formats suggests that immersive venues will not replace stadium concerts but will expand the expressive possibilities of live music. For artists and venues this signals a future in which artist performance and audience expectations are increasingly shaped by immersive

environments.

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Figure 1. Gillette Stadium, Foxborough, MA, USA

Figure 2. Sphere, Las Vegas, NV, USA

The Mobile Sensory Gap: The Negative Impact of Overstimulation in Augmented Reality

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Keywords: augmented reality; psychological ownership; sensory stimulation.

The rapid growth of mobile commerce, expected to reach $8.1 trillion worldwide by 2026 (Shankar et al., 2020), has intensified efforts to enrich digital consumer experiences. Augmented Reality (AR) enables consumers to visualize products in their physical environment, while additional sensory inputs such as haptics and audio promise to enhance immersion (Hampton & Hildebrand, 2026; Heller et al., 2019; Petit et al., 2018). Prior research suggests that multisensory stimulation increases engagement, perceived realism, and psychological ownership—the feeling that a product is "mine" even before purchase (Brasel & Gips, 2014; Peck & Shu, 2009; Aw et al., 2024). However, the implicit assumption that adding more sensory modalities always improves consumer experience remains largely untested.

Drawing on sensory marketing (Krishna, 2012; Krishna et al., 2024) and sensory overload literature (Malhotra, 1984; Spence et al., 2014), this research challenges this assumption by introducing the concept of sensory disturbance, defined as a subjective experience of discomfort or disruption caused by excessive or incongruous sensory stimulation. While multisensory integration can enhance experience, it may also increase cognitive load and reduce processing fluency when stimuli are excessive or poorly aligned (Messner & Wänke, 2011; Flavián et al., 2021). We propose that such disturbance reduces perceived tangibility, a key driver of psychological ownership in digital environments (Peck & Luangrath, 2023; Morewedge et al., 2021), ultimately undermining consumer–product relationships.

To test these ideas, Study 1 employs a custom-built AR mobile application allowing users to visualize products within their environment. The app enables controlled manipulation of sensory modalities, including haptic feedback (vibration) and auditory cues. A 2 (haptic feedback: present vs. absent) × 2 (auditory feedback: present vs. absent) × 2 (product type: chair vs. plant) between-subjects experiment (N = 385) was conducted. Participants interacted with the app and evaluated their experience in terms of sensory disturbance, perceived tangibility (Laroche et al., 2001), and psychological ownership (Peck & Shu, 2009). The findings show that combining multiple sensory modalities, particularly haptics and audio, increases perceived disturbance. This disturbance negatively affects perceived tangibility, which in turn reduces psychological ownership. Additional analyses indicate that auditory input plays a more disruptive role than haptic feedback, consistent with prior research suggesting that sound can be perceived as intrusive or poorly synchronized in digital environments (Spence et al., 2014; Rauschnabel et al., 2022). These results challenge the prevailing assumption of additive sensory benefits and reveal a "mobile sensory gap": while sensory technologies aim to enhance immersion, excessive stimulation may paradoxically undermine the consumer experience.

While Study 1 demonstrates the negative impact of multisensory overstimulation, it does not address whether these effects can be mitigated through design interventions. Study 2 introduces user control over sensory inputs as a key boundary condition. Psychological ownership theory emphasizes perceived control as a central antecedent (Peck et al., 2013). Similarly, research on human–technology interaction suggests that lack of control over automated systems can lead to discomfort and resistance. We propose that sensory disturbance arises not only from the intensity of stimulation but also from the loss of perceived agency when sensory inputs are system-imposed. Study 2 adopts a 2 (sensory load: low vs. high) × 2 (control: user-controlled vs. system-imposed) between-subjects design. Sensory load

is manipulated as in Study 1 (AR only vs. AR with haptics and audio). Control is manipulated by allowing participants in the high-control condition to activate or deactivate sensory features (sound and vibration), while participants in the low-control condition experience automatic stimulation. Participants (n=204) interacted with the AR application and completed the same measures as in Study 1. This design tests whether restoring user agency reduces perceived disturbance and attenuates its negative effects on tangibility and psychological ownership. By introducing control as a moderator, Study 2 extends the theoretical model by integrating insights from psychological ownership and perceived control, showing that negative effects of multisensory stimulation are not inevitable but contingent on interaction design.

