

Gan, Chin Lay et al.

## Article

# Cognitive and affective factors in AI virtual influencer marketing: A stimulus-organism-response and pleasure-arousal-dominance model approach

Digital Business

## Provided in Cooperation with:

International Telecommunications Society (ITS)

*Suggested Citation:* Gan, Chin Lay et al. (2025) : Cognitive and affective factors in AI virtual influencer marketing: A stimulus-organism-response and pleasure-arousal-dominance model approach, Digital Business, ISSN 2666-9544, Elsevier, Amsterdam, Vol. 5, Iss. 2, pp. 1-17, <https://doi.org/10.1016/j.digbus.2025.100150>

This Version is available at:

<https://hdl.handle.net/10419/338021>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by/4.0/>



# Cognitive and affective factors in AI virtual influencer marketing: A stimulus–organism–response and pleasure–arousal–dominance model approach

Chin Lay Gan<sup>a,b</sup>, Yi Yong Lee<sup>a,b</sup>, Tze Wei Liew<sup>c,b,\*</sup>, Su-Mae Tan<sup>c,d</sup>, Faizan Ahmad<sup>e</sup>, Adhi Prasetyo<sup>f</sup>

<sup>a</sup> Centre for Management and Marketing Innovation, CoE for Business Innovation and Communication, Multimedia University, Persiaran Multimedia, Cyberjaya 63100, Selangor, Malaysia

<sup>b</sup> Faculty of Business, Multimedia University, Jalan Ayer Keroh Lama, Melaka, 75450 Melaka, Malaysia

<sup>c</sup> Centre for Interaction and Experience Design, CoE for Immersive Experience, Multimedia University, Persiaran Multimedia, Cyberjaya 63100, Selangor, Malaysia

<sup>d</sup> Faculty of Information Science & Technology, Multimedia University, Jalan Ayer Keroh Lama, Melaka, 75450 Melaka, Malaysia

<sup>e</sup> Cardiff School of Technologies, Cardiff Metropolitan University, Western Avenue, Cardiff, CF5 2YB, Wales, United Kingdom

<sup>f</sup> School of Economics and Business, Telkom University, Jl. Telekomunikasi No. 1, Bandung 40257, West Java, Indonesia

## ARTICLE INFO

### Keywords:

AI-powered virtual influencer  
S-O-R model  
Emotional states  
Satisfaction  
Perceived enjoyment  
Hedonic motivation  
Purchase intention

## ABSTRACT

Despite the exponential rise of AI-powered virtual influencer (VI), the role of user-centric elements, particularly experiential content and emotional factors in shaping consumer decision-making remains underexplored. This study adopts the Stimulus–Organism–Response (S-O-R) framework and incorporates the Pleasure–Arousal–Dominance (PAD) model to conceptualize emotional responses in the VI context. The present research integrates affective (perceived enjoyment, hedonic motivation) and cognitive (satisfaction) emotional states to better understand consumer responses to VI. We surveyed 248 VI followers and employed structural equation modeling to test the conceptual framework. The findings reveal that: (1) Perceived interactivity significantly influences both affective (emotional states, perceived enjoyment, hedonic motivation) and cognitive states (satisfaction); (2) perceived risk and visual appeal significantly influence emotional states; (3) visual appeal significantly influences perceived enjoyment; and (4) hedonic motivation and satisfaction significantly influence willingness to buy. The findings provide practical guidance for designing emotionally engaging VI campaigns by leveraging key stimuli to influence consumer behavior.

## 1. Introduction

Virtual influencer (VI), also known as AI-powered or computer-generated influencer represent a transformative innovation in digital marketing (Kim et al., 2024a). Similar to their human counterparts, VI contributes to brand visibility and consumer engagement through visually rich and curated content (Miao et al., 2022). Their adoption is gaining momentum in Malaysia, where brands seek to connect with younger, digitally savvy audiences (Yap & Ismail, 2022). VI offers unique advantages such as a consistently youthful image and immunity to real-world disruptions like illness or controversy, making them attractive for long-term brand representation. Their ability to produce authentic and relatable content, combined with their growing appeal

among youth segments (Arsenyana & Miowska, 2021), highlights the need to examine how Malaysian consumers respond to VI endorsements in this emerging marketing space (IMM, 2024).

On social media platforms, VI has demonstrated superior performance in engagement metrics such as likes, shares, and views compared to human influencers (Dabiran et al., 2024). These forms of engagement contribute to immersive consumer experiences and the formation of emotional connections with branded messages (Mouritzen et al., 2024). Emotional responses, in turn, play a pivotal role in shaping key behavioral outcomes, including attitude formation and purchase intentions (Na et al., 2024). While emotional engagement with human influencers has been extensively studied (Chen, 2024; Evans et al., 2017; Inan et al., 2023), limited research has investigated how followers emotionally

\* Corresponding author at: Faculty of Business, Multimedia University, Jalan Ayer Keroh Lama, Melaka, 75450 Melaka, Malaysia.

E-mail addresses: [gan.chin.lay@mmu.edu.my](mailto:gan.chin.lay@mmu.edu.my) (C.L. Gan), [leeyiyong9611@gmail.com](mailto:leeyiyong9611@gmail.com) (Y.Y. Lee), [twliew@mmu.edu.my](mailto:twliew@mmu.edu.my) (T.W. Liew), [smtan@mmu.edu.my](mailto:smtan@mmu.edu.my) (S.-M. Tan), [FAhmad@cardiffmet.ac.uk](mailto:FAhmad@cardiffmet.ac.uk) (F. Ahmad), [adhipras@telkomuniversity.ac.id](mailto:adhipras@telkomuniversity.ac.id) (A. Prasetyo).

<https://doi.org/10.1016/j.digbus.2025.100150>

Received 24 April 2025; Received in revised form 18 August 2025; Accepted 24 August 2025

Available online 25 August 2025

2666-9544/© 2025 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

respond to content produced by VI. Preliminary findings suggest that emotional cues embedded in VI content such as tone, expression, or positivity can meaningfully influence audience engagement (Yu et al., 2024a). Additionally, users increasingly apply interpersonal expectations and social schemas to anthropomorphic technologies such as VI (Yan et al., 2024), prompting deeper inquiry into the emotional mechanisms underpinning VI-follower relationships.

Although the literature on VI is growing, much of the current literature remains anchored in identity-related characteristics such as anthropomorphism, authenticity, and perceived humanness (Byun & Ahn, 2023; Laszkiewicz & Kalinska-Kula, 2023; Lim & Lee, 2023; Yang et al., 2023). However, a growing number of recent research has shifted the analytical lens toward content-driven and experiential factors, including interactivity, visual aesthetics, and digital affordances which are recognized as central drivers of user engagement with VI content (Byun & Ahn, 2023; Davlembayeva et al., 2025; Liu et al., 2025). This emerging perspective redirects scholarly attention from the intrinsic traits of VI to the immediate perceptual and affective experiences of users.

An underexplored but increasingly relevant area in VI research involves the role of followers, which are the highly engaged communities whose emotional investments, motivations, and behaviors differ markedly from the broader public (Liu et al., 2025). The followers act not only as consumers but also as content co-creators and distributors, playing a central role in shaping the cultural visibility and commercial success of VI (Liu et al., 2025). Despite their growing influence, follower's perception remains largely unexplored (Liu et al., 2025). In particular, the emotional and psychological processes that underpin followers' attachments to VI and the extent to which these attachments drive consumption behaviors have yet to be empirically investigated. This study aims to address this gap by examining the emotional mechanisms that facilitate follower engagement and influence consumer decision-making in the context of VI marketing.

To address this gap, the present study examines the emotional mechanisms that drive follower engagement and influence consumer decision-making in the context of VI marketing. The study adopts the Stimulus–Organism–Response (S-O-R) framework, a foundational psychological model that explains how external stimuli (e.g., media content) shape internal affective and cognitive states, which in turn influence behavioral outcomes (Chan et al., 2017). The S-O-R model has been widely applied in the influencer marketing literature (Kim et al., 2024b) due to its effectiveness in explaining how individuals process and respond to VI persuasive communication (Kumar & Shankar, 2024). Building on this foundation, the present study contributes to VI research by proposing a more integrative approach that incorporates both affective and cognitive user responses. Specifically, it enriches the S-O-R framework with the Pleasure–Arousal–Dominance (PAD) model to deepen understanding of the ‘Organism’ component. This dual-theoretical lens allows for the conceptualization of emotional and cognitive responses not as separate outcomes but as mutually reinforcing organismic states, shaped by users' perceptual experiences with VI content.

By framing experiential content factors as key perceptual triggers, the study shifts analytical focus from the identity traits of VI to follower-centered experiential processes. This conceptual reorientation broadens the scope of influencer marketing literature but also aligns with recent calls for more psychologically grounded frameworks in online social media marketing environments (Zhang et al., 2023). Accordingly, this study is guided by the following research objectives:

**RO1:** To examine how user-centered emotional engagement influences consumers' willingness to purchase products recommended by VI.

**RO2:** To identify the experiential attributes that shape users' emotional engagement in the context of VI marketing.

The remainder of this paper is structured as follows. Section 2 reviews the emergence of AI-powered VI and outlines the theoretical

foundation of the study, including the conceptual framework focused on user engagement and digital emotionality. Section 3 describes the methodology employed. Section 4 presents the empirical results, and Section 5 concludes with a discussion of theoretical contributions, managerial implications, and directions for future research.

## 2. Literature review

### 2.1. The emergence of AI-powered virtual influencer marketing

Computer-generated humanoid, commonly referred to as VI, is increasingly engaging human audiences across digital platforms (Sands et al., 2022). This emerging phenomenon has been fueled by rapid technological advancements and the widespread adoption of social media (Dabiran et al., 2024). By leveraging artificial intelligence and machine learning, VI is designed to mimic human appearance, behavior, and communication styles (Kim et al., 2024a), offering a distinctive and often interactive digital experience (Sands et al., 2022). For instance, Lil Miquela, one of the earliest and most notable VI, exemplifies the integration of lifelike visual design and narrative storytelling in influencer marketing (Thomas & Fowler, 2021).

As the VI landscape evolves, new characters are continuously being developed, and global brands are increasingly integrating them into their digital marketing strategies. Companies such as Nike, KFC, and Samsung have adopted VI as part of their promotional efforts. Nike has collaborated with the Japanese VI, Imma, to model and promote its products (Imma, 2019). KFC introduced “Virtual Sanders” to appeal to younger consumers through AI-driven avatars and immersive campaigns (Arikhanson, 2019). Similarly, Samsung has launched initiatives with a VI named Sam, signaling the brand's growing investment in AI and augmented reality technologies (Matei, 2024). While the adoption of VI is relatively novel and underexplored in emerging markets (Kumar & Shankar, 2024) such as Malaysia (Yap & Ismail, 2022), the trend signals a broader shift toward more interactive, human-like, and technologically mediated forms of marketing communication (Miao et al., 2022).

### 2.2. A synthesis of key virtual influencer features shaping user attitudes and behaviors

Recent research on VI has examined a broad range of attributes that shape consumer responses. These attributes are commonly categorized into three analytical lenses: identity-based traits, follower-centric dimensions, and experiential content-level characteristics. For instance, Barari et al. (2025) conducted a meta-analysis highlighting the importance of identity-related features such as credibility and attractiveness which significantly impact trust and perceived authenticity. Similarly, Byun and Ahn (2023), through a systematic review, distinguished between VI and human influencer, identifying content-based features like interactivity and visual design as central experiential attributes. Laszkiewicz and Kalinska-Kula (2023) contributed further theoretical grounding by emphasizing the role of parasocial bonding and authenticity in shaping consumer attitudes toward VI.

As summarized in Table 1, identity-based studies typically focus on intrinsic qualities of the VI, such as anthropomorphism, perceived humanness, and source credibility (Barari et al., 2025; Lim & Lee, 2023). These traits help simulate social presence and facilitate trust-building through parasocial relationships (Kumar & Shankar, 2024; Laszkiewicz & Kalinska-Kula, 2023). In contrast, the follower-centric perspective highlights users' psychological and emotional experiences, including parasocial interaction, perceived coolness, and affective engagement as key drivers of behavioral outcomes (Kim et al., 2024a; Lim & Lee, 2023). While identity-focused perspectives dominate existing research, this study shifts focus toward user-centric emotional responses to better understand how the internal states influence behavioral intentions.