Study 3 further refines the understanding of multisensory effects by examining whether disturbance is driven by the quantity of sensory input or by the quality of sensory integration. Multisensory research suggests that congruence between sensory cues enhances processing fluency and consumer evaluations, whereas incongruence increases cognitive effort and reduces experience quality (Krishna et al., 2010; Spence et al., 2014). In AR contexts, poorly synchronized or irrelevant sensory inputs may disrupt immersion and create confusion (Heller et al., 2019; Zhang et al., 2025). To test this, Study 3 employs a 2 (sensory load: low vs. high) × 2 (sensory congruence: high vs. low) between-subjects design. Congruence is manipulated by aligning sensory inputs with the product and interaction context (e.g., subtle, context-relevant vibration and sound) versus introducing mismatched and exaggerated cues. Participants (n=198) evaluated their experience using the same measures as in previous studies. This design allows us to determine that multisensory stimulation can enhance experience when properly aligned and that sensory congruence serves as a key boundary condition of disturbance.

This research contributes to a more nuanced understanding of multisensory digital environments by identifying when and why sensory enrichment enhances vs. undermines the consumer experience. First, it challenges the dominant view that multisensory stimulation uniformly enhances digital experiences (Huang & Liao, 2017) by demonstrating that sensory overload can generate negative psychological outcomes. Second, it introduces sensory disturbance as a novel construct capturing the disruptive effects of excessive or incongruent sensory input in AR environments. Third, it advances understanding of psychological ownership in technology-mediated contexts by identifying perceived tangibility as a key mechanism linking sensory experience to ownership (Morewedge et al., 2021). Importantly, the research identifies two critical boundary conditions: user control and sensory congruence. Together, these findings suggest that the effectiveness of multisensory AR depends not only on the presence of sensory inputs but on how they are designed and experienced. Managerially, the results suggest that firms should move away from a "more is better" approach and instead adopt minimalist, coherent, and user-centered sensory design strategies. Providing users with control over sensory features and ensuring congruence between sensory cues can reduce cognitive overload, enhance perceived tangibility, and foster stronger psychological ownership.

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The Power of Immersion: Can Immersive Experiences Influence Prosocial Decisions?

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Keywords: immersion; virtual reality; awe; prosocial behavior; experiential donation.

Immersive experiences (e.g., experiences that adopt VR/AR, digital immersive exhibits) are growing in its popularity, with an estimated global market value of $180 billion by end of 2026. Such experiences provide not only a new source of entertainment and marketplace interaction, but also a new channel for adopting digital technologies into experiential consumption to affect various consumer behavior. Immersion refers to the sense of "being there" in a mediated environment, and leads to a psychological state of emotional involvement and deeper engagement within the environment (Witmer & Singer 1998). By creating immersive and interactive environments that simulate real-world situations, immersive technologies allow individuals to feel as though they are physically present within a movie scene, an artwork, or a narrative.

Despite the growing popularity of immersive experiences, existing research provides little insight into how they influence real-life decisions. While prior work has mainly focused how various elements of such experiences influence decision making across different domains such as tourism, education, and shopping, we address the following question: Can an immersive VR experience, even when the content is entirely unrelated to a social cause, shift consumers' mindsets and influence prosocial decisions in the real world? Encouraging consumers to donate has always been a challenge, and organizations and companies are continuously making efforts to adopt immersive technologies to foster donations through enhancing empathy (Ventura *et al.* 2020).

In this research, we propose that immersive experiences, even when unrelated to social causes, shape subsequent prosocial decisions by eliciting awe. Specifically, we argue that immersive experiences increase preferences for donating experiences rather than materials. Awe is a positive emotion characterized by wonder and admiration (Keltner & Haidt 2003), often elicited by vast stimuli that extend beyond one's existing mental frameworks. Although
prior research shows that awe can increase donation behavior (Kristofferson *et al*. 2022), our work examines how awe shapes what people choose to give - specifically, whether they prefer to donate to experiences versus materials. We argue that awe fosters self-transcendence and self-smallness, shifting attention away from the self and toward others, which in turn promotes an experiential mindset.

Prior research suggests that donating to experiences (e.g., tutoring programs, counseling sessions) are more closely associated with social connection, long-term well-being, and meaning in life. In contrast, material donations (e.g., educational supplies, first-aid kits) are more tangible and practical, but their benefits are often perceived as immediate and short- term. Building on these concepts, across five studies we examine how immersive experiences - using VR as a tool for consumers to feel immersed (i.e., "being there" in the virtual environment) - will shift consumers' mindset to value experiences more than materials.