Beyond identity and emotional engagement, a growing number of

**Table 1**  
Summary of key variable emphases in virtual influencer research.

Author	VI identity trait-based attributes	Follower centric-based attributes	Experiential content attributes
Laszkiewicz and Kalinska-Kula (2023)	Anthropomorphism, Authenticity	Emotional bonds	Engagement cues
Lim and Lee (2023)	Emotional narrative, Perceived humanness, Perceived credibility	Parasocial interaction, Attitude toward VI	Emotional narrative style (positive/negative post)
Lou et al. (2023)	–	Novelty, Information, Entertainment, Surveillance, Aesthetics, Social interaction	Aesthetics, Perceived uncanny
Yang et al. (2023)	Humanness	–	Perceived interactivity
Akhtar et al. (2024)	Source credibility	Normative/informational social influence	Perceived interactivity
Kim et al. (2024a)	Behavioral realism (humanness)	Eeriness, coolness	–
Kumar and Shankar (2024)	Attractiveness, Credibility	Parasocial relationship Self-discrepancy	–
Mouritzen et al. (2024)	Customization, flexibility, ownership, automation	–	–
Yu et al. (2024a)	–	–	VI's emotional display
Barari, Eisend and Jain, 2025	Credibility, Attractiveness	–	–
Byun and Ahn (2023)	Anthropomorphism, Credibility	Parasocial bonds	Visual style, Interactivity
Davlembayeva et al. (2025)	Perceived traits (warmth, competence, empathy, credibility, fairness, relatedness)	–	–
The current research work	–	Follower's emotional responses (affective and cognitive)	Perceived interactivity, visual appeal, perceived risk

research emphasizes experiential content-level attributes, which describe users' reactions to the design, presentation, and interactive quality of VI-generated content. For example, Lou et al. (2023) and Byun and Ahn (2023) identify visual aesthetics, interactivity, and uncanniness as critical content-based factors that affect users' enjoyment, attention, and emotional arousal. Byun and Ahn (2023) noted that, compared to human influencer, VI offer greater consistency in visual presentation and higher controllability in content creation, making visual appeal particularly salient. The stylized and curated nature of VI content, often designed for harmony and immersion, has been shown to enhance user engagement (Kumar & Shankar, 2024). In this study, visual appeal is thus conceptualized not as a function of VI identity, but as a user's perception of content design quality and aesthetic cohesion.

Another central experiential attribute is perceived interactivity (Table 1), which refers to the extent to which users feel they can meaningfully engage with VI-generated content. Prior research (Akhtar et al., 2024; Davlembayeva et al., 2025) highlights interactivity as a key stimulus that increases user control, immersion, and realism in the VI experience. In digital environments where user agency is crucial, perceived interactivity enhances feelings of co-presence and responsiveness, elements vital for developing user-VI connections (Liu et al., 2020). In the broader influencer marketing context, interactivity has been found to elevate user engagement, involvement, and emotional investment, ultimately influencing behavioral outcomes (Lou et al.,

2023). Within the VI research, interactivity has been positively associated with engagement and source credibility (Kim et al., 2024b; Mouritzen et al., 2024; Yan et al., 2024). For instance, Yang et al. (2023) showed that high interactivity enhances credibility even more than human influencers in Western contexts, while Akhtar et al. (2024) found similar finding in the hospitality context in China. However, limited empirical attention has been devoted to how interactivity shapes emotional and behavioral responses, particularly in the Malaysian context. Addressing this gap, the present study conceptualizes perceived interactivity as a stimulus within the S-O-R framework and explores both its affective and cognitive impacts on consumer purchase willingness, moving beyond prior studies that focused primarily on cognitive outcomes such as compliance and internalization (Davlembayeva et al., 2025).

Furthermore, findings from Byun and Ahn's (2023) review highlight growing skepticism toward VI effectiveness, particularly regarding trustworthiness. This aligns with growing concern over perceived risk, especially due to artificiality and a lack of authenticity in AI-mediated interactions (Lou et al., 2023). Perceived risk is particularly relevant in contexts involving consumer decisions, where emotional trust plays a pivotal role. For example, in healthcare scenarios, users are more likely to distrust AI-generated advice (Cabitzta, 2019). Similarly, in the context of VI, the absence of human presence can lead to doubts about endorsement authenticity, resulting in reduced trust and lower purchase intention (Lou et al., 2023). Recognizing this psychological barrier, the current study integrates perceived risk as an experiential stimulus that may inhibit emotional engagement and suppress behavioral responses.

Grounded in the reviewed literature, this study focuses on three experiential content-level attributes: perceived interactivity, perceived risk, and visual appeal. These attributes offer a user-centered and content-experiential lens for understanding how VI influence emotional responses and consumer decision-making. While perceived interactivity and visual appeal have received growing attention, the integration of perceived risk adds a valuable dimension, especially in light of systematic literature reviews highlighting trust-related concerns in interactions with VI. By framing these variables within the S-O-R model and contextualizing in Malaysia's emerging VI landscape, this study aims to advance understanding of the psychological mechanisms that underlie consumer engagement. This approach redirects the analytical emphasis from identity-based characteristics to experiential stimuli that evoke emotional engagement and drive behavioral intentions.

### 2.3. Stimulus-organism-response framework

The Stimulus–Organism–Response (S-O-R) framework, introduced by Mehrabian and Russell (1974), offers a foundational lens for understanding consumer behavior. It posits that external stimuli (S) affect emotional states (O), which in turn shape observable behavioral responses (R) (Kumar & Shankar, 2024). The model has been widely applied across various domains, including social media marketing (Chen, 2024; Gu & Duan, 2024) and VI marketing (Kumar & Shankar, 2024). Given its relevance to human–technology interaction, the S-O-R framework provides a robust theoretical basis for examining consumer behavior in digital environments.

To elaborate on the affective dimension of the organism component, Mehrabian and Russell (1974) identified pleasure and arousal as fundamental emotional states. Building upon this, Donovan and Rossiter (1982) introduced dominance as a third dimension, resulting in the Pleasure–Arousal–Dominance (PAD) framework. The PAD model has been widely adopted to investigate how emotional states collectively operate as second-order constructs influencing consumer behavior (Huang et al., 2025; Yang et al., 2024). Researchers have emphasized the centrality of pleasure and arousal in capturing affective responses (Yang et al., 2020), a finding validated in online shopping contexts such as engagement with virtual AI streamers (Zhang et al., 2024). While dominance has been shown to be a stronger predictor of purchase

intention (Njeguš et al., 2016), it has received comparatively less attention in consumer behavior literature (Hsieh et al., 2021; Tong et al., 2022). Research in human–robot interaction suggests that dominance warrants deeper investigation, particularly in non-human agent contexts. Individuals high in dominance, who value control, autonomy, and self-expression often seek to assert influence when interacting with non-human agents (Chen & Wyer, 2020). When users perceive a sense of control in interactions with AI technologies such as ChatGPT, their intention to continue usage increases (Xu et al., 2025). Similar effects have been observed with anthropomorphized brands (Kim & Kramer, 2015) and virtual tourism platforms (Cheng & Huang, 2022). Extending this to VI contexts, dominant individuals may not be deterred by artificiality; instead, they may view VI as an adaptable tool that enhance decision-making autonomy. Accordingly, this study integrates all three emotional states: pleasure, arousal, and dominance to explore their collective influence on consumers' willingness to purchase products recommended by VI.

Despite the PAD model's widely applicability in consumer behavior research, its current use within social media marketing contexts remains theoretically limited, particularly in capturing the full spectrum of affective responses. Zhang et al. (2023) highlight that the model does not sufficiently account for hedonic and enjoyment-driven dimensions—key emotional drivers in digital media environments. Therefore, it signals a need for its extension to better reflect consumer engagement in socially interactive and entertainment-rich context. Hedonic and enjoyment-related affective states have been shown to play a critical role in shaping behavioral intentions (Stein et al., 2024; Yang et al., 2020). Parasocial relationships, defined as one-sided perceived emotional bonds with media figures (Xiang et al., 2016), are recognized as key antecedents of media enjoyment. Elevated enjoyment whether hedonic or eudaimonic is a central component of media experiences and contributes to user engagement with VI (Song et al., 2024; Stein et al., 2024). Additionally, in marketing contexts, materialistic consumers are especially responsive to sponsored content by favored humanoid influencer, as such content enhances gratification and amplifies hedonic motivation. Emotional engagement and entertainment value have been shown to significantly boost purchase intentions (Kim et al., 2021).

Beyond affective responses, the organism component of the S-O-R model also encompasses cognitive appraisals, most notably satisfaction (Chan et al., 2017; Naveen et al., 2025). Satisfaction, in particular, represents a cognitive appraisal shaped by individuals' evaluations of prior experiences (Natarajan et al., 2018a). In AI-based and digitally mediated contexts, satisfaction has a well-documented impact on behavioral outcomes (Naveen et al., 2025). Research indicates a robust association between satisfaction and purchase intention, with satisfied consumers more likely to make purchases and form favorable evaluations (Qin et al., 2024). Satisfaction arises when user expectations are met or exceeded, thereby fostering continued use and purchasing behavior. This has been consistently demonstrated in mobile app usage (Naveen et al., 2025; Yu et al., 2024d) and in interactions with social media influencers (Kim & Baek, 2022).

In the present study, perceived interactivity (Shiu et al., 2023), perceived risk (Lee et al., 2023), and visual appeal (Ryu & Ryu, 2021) are conceptualized as external stimuli (S). The organism (O) includes both affective states—pleasure, arousal, dominance (Mehrabian & Russell, 1974), hedonic motivation (Fitriani et al., 2020), and perceived enjoyment (Xiang et al., 2016), and cognitive appraisals such as satisfaction (Kumar et al., 2022). The response (R) in this study is conceptualized as consumers' willingness to buy, representing a comprehensive indicator of both emotional and cognitive readiness to engage in purchasing behavior (Nagano et al., 2023). Willingness to buy goes beyond traditional measures of behavioral intention by encompassing not only evaluative judgments but also affective dispositions that drive consumer decision-making (Ajzen, 1991). This construct has demonstrated particular utility in live-streaming commerce contexts, where it effectively captures the dynamic interplay of emotion and cognition in

shaping consumer actions (Hameed et al., 2025). Accordingly, this study adopts the S-O-R framework to examine the interrelationships among key stimuli, organismic states, and behavioral responses within the VI marketing context, as illustrated in Fig. 1.

#### 2.4. Social media user engagement in AI-powered virtual influencer

##### 2.4.1. Perceived interactivity

Consistent with the digital influencer marketing framework proposed by Shamim and Islam (2022), this study adopts a user-centric perspective, emphasizing the significance of consumer perceptions in shaping interactions with VI. Unlike traditional e-commerce platforms, social media fosters real-time interaction, co-creation, and community-driven storytelling mechanisms that not only deepen engagement but also build trust through shared experiences (Chang, Yen, Chou, & Lo, 2023). This evolving digital landscape underscores the need to understand how users engage with VI to cultivate meaningful digital relationships. As Liu et al. (2020) suggest, when virtual engagement is perceived as authentic and responsive, it can enhance brand recall and positively shape consumer attitudes toward celebrity figures. Moreover, the perceived reciprocity in VI-follower interactions plays a pivotal role in shaping consumer experiences. Drawing on the finding of Ling et al. (2024), which highlight the critical influence of perceived interactivity on purchase behavior, the following hypothesis is proposed:

**H1.** Perceived interactivity positively influences followers' willingness to buy VI recommended products.

##### 2.4.2. Perceived risk

According to the theory of perceived risk, individuals are generally risk-averse and tend to avoid situations where outcomes are uncertain or potentially unfavorable (Wang & Tian, 2023). As such, heightened perceptions of risk can undermine consumers' confidence and reduce their willingness to engage in purchasing behavior. Prior studies have shown that perceived risk negatively affects purchase intentions across various contexts, including food delivery services (Mai et al., 2024) and e-commerce platforms (Qalati et al., 2021). In influencer marketing, this effect is particularly notable, as followers of macro-influencers (those with 100,000 to 1 million followers) may refrain from impulsive purchases due to increased skepticism and caution (Zafar et al., 2023). Furthermore, consumer behavior research highlights that perceived risk negatively influence purchase intention (Tian et al., 2023). Applying these insights to the context of VI, it is reasonable to suggest that perceived risk may similarly hinder consumers' willingness to buy. Therefore, we hypothesize:

**H2.** Perceived risk negatively influences followers' willingness to buy VI recommended products.

##### 2.4.3. Visual appeal

Visually appealing product presentations play a vital role in shaping consumer perceptions and can significantly influence purchase decisions (Yu et al., 2024c). Prior research has established a positive relationship between visual appeal and purchase intention, suggesting that aesthetic elements can directly impact consumer behavior (Yang et al., 2021). Beyond online environments, sensory cues like pleasant scents in physical retail settings have also been shown to elevate emotional responses, encouraging additional purchases by enhancing the overall shopping experience (Bradley & LaFleur, 2016). Furthermore, well-designed retail environments with thoughtfully curated colors, layouts, and decor can generate a strong sense of store attraction, reinforcing consumer interest and driving purchase behavior (Chi & Chen, 2020). In the realm of social commerce, Xiang et al. (2016) emphasized that consumers derive entertainment and informational value from visually appealing content, indicating that compelling visual cues enhance engagement and influence consumers' evaluation of products. Therefore, we hypothesize:

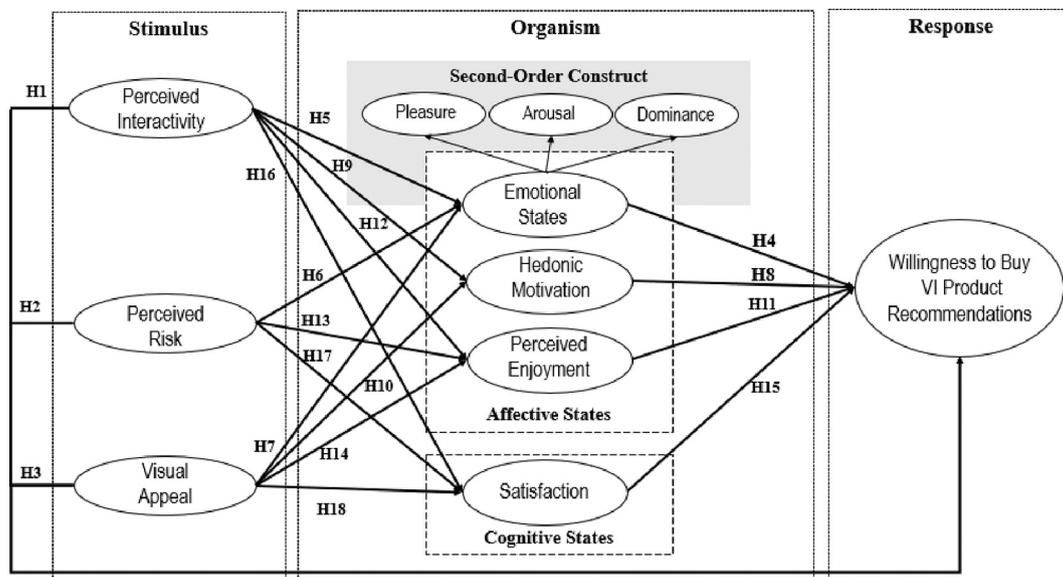


Fig. 1. The present study's proposed framework.