Study 1 (N =102; preregistered) examined how immersion influences donation preferences by only manipulating the device type (2D desktop vs. VR). Participants in both conditions watched the same video of a beach scene in Hawaii, and within the same educational context, they were asked rate which types of donations they would prefer. Results showed that participants in the VR condition were more likely to donate for experiences than those in the 2D desktop condition ($t(79) = 2.03$, $p = .04$). To control for any device type differences, the remaining studies test immersion within VR.

Study 2a used a 2(immersion: high vs. low) between-subjects design. Participants (N = 176) first read a brief description of a VR experience featuring a night sky view of the Swiss Alps. The high immersion condition described the experience as fully immersive and highly present, whereas the low immersion condition described it as only partially immersive and relatively detached. Participants then watched the same VR video and indicated their donation preferences. Results showed that participants in the high-immersion condition were more likely to prefer experiential over material donations than those in the low-immersion condition ($t(135) = 2.07$, $p = .04$). This effect was replicated in **study 2b** ($N = 126$), which used a different VR experience (Galaxy) and using a self-reported measure of immersion ($b = .35$, $F(1,124) = 14.53$, $p < .001$).

Study 3 (preregistered) tested whether awe mediates the effect of immersion on experiential (vs. material) donations. Participants ($N = 164$) watched a VR video of winter snow scenes and then reported their level of awe using a six-item scale adapted from Yaden *et al.* (2019). We also examined whether this effect depends on individual differences in transition difficulty, defined as the extent to which individuals have difficulty distinguishing between real-world experience and simulated experience. Results showed that awe mediated the effect of immersion on experiential donation preferences, and this indirect effect was moderated by transition difficulty. Among individuals low in transition difficulty (-1 SD), stronger awe induced by higher immersion led to a greater preference for experiential donations ($b = .38$, $SE = .14$, 95% CI: [.0945, .6716]). Among individuals high in transition difficulty (+1 SD), this effect was weaker.

Study 4 examined how divided attention moderates the effect of immersion on experiential (vs. material) donations. Attention is central to immersive experience, as immersion depends on allocating cognitive resources to the immersive environment (Fontaine, 1992). Therefore, divided attention may undermine immersion by disrupting the integrative processes. In this study, participants ($N = 140$) watched the same desert video either with additional audio description (high divided attention) or without it (low divided attention), then completed measures of donation preference, immersion, and cognitive load. Results showed an significant interaction between divided attention and immersion ($F(1,121) = 10.76$, $p = .001$). Specifically, for low divided attention condition, immersion increased the likelihood of choosing experiential (vs. material) donations; however, for those in the high divided attention condition, the effect of immersion was no longer significant.

Across all studies, we use VR as an effective tool to create a sense of immersion – as well as isolating the role of immersion by itself – and examine its effect on real-life consumer decisions. Our findings suggest that, after an immersive experience that blends physical and digital worlds together, offering different donation options may be an effective way to enhance the effect of donation appeals, specifically by increasing the likelihood of choosing experiences rather than material donations.

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The Role of Artificial Intelligence in the Competitiveness of Maltese Small & Medium Businesses

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Keywords: AI adoption; liability of smallness; SMB competitiveness.

Introduction

Artificial intelligence (AI) has emerged as a critical driver of innovation, productivity and competitive positioning across industries. The recent diffusion of generative AI has further democratised access to advanced capabilities, making them increasingly viable for small and medium-sized businesses (SMBs). Yet, AI adoption among SMBs remains uneven. While AI holds the potential to mitigate the structural disadvantages that characterise smaller firms, collectively theorised as the liability of smallness (Aldrich & Auster, 1986), its adoption is often constrained by the very same resource limitations it is designed to overcome. This paradox is particularly pronounced in small-state economies such as Malta, where SMBs account for 99.89% of all private-sector firms (National Statistics Office, 2023) and where AI adoption stands at just 17.3%, well below the EU average of 41.17% (Eurostat, 2025). This pilot study addresses two research questions: (1) What challenges associated with the liability of smallness can AI potentially offset for Maltese SMBs? (2) What factors influence AI adoption and readiness across different sectors?

Theoretical Framework

The study draws on three complementary theoretical lenses. The Resource-Based View (RBV) (Barney, 1991) positions AI as a resource amplifier that enables SMBs to extract greater strategic value from limited assets, particularly through cloud-based, as-a-service models that reduce the financial barrier to entry. The Dynamic Capabilities (DC) framework (Teece et al., 1997) explains how firms sense, seize and reconfigure resources in response to technological change, with leadership mindset emerging as a critical micro-foundational driver of AI adoption. The Situated AI perspective (Kemp, 2023) emphasises that sustainable competitive advantage through AI requires deep contextual integration, grounding AI in firm-specific data, workflows, and knowledge, a level of embedding that remains aspirational for most Maltese SMBs. Together, these frameworks explain why AI adoption is uneven and what organisational conditions are required for it to generate durable value.

Methodology

A sequential mixed-methods design was adopted, guided by a pragmatic research philosophy. In the first phase, 15 semi-structured interviews were conducted with decision-makers from Maltese SMBs spanning Finance, Tourism, iGaming, Manufacturing and Technology sectors. Interviews were conducted via Zoom, transcribed and analysed using thematic analysis supported by NVivo, employing hybrid inductive-deductive coding (Braun & Clarke, 2006). Participants were selected through purposive sampling targeting mid-management level or above within the private sector. In the second phase, a quantitative online survey (SurveyMonkey) yielded 127 valid responses from Maltese private-sector SMBs. Respondents were grouped into two categories: Services (n=74) and Production and Distribution (n=53). Non-parametric inferential tests (Chi-Square, Kruskal–Wallis, Fisher's Exact) were applied using IBM SPSS to examine relationships between sector, firm size and AI adoption indicators.

Findings

Thematic analysis of the interviews produced six primary themes: current and planned AI usage,

perceived benefits and opportunities, barriers and challenges, organisational mindset and culture, future outlook, and sectoral adoption readiness. Across the interviews, AI was predominantly used in a supportive capacity, automating administrative tasks, generating content, and improving communication, with only a minority of firms having progressed to operationally embedded use. A central paradox emerged: the primary adoption barriers (limited time, resources, and specialised skills) are precisely the constraints AI is designed to alleviate, creating a self-reinforcing cycle difficult to break without external support.

The quantitative survey confirmed a statistically significant sectoral divide: 63.5% of Services firms reported AI adoption versus 34% of Production and Distribution firms ($\chi^2(1,N=127)=10.79$, $p=.001$). This gap was most pronounced among medium-sized businesses, where 66.7% of Services firms used AI compared to just 17.4% in Production and Distribution ($\chi^2(1)=12.76$, $p<.001$). The most common AI use cases were customer experience and service automation (45%) and predictive analytics for decision support (44%). The three dominant adoption barriers were lack of time and resources (60%), cost and budget limitations (42%), and lack of AI expertise (39%). Notably, 47.4% of those citing time and resource constraints were already implementing AI, suggesting that leadership conviction and digital readiness may be more decisive than resource availability alone.

Two factors emerged as the strongest predictors of adoption. First, leadership AI familiarity showed a highly significant association with AI investment priority ($\chi^2(1,N=127)=30.415$, $p<.001$): leaders familiar with AI were far more likely to prioritise AI investment (77.5%) compared to those who were unfamiliar (27.7%). Second, digital maturity was established as a foundational prerequisite: firms with basic or no IT infrastructure adopted AI at just 5.3%, compared to 59.3% for those with moderate to advanced infrastructure ($\chi^2(1,N=127)=18.854$, $p<.001$). On the ROI side, only 18.9% of firms reported clear positive returns, while 50.39% lacked internal AI capabilities and relied on outsourcing. Looking ahead, 81% of respondents anticipated AI would be a significant driver or moderate enabler in their sector within three to five years.

Conclusions and Implications

The central finding is a defining paradox: while AI offers a powerful mechanism for addressing the resource constraints of small firms, its adoption is impeded by those very same constraints. AI can act as a resource amplifier, enabling SMBs to automate routine tasks, extend the productive capacity of limited human capital, and access enterprise-grade capabilities at reduced cost. However, meaningful adoption requires foundational digital infrastructure, leadership with sufficient AI literacy, and an organisational culture willing to embrace change. Where these conditions are met, primarily in the digitally mature Services sector, adoption is progressing. Where they are absent, most visibly in Production and Distribution, it remains limited.