**H3.** Visual appeal of VI social media posts positively influences followers' willingness to buy recommended products.

## 2.5. Emotional displays in the digital landscape

### 2.5.1. Emotional states (pleasure, arousal, and dominance)

Emotional responses play a crucial role in determining advertising effectiveness, often exerting more influence on consumer decisions than rational evaluations (Kusumasondjaja & Tjiptono, 2019). The PAD model serves as a widely accepted framework for understanding emotional responses in consumer behavior. Pleasure refers to feelings of happiness and contentment; arousal captures excitement and stimulation; and dominance relates to the sense of control in a given situation (Nagano et al., 2023). Positive emotional states, especially pleasure and arousal, are known to drive consumers to extend these experiences through consumption behavior (Kusumasondjaja & Tjiptono, 2019). Previous studies have demonstrated that these PAD dimensions can effectively predict behavioral outcomes such as purchase intention (Shang et al., 2023). In line with this, the present study hypothesized that PAD emotional states influence consumers' willingness to purchase products recommended by VI.

Existing literature establishes a significant and direct relationship between perceived interactivity and emotional responses within digital environments. In the digital space, especially on mobile platforms, user-user interactivity can replicate social presence, fostering emotional connections (Utami et al., 2022). Interactive experiences are known to enhance users' positive affective states, particularly through the induction of flow (i.e., a deeply immersive and focused mental state) often associated with heightened enjoyment and engagement (Arghashi & Yuksel, 2022). Kim and Ko (2019) highlight that interactivity enhance users' emotional engagement by facilitating deeper involvement. Nikhashemi et al. (2021) emphasizes that interactivity serves as a crucial stimulus that shapes consumers' affective evaluations and emotional reactions. As technologies evolve, social media platforms increasingly blur the line between human and virtual interaction, with VI becoming more lifelike and socially engaging (Arsenyan & Miowska, 2021). Thus, we posit that perceived interactivity in VI content strengthens emotional engagement and facilitates meaningful user involvement.

In addition to interactivity, perceived risk plays a crucial role in shaping consumers' emotional responses in digital environments. According to Kim and Lennon (2012), perceived risk evaluations significantly influence emotional states, as consumers often respond

emotionally to their cognitive interpretations of risk. Chebat and Michon (2003) further argue that cognition and emotion are inherently interconnected, with perceptions of risk potentially triggering specific affective responses uncertainty, or caution. In the context of VI marketing, we hypothesized that when followers assess a VI-recommended product as risky whether due to lack of trust, limited product information, or unfamiliarity with the brand, these perceptions may lead to emotional reactions or, in some contexts, heighten them depending on individual traits or novelty-seeking tendencies.

Furthermore, visually appealing content, an important aspect of VI communication has been shown to enhance emotional responses and positively influence purchase decisions (Yang et al., 2021; Yu et al., 2024b). Aesthetics design contributes to the visual richness of digital environments, stimulating sensory pleasure and emotional enjoyment (Cyr et al., 2006). Social commerce consumers often rely on these visual cues not only for entertainment but also for forming impressions about products and brands (Xiang et al., 2016). Therefore, we hypothesized that well-crafted visual content in VI posts may trigger stronger emotional responses, influencing consumer behavior.

**H4.** Emotional states positively influence VI followers' willingness to buy recommended products.

**H5.** Perceived interactivity positively influences VI followers' emotional states.

**H6.** Perceived risk significantly influences VI followers' emotional states.

**H7.** Visual appeal of VI social media posts positively influences followers' emotional states.

### 2.5.2. Hedonic motivation

In the realm of online social media, consumers are increasingly drawn to products endorsed by influential media figures, such as YouTube vloggers and VI, who create immersive and enjoyable experiences through their content (Ladhari et al., 2020). Fitriani et al. (2020) noted that hedonic-driven audiences not only seek clear and informative product cues but also prioritize pleasurable and engaging experiences. Consumers with strong hedonic motivations are especially influenced by the atmosphere of the content, the attractiveness of the media figure, and the aesthetic and experiential appeal of the products promoted. Research has shown that hedonic motivations play a crucial role in shaping purchase intentions, particularly in the context of digital and

social commerce (Luo et al., 2024). Drawing from this, it is posited that hedonic motivation plays a central role in shaping the willingness to buy products recommended by VI.

Chang (2018) emphasized that greater interactivity on social media platforms is linked to higher levels of user fulfillment, which in turn fosters prolonged usage and deeper engagement. In livestream shopping environments, Ma (2023) found that interactivity foster emotional gratification and encourage consumers to remain engaged with the shopping experience. This emotional reward can take the form of hedonic gratification, where enjoyment arises from the social and experiential aspects of the interaction. Interactivity has similarly been found to influence hedonic motivation in e-retailing (Chniti & Bouslama, 2015), and in immersive environments like virtual reality (Lee & Kim, 2021). Thus, it is anticipated that the interactivity between a VI and the followers will stimulate hedonic motivation.

Aesthetically pleasing content are more likely to evoke emotional responses, satisfy users' hedonic needs, and encourage continued engagement (Zheng et al., 2019). Tamilmani et al. (2019) emphasized the importance of considering hedonic motivation in behavioral intention studies, arguing that appealing visuals can enhance both hedonic and utilitarian values. Specifically, visually engaging interfaces reduce consumer mistrust and enhance usability, which in turn increases hedonic motivation and overall user experience (Chin et al., 2025). In the context of mobile shopping, visual cues contribute to a pleasant experience that facilitates both efficient shopping and emotional engagement (Zheng et al., 2019). Therefore, it is proposed that the visual appeal of VI content can stimulate hedonic motivation by making the browsing and purchasing process more enjoyable. Hence, we hypothesize:

**H8.** Follower's hedonic motivation when interacting with VI content on social media positively influences their willingness to buy recommended products.

**H9.** Perceived interactivity between VI and follower positively impacts follower's hedonic motivation.

**H10.** Visual appeal of VI social media posts positively influences their follower's hedonic motivation.

### 2.5.3. Perceived enjoyment

Perceived enjoyment has emerged as a critical construct in social commerce research. Defined as "the degree of pleasure derived from engaging in an activity, regardless of any instrumental or outcome-based goals" (Zhao & Bacao, 2021), perceived enjoyment captures the intrinsic value consumers place on their experiences with digital platforms. In live streaming commerce, for example, enjoyment has been shown to directly influence users' purchase intentions (Dong, 2023). Likewise, Xiang et al. (2016) noted that the enjoyment consumers feel when browsing visually rich and interactive content on social commerce platforms can significantly shape their buying behaviors. Extending these insights to the context of VI marketing, this study posits that followers who enjoy browsing VI-recommended products on social media will be more inclined to make purchases.

In addition, interactivity has consistently been linked with heightened enjoyment across various domains. For instance, Gonzales et al. (2009) demonstrated that interactivity in artistic environments where participants could control and influence elements of the experience, leading to greater perceived enjoyment. Do et al. (2020) further observed that seamless interaction contributes to flow experiences, a psychological state closely tied to enjoyment. In the context of VI content, perceived interactivity may enrich the user experience and foster stronger emotional engagement. Based on this, we hypothesize that the more interactive followers perceive their relationship with a VI to be, the greater their perceived enjoyment of the content.

On the other hand, perceived risk can suppress enjoyment in digital environments. In high-risk situations, such as online gaming or financial transactions, perceived enjoyment has been shown to serve as a buffer

that mitigates the impact of risk on user satisfaction and continuation intentions (Sharma et al., 2020). In the VI context, when followers feel uncertain about the authenticity of the promoted product or the credibility of the influencer, their enjoyment may be compromised. Hence, perceived risk is expected to negatively affect the degree of enjoyment followers derive from VI content.

As Deng et al. (2024) describe, visual appeal represents consumers' aesthetic evaluations of product appearance, often influencing their sensory experiences and emotional reactions. VI, whose identities are often created and curated using digital design tools, are uniquely positioned to deliver visually engaging content. These aesthetic elements can enhance the perceived novelty, entertainment value, and emotional resonance of the posts, ultimately increasing followers' enjoyment (Zafar et al., 2023). Similarly, recent studies have shown that visual appeal significantly and positively predicts users' perceived enjoyment in contexts such as social robot acceptance (Jo & Park, 2024), and continued use of mobile learning applications (Yang, 2024). Therefore, this study hypothesizes that visually compelling VI content will positively influence followers' enjoyment when browsing social media. Based on this literature, we propose the following hypotheses:

**H11.** Perceived enjoyment of VI social media posts positively influences followers' willingness to buy recommended products.

**H12.** Perceived interactivity between VI and follower positively influences the follower's perceived enjoyment.

**H13.** Perceived risk negatively influences VI follower's perceived enjoyment.

**H14.** Visual appeal of VI social media posts positively influenced follower's perceived enjoyment.

### 2.5.4. Satisfaction

In the social media influencer research context, satisfaction refers to the extent to which followers experience positive emotions and fulfillment from engaging with the influencer's content, interpersonal presence, and social interaction. It encompasses enjoyment of shared information, emotional connection, and admiration for the influencer's persona (Kim & Baek, 2022). According to Dabholkar et al. (2009), favorable evaluations of an influencer's social presence and engagement reflect deeper customer satisfaction and attachment. Li and Peng (2021) found that satisfaction significantly predicts consumers' purchase intentions, as satisfied users tend to trust influencers more and are more receptive to their product recommendations.

Moreover, satisfaction extends beyond a single interaction; it plays a critical role in shaping long-term user behavior. Satisfied consumers are more likely to spend additional time on the platform, engage more actively with content, and contribute to positive word-of-mouth marketing, which can influence the purchasing decisions of others (Peng et al., 2018). In the realm of VI marketing, when followers experience high levels of satisfaction with the VI whether through the quality of content, communication style, or perceived authenticity, they are more likely to trust and act upon the influencer's product endorsements. Therefore, this study proposes that follower satisfaction with a VI will positively impact their willingness to purchase the products recommended by that VI.

Zhao and Lu (2012) confirmed that interactivity increase satisfaction by enhancing user engagement and perceptions of being heard or valued. Meng and Wei (2016) highlighted how social media influencers, unlike traditional celebrities, maintain frequent and meaningful communication with their followers, often through real-time comments, responses, and personalized content. Such interactions foster a sense of intimacy and attentiveness that enhances follower satisfaction. Similarly, Jun and Yi (2020) found that proactive responses and direct engagement by influencers help consumers better understand products, address uncertainties, and strengthen emotional bonds. Applied to VI, this suggests that perceived interactivity between a VI and followers

may significantly increase satisfaction by creating a more engaging and informative experience. Hence, we hypothesize that positive interactivity perceptions will translate to higher satisfaction levels among followers. This is consistent with previous research (Yang & Shi, 2025), which has established a significant relationship between perceived interactivity and satisfaction.

While interactivity can enhance satisfaction, perceived risk can have the opposite effect. Risk perceptions, particularly regarding product quality, trustworthiness, or security concerns, are known to undermine consumer satisfaction in digital contexts. Gan and Wang (2017) emphasized that perceived risk is a key inhibitor of user satisfaction in online environments. In mobile commerce, for instance, Hossain (2019) reported a negative relationship between perceived risk and consumer satisfaction, reinforcing the idea that uncertainty and fear of loss reduce the likelihood of a positive shopping experience. Chang et al. (2016) further supported this finding, showing that online shoppers' satisfaction is often diminished when they perceive greater levels of risk. Similarly, Pires et al. (2004) opined that higher perceived risks in social commerce can lead to dissatisfaction and reduced willingness to engage in future purchases. Therefore, in the context of VI marketing, when followers perceive the products recommended by a VI as risky due to issues like brand unfamiliarity or lack of physical verification, their satisfaction with the VI may decrease.

As noted by Han et al. (2021), visually attractive content enhances both sensory pleasure and emotional engagement, two dimensions central to user satisfaction. Visually appealing design create an aesthetically stimulating environment that can boost perceived value and user retention. Kemeny et al. (2016) highlighted that aesthetic elements significantly impact consumer satisfaction and purchase intent, particularly when they are effectively presented in mobile or online retail platforms. Likewise, Chi (2018) emphasized that visual appeal enhances perceived quality, thereby increasing the perceived enjoyment and satisfaction of digital shopping environments. In the context of VI, their posts often rely heavily on visual storytelling and digital aesthetics to attract attention and communicate brand messages. Thus, this study posits that the visual appeal of VI social media posts is a key determinant of follower satisfaction.

**H15.** Satisfaction toward VI positively influences followers' willingness to buy recommended products.

**H16.** Perceived interactivity between VI and the followers positively influences follower satisfaction.

**H17.** Perceived risk negatively influences VI followers' satisfaction.

**H18.** Visual appeal of VI social media posts positively influences followers' s satisfaction.

## 2.6. 2.5 Definitions of constructs

The following table (refer to Table 2) outlines the definitions and key concepts of the constructs, which clarify the objectives of our study:

## 3. Research methodology

### 3.1. Questionnaire design and data collection

The survey items and scales used in this study were based on existing literature (refer to Appendix A), and the questionnaire was prepared and delivered online using Google Forms. To assess the study's constructs - perceived enjoyment, hedonic motivation, perceived interactivity, visual appeal, and willingness to buy - respondents scored the statements on a five-point Likert scale ranging from "1 = strongly disagree to 5 = strongly agree." The research statements of pleasure, arousal, dominance, perceived risk, and satisfaction were measured using a seven-point Likert scale ("1 strongly disagree to 7 strongly agree").

The primary data was collected using a convenience sampling

**Table 2**  
Definitions of constructs.

Research Construct	Operational definition	Ref.
Perceived Interactivity	One's perception of the capability of AI-powered technologies to facilitate interactions between AI-powered VI and follower.	Chang, Yen, Chou, & Lo, 2023
Perceived Risk	It is not known whether VI's followers trust their recommendations as an opinion leader about the product in question and it is an irrelevant construct, or whether the danger associated with purchasing the VI recommended product.	Cabeza-Ramírez et al. (2022)
Visual Appeal	The representational richness of encountered AI-powered VI posts' visual elements, such as pictorial aspects, which aggravate its attraction among users.	Zafar et al. (2023)
Satisfaction	The cumulative influence of a series of VI's follower interactions with their favorite AI-powered VI while consuming the VI's digital content.	Kim and Baek (2022)
Emotional States	The degree to which individuals feel pleasure, arousal toward the VI's aesthetic as a visual representation of brand's personality, feel dominance to which followers can control themselves when VI provide product recommendations.	Purwandari et al. (2022); Tong et al. (2022)
Perceived Enjoyment	The extent to which the activity of browsing the VI's posts is perceived to be enjoyable.	Zafar et al. (2023)
Hedonic Motivation	An emotion that can result in a sense of pleasure and enjoyment as a result of browsing VI's social media posts, such as viewing the VI recommended product.	Goel et al. (2022)
Willingness to Buy	The behavioral intention of a consumer to buy a particular product recommended by VI.	Konuk (2019)

method. The current study examined into respondents' experiences with and following existing AI-powered virtual influencers (VI), ensuring that the study accurately reflects the natural VI diversity observed in the field of study. The current study chose participants who had previously followed a VI, which is defined as "agent augmented with digital avatars, designed to look human" (Arsenyan & Miowska, 2021). To understand VI, it is crucial to understand their followers and the information that is they publish on social media, as this can influence followers' behavioral intention (Khan et al., 2024; Kong & Fang, 2024).

Lil Miquela was selected as the focal VI for this study, based on a set of strategic criteria intended to enhance validity and relevance to the research context. First of all, Lil Miquela's verified Instagram status and categorization as a "public figure" reinforce her legitimacy as a VI (Arsenyan & Miowska, 2021). Second, Lil Miquela demonstrates behavior and communication patterns that closely resemble those of real individuals, fostering authenticity and relatability in the study stimuli (Almasri, 2023). Third, Lil Miquela's substantial online presence boasts over 2.5 million Instagram followers, therefore ensuring a high level of recognizability among participants, which supports familiarity with the influencer (Connell, 2024). Forth, Lil Miquela's realistic appearance and her history of collaborations with prominent brands position her as a credible marketing agent (Thomas & Fowler, 2021), aligning with the study's aim of examining consumer responses to product endorsements.

### 3.2. Stimuli and procedure

Fig. 2 presents the visual stimuli used in this study, comprising four Instagram posts sourced directly from Lil Miquela's verified account. To

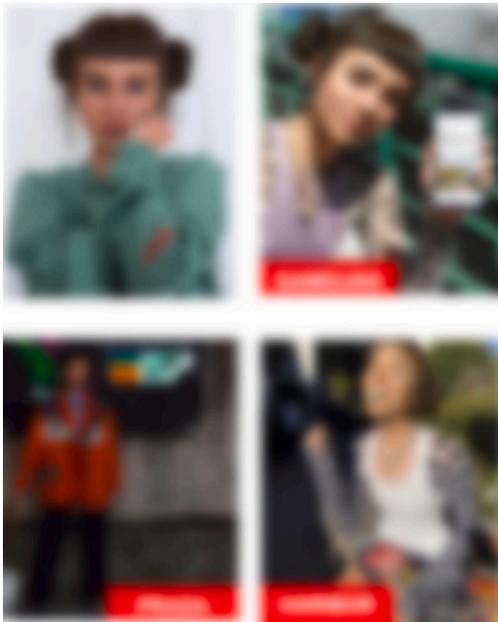


Fig. 2. Study's stimuli.

Notes: Faces and products were blurred to comply with legal and copyright regulations.

ensure a consistent baseline understanding of the VI, participants were first provided with a standardized introductory text. This description positioned Lil Miquela as the first widely recognized virtual influencer, launched in 2016, known for her photorealistic CGI appearance, relatable persona, and brand collaborations with globally recognized companies such as Prada, Pacsun, Samsung, and Haribo:

“Imagine that you are following Lil Miquela, the first widely recognized virtual influencer, launched in 2016. As a computer-generated character, Miquela is recognized for her lifelike appearance, relatable personality, and ability to engage a broad online audience. She frequently shares updates about her daily life, fashion interests, and personal views, making her presence feel authentic and personable. Lil Miquela has collaborated with several prominent brands. She has appeared wearing Prada at Milan Fashion Week, attracting significant media attention. She was also featured as part of Samsung's #TeamGalaxy campaign. For a personal touch, it's worth noting that her favorite candy is Haribo.”

To further ensure familiarity with the VI and increase validity, the sample was drawn from students enrolled in a digital business course. The participants were instructed to follow Lil Miquela on Instagram over a period of several weeks prior to completing the questionnaire. This exposure phase allowed Miquela's content to be naturally integrated in their social media feeds, fostering natural engagement. This approach is consistent with recent virtual influencer research, which emphasizes real-life digital exposure as a method for enhancing the validity of participant responses (Almasri, 2023).

After the introductory phase, participants were presented with four Instagram screenshots: one featuring Lil Miquela's profile and three depicting her endorsements of branded products. The selected stimuli spanned four distinct product categories commonly featured in influencer marketing: (1) Prada (fashion), (2) Haribo (food/confectionery), and (3) Samsung (technology). All posts reflected genuine, publicly available brand collaborations from Miquela's Instagram feed. To ensure consistency in presentation and reduce potential confounds, all images were standardized in terms of visual format and dimensions.

Although brand familiarity was not directly measured in the present study, the selected brands such as Prada, Samsung, and Haribo were

included based on their collaborations with Lil Miquela, as shown on the verified social media account. These brands are internationally recognized and widely marketed across various regions, including Southeast Asia. According to Interbrand (2025), Prada and Samsung are consistently ranked among the world's top 100 most recognized brands, and Samsung was also named a trusted brand in Malaysia in 2025. Haribo, a global confectionery company, operates in over 100 countries and reports near-universal brand awareness in key markets (HARIBO, 2025). While direct familiarity among participants was not assessed, these indicators suggest a reasonable likelihood that the selected brands would be recognizable, supporting the decision to use authentic, real-world influencer collaborations to enhance contextual realism. This selection strategy aligns with established practices in influencer marketing research, which emphasize the use of realistic and contextually relevant influencer-brand associations to improve the credibility and applicability of findings (Lou & Yuan, 2019; Um, 2023).

## 4. Results

### 4.1. Descriptive statistics

An informed consent form and a message of introduction accompanying the survey stated that the questionnaire would only be used for academic reasons and that the information they provided would be kept totally confidential. A total of 257 surveys were received, 9 of which were excluded for straight lining responses (Hair et al., 2022), leaving 248 legitimate respondents who followed a VI, hence only those 248 responses were analyzed for data analysis.

Table 3 displayed the demographic characteristics of the respondents in this study. There were 128 (51.6 %) female and 120 (48.4 %) males. The respondents used social media on a daily basis, with 79.1 % using it for one to seven hours. 233 respondents were active on Instagram, 224 on WhatsApp, and 208 on Facebook. Of all responders, 126 (50.8 %) said they knew virtual influencer Imma, followed by Bermuda (42, 16.9 %) and Kizuna AI (36, 14.5 %). More than half of respondents (55.6 %) expressed an interest in watching AI-powered virtual influencers share entertainment content, followed by lifestyle (124, 50 %) and fashion (120, 48.4 %).

### 4.2. Common method bias and method variance assessment

Single source bias could compromise the validity of the results because the data came from a single questionnaire (Ha Le & Ngoc, 2024). This study used two statistical techniques to screen for CMB and CMV. First, this study used Kock's (2015) approach to evaluate the full collinearity VIF scores of the constructs' factors. The VIF scores varied from 1.320 to 4.879 (refer to Table 4), which was lower than the suggested threshold of five (Yap et al., 2023), indicating that CMB is not of significant concern in the data (Kock, 2015). Additionally, the present research used the marker-variable technique (Lindell & Whitney, 2001). This study employed a marker variable known as a blue attitude on a four-item scale that was not theoretically related to the model's components, as noted by Podsakoff et al. (2003). Despite the inclusion of a marker variable in the model (refer to Table 5), the  $R^2$  change was only 63 % (less than 10 %). As a result, the analysis evidently shows that CMV is not a concern. Consequently, the findings confirm that single source bias was not present in this study.

### 4.3. Assessment of the measurement model

For the measurement assessment, the outer loadings, reliability, convergent validity, and discriminant validity were evaluated. Emotional state was conceptualized in this study as a reflective-reflective second-order construct, in accordance with Yang et al.'s (2022) suggestions. Emotional state was represented by eleven items that represented three interrelated first-order constructs (namely,

**Table 3**  
Demographic profile.

Profile	Categories	Frequency	Percentage
Gender	Female	128	51.6
	Male	120	48.4
Educational level	Diploma	99	39.9
	Bachelors or undergraduate	149	60.1
Social media	Facebook	208	83.9
	Facebook messenger	136	54.8
	iMessage	29	11.7
	Instagram	233	94.0
	LinkedIn	24	9.7
	Pinterest	51	20.6
	Snapchat	62	25.0
	Telegram	169	68.1
	TikTok	139	56.0
	Twitter	91	36.7
	WeChat	159	64.1
	WhatsApp	224	90.3
	Youtube	190	76.6
	Twitch	3	1.2
Social media daily usage	Discord/XiaoHong Shu	2	0.8
	Less than 1 h	9	3.6
	1–3 h	51	20.6
	3–5 h	95	38.3
	5–7 h	50	20.2
Virtual influencers	More than 7 h	43	17.3
	Humainod virtual influencer:		
	Bermuda	42	16.9
	Imma	126	50.8
	Lil Miquela	17	6.9
	Maya	18	7.3
	Shudu	3	1.2
	2D-animated virtual influencer:		
	Gawr Gura	34	13.7
	Kizuna AI	36	14.5
Type of information interest	Beauty	112	45.2
	Business	73	29.4
	Entertainment	138	55.6
	Fashion	120	48.4
	Food	117	47.2
	Health	61	24.6
	Lifestyle	124	50.0
	Travel	91	36.7
	Sports	63	25.4
	Music	1	0.4

**Table 4**  
Full collinearity testing.

HM	ES	PE	PI	PR	SA	VA	WTB
3.841	4.879	3.989	3.046	1.32	4.116	2.469	2.763

**Table 5**  
Changes in R<sup>2</sup> after adding marker variable.

	R <sup>2</sup> (Before add in marker variable)	R <sup>2</sup> (After add in marker variables)
WTB	0.638	0.642

emotion with dominance, emotion with arousal, and emotion with pleasure).