For SMB leaders, the evidence suggests prioritising foundational digital infrastructure, cultivating AI literacy at leadership level, and beginning with small, manageable AI initiatives. For policymakers, a phased, differentiated support model is recommended: first-phase grants should target foundational digital infrastructure before AI-specific funding, with sector-specific programmes recognising the different starting points of services versus production firms. For technology vendors, there is a clear market gap for lightweight, modular solutions designed for small teams and legacy environments. This study contributes context-specific empirical evidence on AI adoption in a small-state economy and provides a foundation for future longitudinal and comparative research across similar EU member states.

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Tourist Visits Through the Virtual Reality: A Study Exploring the Tourism of the Future

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Keywords: Metaverse tourism; Virtual reality; User experience; Technology acceptance.

This study analyses the determinants of tourists' attitudes toward metaverse-based tourism by integrating experiential and technological perspectives. It examines how visual and navigation design shape enjoyment, effort expectancy and performance expectancy, and how these factors influence overall attitudes. Using an immersive virtual tourism scenario accessed through Meta Quest 2 VR headsets, data were collected from 159 university students after a controlled five-minute experience and a structured questionnaire. PLS-SEM results show that design features significantly enhance enjoyment and expectancy perceptions, with performance expectancy emerging as the strongest predictor of attitude. The study extends technology acceptance models to immersive tourism contexts and offers practical guidance for metaverse experience design.

Introduction

The expansion of metaverses and immersive virtual reality has accelerated experiential consumption through enabling technologies (Buhalis et al., 2023; Debnath & Srivastava, 2025; Jo, 2023; Sánchez-Amboage et al., 2024; Volchek & Brysch, 2023). Virtual reality glasses facilitate accessible, highly immersive interaction with three-dimensional virtual environments (Baker et al., 2023; Pinto et al., 2022). As persistent shared spaces, metaverses support social and experiential activities beyond gaming, with tourism emerging as a particularly salient domain due to its hedonic and symbolic value (Buhalis et al., 2023; Kaur et al., 2024). Virtual tourism enables destination exploration without physical constraints (Jo, 2023; Volchek & Brysch, 2023). Prior VR research shows that immersion and realism enhance enjoyment and attitudes (Baker et al., 2023; Çolakoğlu et al., 2024; Jo, 2023), suggesting positive effects on perceptions of virtual and real destinations (Bigne & Maturana, 2023; Hao et al., 2025; Pinto et al., 2022). Accordingly, this study examines how visual and navigation design shape experiential and cognitive evaluations in metaverse tourism (Han et al., 2019).

Framework

Virtual reality enables immersive tourism experiences without physical constraints (Sánchez-Amboage et al., 2024). Visual design enhances realism and immersion (Bretos et al., 2024), while navigation design supports intuitive movement (Shahbaz Badr & De Amicis, 2023). Enjoyment shapes expectancy perceptions (Baker et al., 2023). Following UTAUT, performance and effort expectancy strongly influence attitudes toward metaverse tourism (Venkatesh et al., 2012).

3. Methodology

This study used a quantitative cross-sectional design to examine attitudes toward metaverse-based tourism. Data were collected from 159 Colombian university students through voluntary participation. Using Meta Quest 2 headsets, participants completed brief training, a five-minute virtual tourism experience and a structured questionnaire measuring design perceptions, enjoyment, expectancies and attitudes. Data were analysed using PLS-SEM, suitable for predictive exploratory models.

Results

Reliability and validity were assessed through convergent and discriminant analyses. Convergent validity was confirmed using AVE values above 0.5, alongside individual and composite reliability (Sarstedt et al., 2022) (Table 1). Discriminant validity was verified using the Fornell–Larcker criterion (Fornell & Larcker, 1981) and the HTMT ratio (Henseler et al., 2014).