In the present study, item loadings were extremely acceptable, with all items having loading values more than 0.708 (Hair et al., 2019). Table 6 summarizes the results, which reveal that all composite reliability values were greater than 0.70 (Hair et al., 2019), confirming sufficient reliability. Furthermore, this study found that average variance extracted values exceeded the 0.50 cut-off threshold, indicating that each latent construct's indicators were adequately explained and

**Table 6**  
Construct reliability and validity.

First Order Construct	Second Order Construct	Items	Loading	CR	AVE
Hedonic Motivation		HM1	0.874	0.943	0.736
		HM2	0.893		
		HM3	0.870		
		HM4	0.892		
		HM5	0.892		
		HM6	0.712		
Perceived Enjoyment		PE1	0.897	0.951	0.830
		PE2	0.900		
		PE3	0.930		
Perceived Interactivity		PI1	0.876	0.919	0.740
		PI2	0.890		
		PI3	0.834		
		PI4	0.840		
Perceived Risk		PR1	0.856	0.906	0.763
		PR2	0.867		
		PR3	0.897		
Satisfaction		SA1	0.903	0.957	0.818
		SA2	0.898		
		SA3	0.915		
		SA4	0.909		
		SA5	0.896		
Visual Appeal		VA1	0.892	0.936	0.829
		VA2	0.924		
		VA3	0.915		
		AS1	0.944		
		AS2	0.951		
Arousal		AS3	0.928	0.952	0.869
		DM1	0.892		
		DM2	0.928		
Dominance		DM3	0.931	0.948	0.859
		PS1	0.895		
		PS2	0.913		
Pleasure		PS3	0.933	0.927	
		PS4	0.896		
		Pleasure (PS)	0.943		
		Arousal (AS)	0.927		
Willingness to Buy		Dominance (DM)	0.927	0.948	0.859
		WTB1	0.919		
		WTB2	0.935		
		WTB3	0.927		

Note(s): CR: Composite reliability; AVE: Average variance extracted.

linked with one another (Hair et al., 2019). The discriminant validity was validated when AVE's square root exceeded its greatest correlation with any construct (Fornell & Larckers, 1981). Furthermore, as per the findings of the heterotrait-monotrait (HTMT) criterion (refer to Table 7), the HTMT values were lower than 0.90, thereby ensuring the discriminant validity (Henseler et al., 2015).

#### 4.4. Assessment of the structural model

Mardia's multivariate kurtosis coefficient,  $\beta = 120.985$  ( $p < 0.01$ ) and multivariate skewness coefficient,  $\beta = 15.679$  ( $p < 0.01$ ), show the fact the data did not correspond to a multivariate normal distribution (Cain et al., 2016). Thus, this study presented the path coefficients, standard errors, t-values, p-values, and confidence intervals of the structural model using a 5000-sample re-sample bootstrapping approach to determine the significance of the hypotheses, as recommended by Hair et al. (2019). Table 8 summarizes the findings from the developed hypotheses. The variables explain 63.8 % of the variation in willingness to buy ( $R^2 = 0.63$ ), showing moderate explanatory power (Hair et al., 2022).

In terms of stimulus factors, perceived interactivity ( $\beta = -0.026$ ;  $p > 0.05$ ), perceived risk ( $\beta = -0.039$ ;  $p > 0.05$ ), and visual appeal ( $\beta = -0.056$ ;  $p > 0.05$ ) do not significantly influence willingness to buy, thus empirical data did not support H1, H2, and H3. In terms of organism

**Table 7**  
Fornell–Larcker criterion and heterotrait-monotrait ratio (HTMT).

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1. HM									<b>0.858</b>							
2. ES	0.805								0.763	<b>0.859</b>						
3. PE	0.838	0.863							0.781	0.818	<b>0.911</b>					
4. PI	0.611	0.725	0.698						0.555	0.671	0.634	<b>0.860</b>				
5. PR	0.398	0.474	0.376	0.500					0.351	0.431	0.336	0.430	<b>0.873</b>			
6. SA	0.788	0.873	0.831	0.740	0.442				0.738	0.833	0.780	0.682	0.396	<b>0.904</b>		
7. VA	0.529	0.654	0.613	0.849	0.471	0.614			0.483	0.609	0.560	0.753	0.412	0.566	<b>0.910</b>	
8. WTB	0.843	0.729	0.736	0.518	0.304	0.731	0.433		0.776	0.686	0.682	0.473	0.270	0.681	0.393	<b>0.927</b>

**Table 8**  
Summary of hypotheses testing.

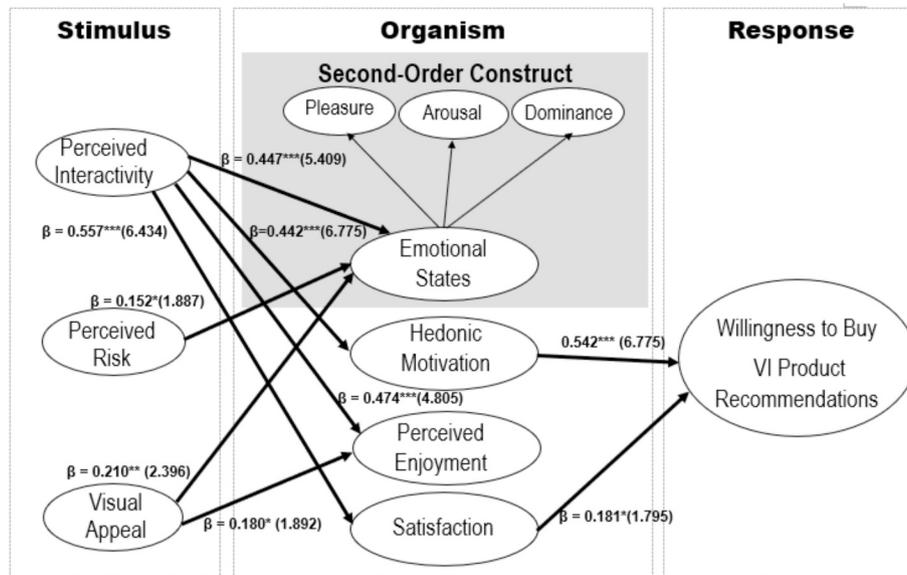
	Beta	Standard Deviation	t-value	p-values	Remark	5.0 %	95.0 %	f <sup>2</sup>	Effect Size
H1: PI → WTB	-0.026	0.077	0.331	0.370	Not Supported	-0.142	0.116	0.001	Small
H2: PR → WTB	-0.039	0.048	0.806	0.210	Not Supported	-0.122	0.036	0.003	Small
H3: VA → WTB	-0.056	0.075	0.746	0.228	Not Supported	-0.183	0.064	0.004	Small
H4: ES → WTB	0.131	0.105	1.244	0.107	Not Supported	-0.035	0.311	0.010	Small
H5: PI → ES	0.447	0.083	5.409***	< 0.001	Supported	0.323	0.596	0.164	Medium
H6: PR → ES	0.152	0.081	1.887*	0.030	Supported	0.019	0.284	0.037	Small
H7: VA → ES	0.210	0.088	2.397**	0.008	Supported	0.061	0.350	0.037	Small
H8: HM → WTB	0.542	0.080	6.775***	< 0.001	Supported	0.402	0.670	0.268	Medium
H9: PI → HM	0.442	0.094	4.674***	< 0.001	Supported	0.290	0.601	0.124	Small
H10: VA → HM	0.151	0.099	1.528	0.063	Not Supported	-0.015	0.312	0.015	Small
H11: PE → WTB	0.071	0.091	0.777	0.219	Not Supported	-0.091	0.211	0.003	Small
H12: PI → PE	0.474	0.099	4.805***	< 0.001	Supported	0.321	0.643	0.161	Small
H13: PR → PE	0.057	0.080	0.719	0.236	Not Supported	-0.066	0.191	0.005	Small
H14: VA → PE	0.180	0.095	1.892*	0.029	Supported	0.024	0.335	0.024	Small
H15: SA → WTB	0.181	0.101	1.795*	0.036	Supported	0.020	0.350	0.023	Small
H16: PI → SA	0.557	0.087	6.434***	< 0.001	Supported	0.422	0.706	0.249	Medium
H17: PR → SA	0.115	0.078	1.484	0.069	Not Supported	-0.011	0.246	0.021	Small
H18: VA → SA	0.099	0.093	1.064	0.144	Not Supported	-0.064	0.244	0.008	Small

Note(s): \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ .

factors, hedonic motivation ( $\beta = 0.542$ ;  $p < 0.001$ ) and satisfaction ( $\beta = 0.181$ ;  $p < 0.05$ ) significantly influence willingness to buy, thus empirical data support H8 and H15. Perceived enjoyment ( $\beta = 0.071$ ;  $p > 0.05$ ) and emotional states ( $\beta = 0.131$ ;  $p > 0.05$ ) do not significantly influence willingness to buy, thus empirical data did not support H4 and H11.

Perceived interactivity significantly influences emotional states ( $\beta = 0.447$ ;  $p < 0.001$ ), hedonic motivation ( $\beta = 0.442$ ;  $p < 0.001$ ), perceived

enjoyment ( $\beta = 0.474$ ;  $p < 0.001$ ), and satisfaction ( $\beta = 0.557$ ;  $p < 0.001$ ), thus empirical data support H5, H9, H12, and H16. Perceived risk significantly influences emotional states ( $\beta = 0.152$ ;  $p < 0.05$ ), thus empirical data support H6. Perceived risk does not significantly influence perceived enjoyment ( $\beta = 0.057$ ;  $p > 0.05$ ) and satisfaction ( $\beta = 0.115$ ;  $p > 0.05$ ), thus empirical data did not support H13 and H17. The influences of visual appeal on emotional states ( $\beta = 0.210$ ;  $p < 0.01$ ) and perceived enjoyment ( $\beta = 0.180$ ;  $p < 0.05$ ) are significant, thus the



**Fig. 3.** Streamlined diagram with only significant hypotheses paths.  
Notes: \*\*\* =  $p < 0.001$ ; \*\* =  $p < 0.01$ ; \* =  $p < 0.05$ .

research hypothesis of H7 and H14 are supported by empirical data. The influences of visual appeal on hedonic motivation ( $\beta = 0.151; p > 0.05$ ) and satisfaction ( $\beta = 0.099; p > 0.05$ ) are not significant, thus the research hypothesis of H10 and H18 are not supported by empirical data. Fig. 3 shows the overall results model.

4.5. PLS-prediction

This study evaluated the root-mean-square error (RMSE), the most commonly used metric for measuring the extent of prediction error when examining the predictive power of a conceptual framework (Shmueli et al., 2019). This study evaluates each indicator's PLS-RMSE values to its naïve linear regression model (LM) benchmark. As a general rule, the current research framework has strong predictive power because the PLS-SEM analysis generates smaller prediction errors in terms of RMSE than the LM for all indicators (Shmueli et al., 2019). Table 9 presents the results of the PLS-predict model.

5. Research discussions

5.1. Discussion

This study employed the S-O-R framework to explore how followers' emotional engagement with VI is shaped by perceived interactivity, visual appeal, and perceived risk, and how these predictors, in turn, influence willingness to buy VI-recommended products. Our findings contribute to the growing body of literature on consumer behavior in VI contexts by highlighting the emotional mechanisms through which users engage with AI-powered influencer content.

We focused on perceived interactivity, particularly the human-to-human interaction (Zhao & Lu, 2012) between followers and humanoid VI. Perceived interactivity emerged as the most influential stimulus affecting affective and cognitive emotional states, including PAD emotional states, hedonic motivation, enjoyment, and satisfaction. This supports earlier work that identified interactivity as a central factor in digital engagement (Arghashi & Yuksel, 2022; Javornik, 2016; Mai et al., 2024). In line with Ma's (2023) study, perceived interactivity is positively correlated with hedonic motivation. Our research supports this finding, suggesting that catering to the pleasure-seeking desires of social media followers, such as allowing them to explore product recommendations from their favorite influencers, is essential for maintaining a dedicated following. This highlights the positive impact of interactive engagement between influencers and their followers on the motivation to seek out enjoyable experiences. Beyond hedonic motivation, this study found that perceived interactivity can also fulfill emotional states like arousal and pleasure associated with the aesthetic design of influencer content or a sense of dominance in selecting influencer recommendations. Our findings corroborate recent research (Yang et al., 2024) that reported a significant relationship between perceived interactivity and emotional states. However, the result contradicts Lee et al.'s (2016) that did not uncover the significant relationship.

Our study established a direct correlation between perceived interactivity and perceived enjoyment, aligning with existing research. While previous studies (Chen et al., 2024) have confirmed this relationship in

Table 9  
PLS-predict.