Table 1. Test Reliability and Validity of the Measurement Tool

Item	Loads*	t-statistic	P Values	VIF Values	Construct	Cronbach's Alpha	Composite reliability	Composite reliability	Average variance extracted
AT1	0.926	21.424	0.000	1.453	Attitude to toward tourism in the metaverse	0.925	0.926	0.952	0.869
AT2	0.920	23.095	0.000	1.532					
AT3	0.951	7.773	0.000	1.589					
EE1	0.894	34.919	0.000	2.076	Effort Expectance	0.872	0.886	0.921	0.793
EE2	0.923	26.352	0.000	1.980					
EE3	0.933	32.921	0.000	1.954					
EJ1	0.948	34.355	0.000	2.121	Enjoyment	0.945	0.942	0.961	0.887
EJ2	0.965	44.204	0.000	2.633					
EJ3	0.954	32.660	0.000	1.831					
ND1	0.923	8.639	0.000	1.579	Navigation Desing	0.890	0.889	0.937	0.819
ND2	0.913	8.372	0.000	2.063					
ND3	0.923	9.041	0.000	1.981					
PE1	0.909	47.748	0.000	2.095	Performance Expectance	0.888	0.887	0.932	0.817
PE2	0.906	52.466	0.000	2.467					
PE3	0.891	57.175	0.000	2.478					
VD1	0.958	43.739	0.000	1.670	Visual Desing	0.799	0.794	0.927	0.832
VD2	0.954	37.608	0.000	2.018					

(AT: Attitude to toward tourism in the metaverse; EE: Effort Expectance; EJ: Enjoyment; ND: Navigation Desing; PE: Performance Expectance; VD: Visual Desing. Note: *Significant difference: P-value < 0.05)

To test the model's hypotheses, a bootstrapping procedure with 5,000 subsamples was applied to obtain bootstrap means, t-values and p-values for all path coefficients (Sarstedt et al., 2022), as shown in Table 2. The structural model, estimated using PLS-SEM, confirmed most of the hypothesised relationships among the design, experiential and attitudinal constructs.

Table 2. Model Test

Hypothesis	Validity	Original Sample (β)	T-statistic	P Values
H1: VD -> EJ	Supported	0.470*	5.260	0.000
H2: VD -> PE	Supported	0.228*	3.129	0.000
H3: VD -> EE	Supported	0.237*	2.798	0.000
H4: ND -> EJ	Supported	0.382*	4.429	0.000
H5: ND -> PE	Supported	0.118**	1.840	0.051
H6: ND -> EE	Supported	0.356*	4.019	0.000
H7: EJ -> EE	Supported	0.249*	3.060	0.000
H8: EJ ->PE	Not Supported	0.159	1.570	0.112
H9: EE -> AT	Supported	0.220*	3.705	0.000
H10: PE -> AT	Supported	0.560*	6.705	0.000

(*Significant difference: P-value < 0.05; **Significant difference: P-value < 0.1).

Discussion

The findings support the proposed framework, confirming the relevance of immersive design and UTAUT constructs in shaping attitudes toward metaverse tourism.

Conclusions

This study validates an integrative model explaining attitudes toward metaverse tourism through immersive design, hedonic responses and UTAUT-based beliefs. Visual design drives enjoyment and signals usefulness, while navigation design enhances experiential fluency. The asymmetric role of enjoyment clarifies attitude formation. Practically, visually rich, intuitive environments are essential. Limitations in sample scope, design and technology indicate future research directions.

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Translating AI-Informed Instructional Design into Responsible Practice: Evidence from the ELEVATE AI Living Lab

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Artificial Intelligence (AI) capability has become a strategic priority across higher education, industry and the public sector (Department for the Economy, 2024; Carson and Farry, 2025; Microsoft, 2025). Despite this momentum, evidence-based pathways for responsible AI adoption and structured AI literacy development remain limited. Many organisations are moving quickly to deploy AI tools, but far fewer have practice-grounded, empirically informed models showing how responsible use can be developed and refined across authentic settings. This paper addresses that gap through the ELEVATE AI initiative, a university-anchored living-lab designed to translate AI-Informed Instructional Design (AIID) (Choi et al., 2024) into real-world practice across multiple stakeholder contexts.

The study's principal contribution is the AHEAD (AI Forward, Human-Centred Education in AI Development) framework. Critically, AHEAD (see figure 1.) does not emerge as a purely conceptual model; rather, it is generated as a design output of iterative Design-Based Research (DBR) cycles, grounding its novelty in its dual function as both a synthesis artefact and a transferable scaffold. Unlike existing AI literacy frameworks, which tend to be either competency taxonomies (Miao et al., 2024) or policy instruments (Jisc, 2024), AHEAD integrates the U-A-C-I learning loop (Understand, Apply, Create, Innovate) with embedded ethical governance checkpoints via a Self-Governing Framework (SGF), enabling institutions to operationalise responsible AI adoption across curricula, professional development and cross-sector engagement. Its transferability is further evidenced by adoption as the organising spine for a 2 revised BSc pathways (Business Studies/Marketing) recently revalidated at Ulster University, and by application across academic, industry and emerging public-sector contexts within a single coherent study.