Construct	Q <sup>2</sup> predict			
Willingness to Buy (WTB)	0.202			
	RMSE			
Items	PLS	LM	PLS-LM	Q <sup>2</sup> predict
WTB1	0.829	0.838	-0.008	0.182
WTB2	0.847	0.858	-0.011	0.178
WTB3	0.870	0.899	-0.029	0.157

Notes: RMSE = root-mean-square error; PLS = partial least squares; LM = linear regression model.

the context of augmented reality technology, our research extends this finding to the realm of artificial intelligence-powered influencers. Specifically, our results demonstrate that interacting with VI positively impacts followers' enjoyment of viewing their social media posts. Our findings corroborate existing research demonstrating a significant relationship between perceived interactivity and satisfaction (Ibáñez-Sánchez et al., 2022). This suggests that influencer-follower interactions can foster a sense of closeness and fulfillment among followers, as interaction is often a highly satisfying aspect of life. This implies that technology like VI can assist Internet users in satisfying their socializing expectations (Rauschnabel, 2018). Perceived interactivity can improve user happiness and communication in interaction-based experiences (Ibáñez-Sánchez et al., 2022).

Although interactivity is a key driver of engagement in digital marketing, this study found that perceived interactivity with VI did not significantly influence followers' willingness to buy recommended products. According to the Elaboration Likelihood Model (Petty & Cacioppo, 1986), peripheral cues like interactivity may have limited persuasive impact unless users are highly involved in the decision-making process. When followers engage primarily for entertainment, they may not deeply process promotional content. Moreover, if the interactivity feels overly commercial or inauthentic, it can reduce its persuasive effectiveness (Evans et al., 2017). Without trust cues or detailed product information, interactivity alone may be insufficient to drive purchase decisions (Nikhashemi et al., 2021).

Additionally, this study discovered that perceived risk significantly predicted emotional states, implying that the sensations and anxieties connected with browsing or purchasing influencer-promoted items and services influenced the emotions of their followers. This is consistent with Zuckerman's (1994) theory of risk-taking behavior, which holds that people are constantly looking for optimal stimulation to achieve their goals. When environmental stimulation is either too intense or too low, people adapt their behavior to maintain a comfortable degree of "pleasantness" (Lim et al., 2010).

Although perceived risk has been found to significantly influence consumer behavior in many contexts (Natarajan et al., 2018b; Hubert et al., 2017), it did not significantly predict willingness to buy VI-recommended products in this study. This aligns with findings by Rouibah et al. (2016), who reported that perceived risk was not a major factor in mobile payment adoption, suggesting that in certain digital environments, users may downplay risk when usability or gratification is high. In VI marketing, perceived risk may be overshadowed by hedonic motivations (e.g., entertainment, novelty), and visual appeal, especially in low-stakes or impulse-driven purchases (Shao, 2024). Therefore, in the context of VI recommendations, perceived risk present may not carry enough weight to significantly deter followers' willingness to buy, especially when affective or hedonic factors dominate the user experience. Specifically, this study found that hedonic motivation strongly predicted willingness to buy VI product recommendations.

This study found that visual appeal positively influences emotional states and perceived enjoyment in VI social media posts. Similarly, research on mobile commerce environments has demonstrated that perceived visual attractiveness significantly enhances enjoyment and pleasure (Cyr et al., 2006; Hsieh et al., 2021). Therefore, it can be concluded that in the context of VI, the aesthetic appeal of VI social media posts can provide visual cues that facilitate feelings of enjoyment and pleasure. In contrast to emotional states and perceived enjoyment, hedonic motivation, another affective element, was not significantly influenced by visual appeal. Although visual appeal can enhance attention, aesthetic pleasure, and engagement (Deng et al., 2024; Zafar et al., 2023), it may not directly influence consumers' purchase intentions, particularly in the context of VI marketing. One reason could be that aesthetic elements are often processed as peripheral cues (Petty & Cacioppo, 1986). While these cues capture attention and improve enjoyment experience, they may not convey sufficient information about product quality, credibility, or utility, which are often critical to

purchase decisions (Han et al., 2021).

Hedonic motivation and satisfaction were significant predictors of willingness to buy, aligning with previous studies by Gan and Wang (2017), and Zhang et al. (2023). This significant result suggests that followers with higher levels of perceived value, such as hedonic motivation, and satisfaction are more likely to develop purchase intent. In the context of VI, this can be explained by the fact that followers evaluate not only product traits and qualities, but also the complete purchasing experience. When followers enjoy their experience and find browsing or looking for VI-recommended products appealing, they are more likely to become satisfied and eventually purchase.

Supporting this, the Importance–Performance Map Analysis (IPMA) further revealed that hedonic motivation, representing an affective dimension of the user experience, exhibited both high performance and high importance in predicting willingness to purchase VI-recommended products. This underscores the critical role of emotional gratification in influencing consumer purchase behavior within VI contexts. In contrast, while satisfaction, reflecting a more cognitive assessment of the experience, also emerged as a significant predictor, its relatively lower importance score suggests a more limited influence on purchase intention. Taken together, these results indicate that affective responses may exert a more substantial impact on consumers' willingness to engage in purchase behavior than cognitive evaluations such as satisfaction.

Conversely, this study found that emotional states (pleasure, arousal, and dominance) and perceived enjoyment did not significantly predict willingness to buy. These results diverge from prior empirical findings (Dong, 2023; Shang et al., 2023), which have highlighted the influence of emotional responses and perceived enjoyment on consumer behavior. A plausible explanation may be that emotional responses and perceived enjoyment are more strongly associated with engagement or continued interaction intentions rather than direct purchase behaviors. For instance, research in tourism and immersive technology contexts suggests that visual appeal and the enjoyment aspects of virtual environments enhance users' experiential enjoyment and engagement (Tussyadiah et al., 2018; Fan et al., 2022). In these contexts, enjoyment functions as a driver of experiential involvement rather than transactional intent. Similarly, the immersive and affective features of technologies like augmented and virtual reality are known to heighten user engagement and co-creation of experiences (Abou-Shouk et al., 2024), which may not necessarily translate into immediate purchase intentions.

### 5.2. Theoretical implications

Perceived interactivity is widely acknowledged as a central factor in driving user engagement within digital environments, owing to its ability to enhance perceptions of agency, responsiveness, and psychological involvement (Liu et al., 2020; Mouritzen et al., 2024; Yan et al., 2024). Extending this line of inquiry, Davlembayeva et al. (2025) investigated interactivity in VI marketing using the perspective of social influence theory, focusing primarily on cognitive outcomes such as compliance and internalization. While this cognitive orientation has offered valuable contributions, the present study shifts attention to the affective processes that may also be triggered during interactions between users and VI. To address this theoretical gap, the study conceptualizes perceived interactivity within the S-O-R framework, viewing it as an external stimulus that initiates both affective and cognitive internal states. Specifically, the Pleasure–Arousal–Dominance (PAD) model is employed to capture the multidimensional nature of affective responses, complemented by constructs such as hedonic motivation and perceived enjoyment. In parallel, satisfaction is introduced as a cognitive response, allowing for a more comprehensive representation of both affective and cognitive reactions within the organismic component of the S-O-R framework. This approach also responds to the limitations noted by Zhang et al. (2023), who observed that the PAD model alone does not fully account for hedonic and enjoyment-driven affective reactions in digital media contexts. This integration advances theory by

reconceptualizing interactivity as a dual-pathway construct that operates through both affective and cognitive organismic states. This shift positions emotional engagement as an equally critical mechanism in shaping consumer responses to VI. By combining the theoretical strengths of the S-O-R and PAD models, this research contributes a more complete and nuanced perspective on how consumers respond to VI, thereby laying the foundation for future advancements in the study of technologically mediated consumer interactions.

Beyond interactivity, this study also extends theoretical discussions on the affective role of experiential factors: perceived risk and visual appeal in shaping user responses to VI. Rather than framing risk solely as a barrier to trust or adoption (Cabitza, 2019), this study positions perceived risk as a psychologically salient stimulus capable of influencing emotional states. This interpretation broadens traditional cognitively dominated perspectives of risk by highlighting its emotional resonance in AI-mediated environments. In addition, the study underscores the significance of visual appeal in generating affective engagement, emphasizing how perceptual stimuli such as design quality and visual richness contribute to emotional connection with VI. Together, these insights support a more integrative theoretical model in which emotional factors and experiential factors jointly influence consumer experience. Collectively, these insights support a broader theoretical model of digitally mediated consumer experience—one that accounts for the interactive influence of perceptual and affective cues in structuring user engagement with VI.

### 5.3. Practical implications

In the context of social media, where virtual interactions are central, interactivity plays a pivotal role in determining influencer effectiveness, shaping behavioral intentions like connection, emotional affiliation, and co-creation between followers and influencers (Ki et al., 2022). This study emphasizes the importance of engagement interactivity in fostering emotional attachments such as pleasure, arousal, and dominance while also stimulating hedonic motivations and perceived enjoyment among VI followers. These findings suggest that brands and marketers should prioritize designing engaging, interactive experiences to deepen emotional attachments between followers and VI. Practical strategies include facilitating real-time participatory content (e.g., live Q&As, polls, and comment-driven narratives), delivering emotionally resonant storytelling, and promoting co-creation activities that empower users to contribute to VI content. To further enhance user enjoyment and loyalty, marketers could integrate gamification features such as challenges, virtual rewards, or leaderboards, and tailor content that reflects the values, interests, and aesthetic preferences of their target (Dabiran et al., 2024). By focusing on both emotional resonance and interactive design, brands could foster more meaningful, hedonic, and fostering deeper VI-follower engagement and encouraging ongoing participation.

This study underscores the significance of fostering strong connections (perceived interactivity) between VI and their followers through interactive experiences, which can have a profound impact on followers' cognitive states, particularly their satisfaction. By leveraging AI-driven tools to deliver personalized content and interactions based on individual preferences, businesses can create experiences that make followers feel recognized and appreciated (Ki et al., 2022). Additionally, promoting interaction and shared experiences through online communities, such as forums, social media groups, or virtual events, can deepen these connections. Real-time interaction technologies, like live streaming, live chats, and AI-driven features, further enhance engagement by providing opportunities for followers to interact with VI in real-time, thereby increasing their sense of connection. These strategies contribute to building stronger relationships, ultimately enhancing satisfaction and cultivating greater loyalty. Companies could foster community engagement through dedicated platforms where followers can interact with VI and other community members, reinforcing

emotional bonds and increasing loyalty. By integrating these strategies, businesses can elevate user satisfaction, boost engagement, and foster long-term relationships with followers.

This study demonstrates that both visual appeal and perceived risk significantly influence emotional states. Interestingly, the findings suggest a positive relationship between perceived risk and emotional states, which underscores the complexity of emotional responses in consumer behavior. To leverage these insights, businesses could invest in high-quality, visually appealing content that aligns with their brand identity, as it enhances emotional engagement and generates positive affective responses. Additionally, to address the heightened emotional engagement that comes with perceived risk, companies can incorporate social proof (Cialdini, 2001), such as customer reviews and testimonials, which can reduce uncertainty and foster trust. For VI, maintaining consistency in visually appealing content is essential to evoke positive emotional states like pleasure and arousal, while managing perceptions of risk that may lead to heightened emotional engagement. By emphasizing the visual appeal of VI social media posts and strategically incorporating social proof, businesses can boost emotional engagement, mitigate the emotional effects of perceived risk, and enhance overall user experiences, thereby cultivating stronger consumer relationships.

Finally, hedonic motivation and satisfaction are crucial drivers of consumers' willingness to purchase products recommended by VI. To enhance satisfaction, businesses could focus on improving customer service, promoting transparency, building trust, and fostering community engagement, as these factors increase consumer loyalty and lead to more positive emotional responses, ultimately driving purchase behavior. Additionally, organizations can stimulate hedonic motivation by introducing novel elements such as limited-edition products, surprise events, or collaborations, which generate excitement, enhance enjoyment, and foster deeper engagement with consumers. Strengthening community engagement through interaction, virtual events, and opportunities for co-creation can further improve satisfaction and emotional attachment, reinforcing both hedonic motivations and the overall consumer experience, leading to greater willingness to act on VI recommendations.

## 6. Conclusions, limitations and future research

This study investigates the interplay between visual appeal, perceived interactivity, hedonic motivation, and satisfaction in the context of VI marketing on social media. The findings highlight how visually engaging content, meaningful user interaction, and emotionally resonant experiences contribute to increased consumer engagement, satisfaction, and commercial impact. As one of the first empirical investigations focusing on Malaysian consumers' responses to VI, this research provides foundational insights and sets the stage for future exploration. To build on these findings, future research could broaden the platform scope by including other social media channels such as Facebook, YouTube, or TikTok, particularly within sectors like fashion, lifestyle, and travel, where VI is increasingly active. As VI marketing continues to evolve, further investigation into gender-related effects across different contexts or consumer segments may enrich our understanding of user engagement and decision-making processes.

Despite its contributions, this study is subject to several limitations. First, it centers on a single VI (i.e., Lil Miquela), which may limit the generalizability of the findings to other VI with differing personas, visual aesthetics, or brand affiliations. Future research could consider a broader range of VI that vary in familiarity, design, and brand identity to determine whether the observed effects persist across different VI typologies. Second, the sample comprised university students enrolled in a digital business course, reflecting a common approach in existing VI research, which typically centers on university student populations (Kim et al., 2024a; Liu et al., 2025; Um, 2023). University students typically possess moderate financial independence, making them a relevant cohort for examining purchasing behavior (Liu et al., 2025). Their

spending capacity, combined with a tendency to form emotional connections, such as perceiving emotionally expressive virtual agents as more relatable, provides a valuable perspective for exploring the psychological and behavioral factors shaping consumption among younger generations (Ham et al., 2024; Kim et al., 2024a). Nevertheless, although university student demographics are generally digitally literate and familiar with AI-driven content (Yusoff et al., 2025), their relative homogeneity may limit the generalizability of the findings and constrain external validity (Creswell & Creswell, 2022). Future research would benefit from recruiting more diverse and representative samples across different age groups, occupations, and cultural contexts to enhance generalizability.