The methodological design operationalises DBR through four iterative intervention cycles, each functioning as a bounded design phase contributing evidence to the refinement of subsequent activity. The study was conducted within Ulster University Business School, with three formally evaluated cycles and one translational extension strand. The evaluated cycles comprised: (1) an 8-hour sustainability-focused hackathon engaging a mixed cohort of approximately 40 undergraduate and postgraduate students, academic staff and external stakeholders; (2) a series of student AI literacy micro-workshops delivered across Marketing and Management cohorts (pre-intervention n = 234; post-intervention n = 186; matched subset n = 175); and (3) faculty continuing professional development workshops (e.g. on AI-assisted feedback) attended by academic staff within the Business School. The Connected5 programme, a fourth strand targeting 15 micro-SME participants from Northern Ireland's Causeway Coast region, functioned as a translational DBR cycle extending intervention principles into an industry context. Participant profiles thus span three distinct populations: undergraduate and postgraduate students in business disciplines; academic staff engaged in professional development; and founders and managers of micro-SMEs operating in a regional economy with active digital skills priorities.

Evaluation employed a mixed-methods strategy combining pre- and post-intervention survey data with qualitative evidence from participant feedback, facilitator observations and artefact outputs. Survey instruments assessed four indicators across cycles: self-reported familiarity with generative AI; confidence in application for study or work-related tasks; understanding of ethical considerations and limitations; and future-use intentions. These indicators were used both diagnostically, to inform within-

session facilitation decisions and evaluatively, enabling cross-cycle comparison. The student strand generated the most structured quantitative evidence, with aggregate cohort-level comparisons supplemented by a matched-subset cluster analysis identifying differentiated pre- and post-intervention learner profiles. Qualitative data from the faculty and SME strands provided design-relevant insights into readiness and contextual transfer, informing iterative refinement of the AHEAD framework across cycles.

Findings indicate consistent gains across cycles in participant confidence, practical capability and ethical awareness. In the student strand, aggregate post-workshop improvements were observed across all four survey indicators, with the largest gains in ethical awareness (+1.30) and confidence in application (+1.12). However, the most significant design insight from this strand is that the intervention did not produce a uniform response. The matched subset analysis revealed a more differentiated four-profile post-intervention structure, characterised as Emerging Users, Super Users, Confident Adopters and Ethical Sceptics. This, compared to a broader three-profile pre-intervention baseline. Notably, a subset of students moved towards more cautious, ethically reflective positions following exposure, suggesting that increased awareness of risk, limitation and governance can produce reflective restraint rather than greater uptake. This challenges the assumption that successful AI education should be measured by increased adoption alone, which directly informed subsequent design iterations within the DBR cycle.

Across cycles, three transferable design principles emerge. First, shorter, modular learning formats consistently outperformed extended training in sustaining engagement and enabling immediate application across both academic and professional contexts. Second, authentic, context-specific tasks were the primary driver of progression from exploratory to purposeful AI use. Third, systematic codification of outputs within the AHEAD framework enabled knowledge retention and continuity across intervention cycles, mitigating the knowledge attrition that often limits living-lab impact. Regarding contextual transferability, the study deliberately tested intervention principles across heterogeneous participant populations: students; academic staff; and SME founders - who differ in prior AI experience, organisational objectives and institutional context. The degree of coherence observed across these settings, alongside the framework's curriculum-level adoption, provides evidence of transferability within a quadruple-helix ecosystem. Future research should examine AHEAD's performance across different disciplinary contexts, extended timeframes and higher education systems beyond the Northern Irish context.

This paper demonstrates that a university-based living lab, when structured through a DBR approach, can function as a productive infrastructure for iteratively developing, evaluating and scaling responsible AI literacy interventions. The AHEAD framework, supported by embedded ethical governance mechanisms, provides a practically grounded and institutionally adaptable model for organisations seeking human-centred AI capability development. The study extends DBR scholarship into the domain of AI literacy and human-AI interaction and offers a contribution to emerging debates on responsible AI implementation in education by foregrounding both the differentiated nature of learner and organisational responses and the governance architectures required to support them.

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