Although this study was conducted within Malaysia's multicultural context, where the population comprises diverse ethnic backgrounds, cultural variables were not directly measured. Nonetheless, it is important to consider Malaysia's overall cultural orientation when interpreting the findings. Despite its ethnic diversity, Malaysia is identified as a collectivist society (Jan, 2025), with high social media engagement among younger demographics (MCMC, 2023). These characteristics may have influenced how participants engaged with the VI, potentially contributing to greater acceptance of anthropomorphized AI technology (Dang & Li, 2025), particularly in response to content emphasizing relational connections or community-oriented themes. Drawing on cultural dimension's theory (Hofstede, 2001), prior research suggests that individuals from collectivist cultures are generally more receptive to messages that emphasize social connectedness, while those from individualist cultures tend to favor communication that highlights personal autonomy and self-expression (Kim & Sundar, 2012). Integrating this perspective enhances the interpretation of our findings by suggesting that cultural values may moderate affective and cognitive responses to AI-mediated persuasion. This perspective also offers a more nuanced understanding of the extent to which these findings may (or may not) be transferable to individualist societies. Accordingly, future research is encouraged to adopt cross-cultural comparative approaches or incorporate cultural dimensions as moderating variables to examine how consumer responses to VI vary across sociocultural environments.

Finally, while this study focused on emotional reactions using the PAD model (pleasure, arousal, dominance), future research could examine other psychological mechanisms, such as trust (Muniz et al., 2024) to gain deeper insight into emotional dynamics in VI marketing. Given the role of perceived authenticity in influencer marketing, trust may be a critical factor shaping consumer responses in AI-mediated environments. In particular, exploring the mediating roles of emotional states in the relationship between VI characteristics and behavioral outcomes such as purchase intentions would provide a more comprehensive understanding of how interactivity, risk, and visual appeal influence consumer decision-making.

## CRediT authorship contribution statement

**Chin Lay Gan:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Yi Yong Lee:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Tze Wei Liew:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Su-Mae Tan:** Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Investigation, Data curation, Conceptualization. **Faizan Ahmad:** Writing – review & editing, Validation, Software, Resources, Project administration, Methodology, Data curation. **Adhi Prasetyo:** Writing – review & editing, Validation, Software, Resources, Project administration, Investigation, Data curation.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgements

This work was supported by Multimedia University Malaysia under the MMU Postdoctoral Research Fellow Grant (Grant No. MMUI/240043).

## Appendix A. Survey items with literature source

Construct	Items
Hedonic Motivation (Goel et al., 2022)	Discovering/discover the product/service recommendations of AI-powered virtual influencers on social media ... HM1 - ... will be an exciting experience. HM2 - I will be happy to ... HM3 - Satisfying to be among the first to ... HM4 - ... should be an exciting experience. HM5 - I should feel happy with ... HM6 - I like to try a new product before others do.
Perceived Enjoyment (Zafar et al., 2023)	Browsing the AI-powered virtual influencer's social media posts is ... PE1 - ... fun for me. PE2 - ... is interesting. PE3 - ... is enjoyable. PE4 - ... is exciting.
Perceived Interactivity (Chang et al., 2023)	I can easily... the AI-powered virtual influencer. PI1 - ... communicate with ... on social media. PI2 - ... exchange and share opinions with ... on social media. PI3 - ... and quickly access and understand interesting information posted by the social media ... PI4 - ... and effectively search online for interesting information posted by the social media ...
Perceived Risk (Cabeza-Ramírez et al., 2022)	... the AI-powered virtual influencer... PR1 - It is risky to buy products or services recommended by ... PR2 - Buying products or services promoted by ... adds to the uncertainty about the results I will get from buying the products or services. PR3 - Using ... recommendation exposes me to a general risk about the results of the products or services.
Satisfaction (Kim & Baek, 2022)	... relationship with the AI-powered virtual influencer ... SA1 - I feel satisfied with the ... SA2 - My ... does a good job of fulfilling my needs. SA3 - My ... makes me very happy. SA4 - My ... is close to ideal. SA5 - Having a ... is one of the most satisfying things in my life.
Visual Appeal (Zafar et al., 2023)	AI-powered virtual influencer posts show me plenty of pictures and videos ... VA1 - ... which are visually pleasing. VA2 - ... which are visually appealing. VA3 - ... display visually pleasing design.
Arousal (Tong et al., 2022)	The aesthetic design of the AI-powered virtual influencer... AS1 - ... excites me. AS2 - ... exhilarates me. AS3 - ... stimulates me.
Dominance (Purwandari et al., 2022)	... I can control/choose what products and services ... DM1 - ... I will receive from the AI-powered virtual influencers. DM2 - I feel that ... experience I will get from the AI-powered virtual influencers. DM3 - When I follow the AI-powered virtual influencers, ... recommendations I will get.
Pleasure (Tong et al., 2022)	The ... design of the AI-powered virtual influencer ... PS1 - ... aesthetic ... is pleasing. PS2 - ... creativity and artistic ... makes me happy. PS3 - ... creativity and artistic ... satisfy me. PS4 - ... aesthetic ... makes me contented.
Willingness to Buy (Konuk, 2019)	... buy (buying) a product or service recommended by the AI-powered virtual influencer. WTB1 - I consider ... WTB2 - I will ... WTB3 - There is a strong likelihood that I will ...

## Data availability

Data will be made available on request.

## References

- Abou-Shouk, M., Zouair, N., Abdelhakim, A., Roshdy, H., & Abdel-Jalil, M. (2024). The effect of immersive technologies on tourist satisfaction and loyalty: The mediating role of customer engagement and customer perceived value. *International Journal of Contemporary Hospitality Management*, 36(11), 3587–3606.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Akhtar, N., Hameed, Z., Islam, T., Pant, M. K., Sharma, A., Rather, R. A., & Kuzior, A. (2024). Avatars of influence: Understanding how virtual influencers trigger consumer engagement on online booking platforms. *Journal of Retailing and Consumer Services*, 78.
- Almasri, Y. (2023). Fashion virtual influencers: Antecedents influencing females' behavioral intentions in Jordan. *Dirasat: Human and Social Sciences*, 50, 391–402.
- Arghashi, V., & Yuksel, C. A. (2022). Interactivity, inspiration, and perceived usefulness! How retailers' AR-apps improve consumer engagement through flow. *Journal of Retailing and Consumer Services*, 64.
- Arikhanson, A. (2019). Is KFC's virtual influencer Colonel Sanders the start of a new (weird) trend?. Retrieved October 28, 2024, from <https://arikhanson.com/is-kfcs-virtual-influencer-colonel-sanders-the-start-of-a-new-weird-trend/>.

- Arsenyana, J., & Miowska, A. (2021). Almost human? A comparative case study on the social media presence of virtual influencers. *International Journal of Human-Computer Studies*, 155.
- Barari, M. M., Eisend, M., & Jain, S. P. (2025). A meta-analysis of the effectiveness of social media influencers: Mechanisms and moderation. *Journal of the Academy of Marketing Science*. <https://link.springer.com/article/10.1007/s11747-025-01107-3#citeas>.
- Bradley, G. T., & LaFleur, E. K. (2016). Toward the development of hedonic-utilitarian measures of retail service. *Journal of Retailing and Consumer Services*, 32, 60–66.
- Byun, K. J., & Ahn, S. J. (2023). A systematic review of virtual influencers: Similarities and differences between human and virtual influencers in interactive advertising, journal of interactive advertising, 23:4, 293-306. *Journal of Interactive Advertising*, 23(4), 293–306.
- Cabeza-Ramírez, L. J., Sanchez-Canizares, S. M., Santos-Roldan, L. M., & Fuentes-García, F. J. (2022). Impact of the perceived risk in influencers' product recommendations on their followers' purchase attitudes and intention. *Technological Forecasting and Social Change*, 184.
- Cabitza, F. (2019). Biases affecting human decision making in AI-supported second opinion settings. In *International conference on modeling decisions for artificial intelligence* (pp. 283–294). Springer.
- Cain, M. K., Zhang, Z., & Yuan, K. H. (2016). Univariate and multivariate skewness and kurtosis for measuring nonnormality: Prevalence, influence and estimation. *Behavior Research Methods*, 49(5), 1716–1735.
- Chan, T. K., Cheung, C. M., & Lee, Z. W. (2017). The state of online impulse-buying research: A literature analysis. *Information & Management*, 54(2), 204–217.
- Chang, C. M. (2018). Understanding social networking sites continuance. *Online Information Review*, 42(6), 989–1006.
- Chang, C. M., Yen, C. H., Chou, S. Y., & Lo, W. W. (2023). What motivates viewers to purchase recommended products in live streaming? The moderating role of extroversion–Introversion personality. *Asia Pacific Journal of Marketing and Logistics*, 35(12), 2983–3007.
- Chang, S., Chih, W. H., Liou, D. K., & Yang, Y. (2016). The mediation of cognitive attitude for online shopping. *Information Technology & People*, 29(3).
- Chebat, J., & Michon, R. (2003). Impact of ambient odors on mall shoppers' emotions, cognition and spending: A test of competitive causal theories. *Journal of Business Research*, 56(7), 529–539.
- Chen, C. (2024). YouTube influencer marketing through parasocial interaction: A dyadic perspective. *Journal of Research in Interactive Marketing*, 19(3), 460–481.
- Chen, S., Tian, Y., & Pei, S. (2024). Technological use from the perspective of cultural heritage environment: Augmented reality technology and formation mechanism of heritage-responsibility behaviors of tourists. *Sustainability*, 16(18).
- Chen, Y., & Wyer, S. (2020). The effects of endorsers' facial expressions on status perceptions and purchase intentions. *International Journal of Research in Marketing*, 37(2), 371–385.
- Cheng, L. K., & Huang, H. L. (2022). Virtual tourism atmospheres: The effects of pleasure, arousal, and dominance on the acceptance of virtual tourism. *Journal of Hospitality and Tourism Management*, 53, 143–152. <https://doi.org/10.1016/j.jhtm.2022.10.002>
- Chi, T. (2018). Mobile commerce website success: Antecedents of consumer satisfaction and purchase intention. *Journal of Internet Commerce*, 17(3), 189–215.
- Chi, T., & Chen, Y. (2020). A study of lifestyle fashion retailing in China. *Marketing Intelligence & Planning*, 38(1), 46–60.
- Chin, C., Cham, T. H., Ling, J. P., B. C. J., & Chan, W. C. (2025). Exploring the interplay of enjoyment and practicality's dimensions: Youths' purchase intention in augmented reality shopping platforms. *Young Consumers*, 26(2), 270–295.
- Chniti, N. A., & Bouslama, N. (2015). Effects of perceived interactivity on commercial web sites' experiential value. *International Journal of Innovation and Scientific Research*, 16(2), 514–525.
- Cialdini, R. B. (2001). *Influence: Science and practice* (4th ed.). Allyn & Bacon.
- Connell, A. (2024). 82 Latest influencer marketing statistics for 2024. Retrieved from <https://adamconnell.me/influencer-marketing-statistics/>.
- Creswell, J. W., & Creswell, J. D. (2022). *Research design qualitative, quantitative, and mixed methods approaches* (six ed.). SAGE Publications, Inc.
- Cyr, D., Head, M., & Ivanov, A. (2006). Design aesthetics leading to m-loyalty in mobile commerce. *Information & Management*, 43(8), 950–963.
- Dabholkar, P. A., van Dolen, W. M., & Ruyter, K. (2009). A dual-sequence framework for B2C relationship formation: Moderating effects of employee communication style in online group chat. *Psychology and Marketing*, 26(2), 145–174.
- Dabiran, E., Farivar, S., Wang, F., & Grant, G. (2024). Virtually human: Anthropomorphism in virtual influencer marketing. *Journal of Retailing and Consumer Services*, 79.
- Dang, Q., & Li, G. (2025). *Unveiling trust in AI: The interplay of antecedents, consequences, and cultural dynamics*. AI & Society.
- Davlembayeva, D., Chari, S., & Papagiannidis, S. (2025). Virtual influencers in consumer behaviour: A social influence theory perspective. *British Journal of Management*, 36, 202–222.
- Deng, Y., Shen, H., & Ji, X. (2024). Exploring virtual fashion consumption through the emotional three-level theory: Reflections on sustainable consumer behavior. *Sustainability*, 16(13).
- Do, H., Shih, W., & Ha, Q. (2020). Effects of mobile augmented reality apps on impulse buying behavior: An investigation in the tourism field. *Heliyon*, 6.
- Dong, Y. (2023). Exploring the marketing strategies of live web-based shopping based on TikTok live streaming platform. *Academic Journal of Management and Social Sciences*, 3(3), 149–152.
- Donovan, R., & Rossiter, J. (1982). Store atmosphere: An environmental psychology approach. *Journal of Retailing*, 58, 34–57.
- Evans, N. J., Phua, J., Lim, J., & Jun, H. (2017). Disclosing Instagram influencer advertising: The effects of disclosure language on advertising recognition, attitudes, and behavioral intent. *Journal of Interactive Marketing*, 17(2), 138–149.
- Fan, X., Jiang, X., & Deng, N. (2022). Immersive technology: A meta-analysis of augmented/virtual reality applications and their impact on tourism experience. *Tourism Management*, 91.
- Fitriani, W. R., Mulyono, A. B., Hidayanto, A. N., & Munajat, Q. (2020). Reviewer's communication style in youtube product-review videos: Does it affect channel loyalty? *Heliyon*, 6(9).
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50.
- Gan, C., & Wang, W. (2017). The influence of perceived value on purchase intention in social commerce context. *Internet Research*, 27(4), 772–785.
- Goel, P., Parayitam, S., Sharma, A., Rana, N. P., & Dwivedi, Y. K. (2022). A moderated mediation model for e-impulse buying tendency, customer satisfaction and intention to continue e-shopping. *Journal of Business Research*, 142, 1–16.
- Gonzales, A. L., Finley, T., & Duncan, S. P. (2009). Perceived interactivity: Does interactivity increase enjoyment and creative identity in artistic spaces?. In *Proceedings of CHI 2009* (pp. 415–418). Boston, MA.
- Gu, C., & Duan, Q. (2024). Exploring the dynamics of consumer engagement in social media influencer marketing: From the self-determination theory perspective. *Humanities and Social Sciences Communications*, 11(587).
- Ha Le, T., & Ngoc, B. M. (2024). Consumption-related social media peer communication and online shopping intention among gen Z consumers: A moderated-serial mediation model. *Computers in Human Behavior*, 153.
- Hair, J., Risher, J., Sarstedt, M., & Ringle, C. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24.
- Hair, J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). SAGE Publications.
- Ham, J., Li, S., Looi, J., & Eastin, M. S. (2024). Virtual humans as social actors: Investigating user perceptions of virtual humans' emotional expression on social media. *Computers in Human Behavior*, 155.
- Hameed, I., Zainab, B., Akram, M., Ying, W. J., Xing, C. C., & Khan, K. (2025). Decoding willingness to buy in live-streaming retail: The application of stimulus organism response model using PLS-SEM and SEM-ANN. *Journal of Retailing and Consumer Services*, 84.
- Han, S., Yoon, J., & Kwon, J. (2021). Impact of experiential value of augmented reality: The context of heritage tourism. *Sustainability*, 13.
- HARIBO. (2025). HARIBO international: No. 1 in fruit gummies worldwide. Retrieved from HARIBO <https://www.haribo.com/en>.
- Henseler, J., Hubona, G., & Ray, P. (2015). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management & Data Systems*, 116(1).
- Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. Thousand Oaks, CA: Sage.
- Hossain, M. A. (2019). Security perception in the adoption of mobile payment and the moderating effect of gender. *PSU Research Review*, 3(3), 179–190.
- Hsieh, S. H., Lee, C. T., & Tseng, T. H. (2021). Branded app atmospherics: Examining the effect of pleasure–arousal–dominance in brand relationship building. *Journal of Retailing and Consumer Services*, 60.
- Huang, J., Yang, S., & Chang, S. (2025). Impact of customer perceptions of virtual influencers on value co-creation in streaming platforms. In *7th international conference on knowledge innovation and invention* (p. 89). Nagoya, Japan.
- Hubert, M., Blut, M., Brock, C., Backhaus, C., & Eberhardt, T. (2017). Acceptance of smartphone-based mobile shopping: Mobile benefits, customer characteristics, perceived risks, and the impact of application context. *Psychology & Marketing*, 34(2), 175–194.
- Ibáñez-Sánchez, S., Orús, C., & Flavián, C. (2022). Augmented reality filters on social media. Analyzing the drivers of playability based on uses and gratifications theory. *Psychology & Marketing*, 39, 559–578.
- IMM, I. O. (2024). *15 marketing trends to look out for in Malaysia 2025*. Institute of Marketing Malaysia. Retrieved from <https://imm.org.my/assets/publication/file/15%20MARKETING%20TRENDS%20TO%20LOOK%20OUT%20FOR%20IN%20MALAYSIA%202025.pdf>.
- Imma, G. (2019). Instagram post. Retrieved October 28, 2024, from Instagram: [https://www.instagram.com/imma.gram/p/Bv0XB3d84H/?img\\_index=3](https://www.instagram.com/imma.gram/p/Bv0XB3d84H/?img_index=3).
- Inan, D., Hidayanto, A. Z., Juita, R., Maulana, A., Putri, D. M., Farhan, M. F., ... Sanglise, M. (2023). The follower-influencer experience affecting the intention to follow recommendation: PAD perspective. In *2022 Seventh international conference on informatics and computing (ICIC)*. Denpasar, Bali, Indonesia.
- Interbrand. (2025). Best global brands top 100 2024. Retrieved from Interbrand: <https://interbrand.com/best-global-brands/>.
- Jan, G. (2025). Country comparison bar charts. Retrieved from Geert Hofstede: <https://geerthofstede.com/country-comparison-bar-charts/>.
- Javornik, A. (2016). It's an illusion, but it looks real! Consumer affective, cognitive and behavioural responses to augmented reality applications. *Journal of Marketing Management*, 32(9–10), 987–1011.
- Jo, H., & Park, D. (2024). A multi-faceted examination of social robots. *IEEE Access*, 107459–107475.
- Jun, S., & Yi, J. (2020). What makes followers loyal? The role of influencer interactivity in building influencer brand equity. *Journal of Product and Brand Management*, 29(6), 803–814.
- Kemeny, I., Simon, J., Nagy, A., & Szucs, K. (2016). Measuring quality perception in electronic commerce: A possible segmentation in the Hungarian market. *Industrial Management & Data Systems*, 116(9), 1946–1966.

- Khan, A., Khan, Z., & Nabi, M. K. (2024). "I think exactly the same"—Trust in SMI and online purchase intention: A moderation mediation analysis using PLS-SEM. *Journal of Advances in Management Research*, 21(2), 311–330.
- Ki, C. W., Park, S., & Kim, Y. K. (2022). Investigating the mechanism through which consumers are 'inspired by' social media influencers and 'inspired to' adopt influencers' exemplars as social defaults. *Journal of Business Research*, 144, 264–277.
- Kim, D., & Ko, Y. J. (2019). The impact of virtual reality (VR) technology on sport spectators' flow experience and satisfaction. *Computers in Human Behavior*, 93, 346–356.
- Kim, E., Shoenberger, H., & Sun, Y. (2021). *Living in a material world: Sponsored Instagram posts and the role of materialism, hedonic enjoyment, perceived trust, and need to belong* (pp. 1–11). *Social Media + Society*.
- Kim, H. C., & Kramer, T. (2015). Do materialists prefer the "brand-as-servant"? The interactive effect of anthropomorphized brand roles and materialism on consumer responses. *Journal of Consumer Research*, 42(2), 284–299.
- Kim, I., Ki, C. C., Lee, A. H., & Kim, Y. (2024a). Virtual influencer marketing: Evaluating the influence of virtual influencers' form realism and behavioral realism on consumer ambivalence and marketing performance. *Journal of Business Research*, 176.
- Kim, J., & Lennon, S. J. (2012). Effects of reputation and website quality on online consumers' emotion, perceived risk and purchase intention. *Journal of Research in Interactive Marketing*, 7(1), 33–56.
- Kim, J. Y., Ko, S. H., & Choi, Y. (2024b). Unveiling the power of social influencers in brand trust and brand identification. *South African Journal of Business Management*, 55(1).
- Kim, M., & Baek, T. H. (2022). I'll follow the fun: The extended investment model of social media influencers. *Telematics and Informatics*, 74.
- Kim, Y., & Sundar, S. S. (2012). Anthropomorphism of computers: Is it mindful or mindless? *Computers in Human Behavior*, 28(1), 241–250.
- Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration*, 11(4), 1–10.
- Kong, H., & Fang, H. (2024). Research on the effectiveness of virtual endorsers: A study based on the match-up hypothesis and source credibility model. *Sustainability*, 16(5).
- Konuk, F. A. (2019). Consumers' willingness to buy and willingness to pay for fair trade food: The influence of consciousness for fair consumption, environmental concern, trust and innovativeness. *Food Research International*, 120, 141–147.
- Kumar, A., & Shankar, A. (2024). Investigating the role of metaverse influencers' attributes for the next generation of services. *Journal of Services Marketing*, 38(7), 816–838.
- Kumar, P., Mokha, A. K., & Pattnaik, S. C. (2022). Electronic customer relationship management (E-CRM), customer experience and customer satisfaction: Evidence from the banking industry. *Benchmarking: An International Journal*, 29(2), 551–572.
- Kusumasondjaja, S., & Tjiptono, F. (2019). Endorsement and visual complexity in food advertising on Instagram. *Internet Research*, 29(4), 659–687.
- Ladhari, R., Massa, E., & Skandrani, H. (2020). YouTube vloggers' popularity and influence: The roles of homophily, emotional attachment, and expertise. *Journal of Retailing and Consumer Services*, 54(5), 1–11. *Journal of Retailing and Consumer Services*, 54(5), 1–11.
- Laszkiewicz, A., & Kalinska-Kula, M. (2023). Virtual influencers as an emerging marketing theory: A systematic literature review. *International Journal of Consumer Studies*, 47(6), 2479–2494.
- Lee, J. A., Jeong, M., & Jeon, M. M. (2016). Effects of experiential stimuli on customers responses an example of bed and breakfast websites. *Journal of Hospitality and Tourism Technology*, 7(4), 390–404.
- Lee, W., & Kim, Y. H. (2021). Does VR tourism enhance users' Experience? *Sustainability*, 13.
- Lee, Y. Y., Gan, C. L., & Liew, T. W. (2023). Do E-wallets trigger impulse purchases? An analysis of Malaysian gen-Y and gen-Z consumers. *Journal of Marketing Analytics*, 11, 244–261.
- Li, Y., & Peng, Y. (2021). Influencer marketing: Purchase intention and its antecedents. *Marketing Intelligence & Planning*, 39(7), 960–978.
- Lim, C. H., Martin, T. G., & Kwak, D. H. (2010). Examining television consumers of mixed martial arts: The relationship among risk taking, emotion, attitude, and actual sport-media-consumption behavior. *International Journal of Sport Communication*, 3, 49–63.
- Lim, R. E., & Lee, S. Y. (2023). "You are a virtual influencer!": Understanding the impact of origin disclosure and emotional narratives on parasocial relationships and virtual influencer credibility. *Computers in Human Behavior*, 148. <https://doi.org/10.1016/j.chb.2023.107897>
- Lindell, M. K., & Whitney, D. J. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology*, 86(1), 114–121.
- Ling, S., Zheng, C., Cho, D., Kim, Y., & Dong, Q. (2024). The impact of interpersonal interaction on purchase intention in livestreaming E-commerce: A moderated mediation model. *Behavioral Science*, 14(4).
- Liu, C., Zhang, Y., & Zhang, J. (2020). The impact of self-congruity and virtual interactivity on online celebrity brand equity and fans' purchase intention. *J. Prod. Brand manage.* 29, 783–801. *The Journal of Product and Brand Management*, 29, 783–801.
- Liu, H., Yu, K., & Gong, J. (2025). Bridging the virtual and real: Emotional engagement in virtual influencer endorsements. *Young Consumers*, 26(3), 482–501.
- Lou, C., Kiew, S. T., Chen, T., Lee, T. Y., Ong, J. E., & Phua, Z. (2023). Authentically fake? How consumers respond to the influence of virtual influencers. *Journal of Advertising*, 52(4), 540–557.
- Lou, C., & Yuan, S. (2019). Influencer marketing: How message value and credibility affect consumer Trust of Branded Content on social media. *Journal of Interactive Advertising*, 19(1), 58–73.
- Luo, J. M., Kong, A., Chan, S. H., & Lam, C. F. (2024). Hedonism and opinion leadership influence on consumer behavior in the context of first-class flights from short videos on social media. *Journal of Quality Assurance in Hospitality and Tourism*. <https://www.tandfonline.com/doi/full/10.1080/1528008X.2024.2406028#abstract>.
- Ma, Y. (2023). Effects of interactivity affordance on user stickiness in livestream shopping: Identification and gratification as mediators. *Heliyon*, 9.
- Mai, X. T., Trinh, T. T., & Ryan, C. (2024). Are you hungry for play? Investigating the role of emotional attachment on continuance intention to use food delivery apps. *Journal of Hospitality and Tourism Insights*, 7(5), 2968–2991.
- Matei, M. (2024). Virtual influencer Sam is coming to Unpacked to present the Galaxy S24. Retrieved October 28, 2024, from SamMobile: <https://www.sammobile.com/news/virtual-influencer-sam-coming-to-unpacked-to-present-galaxy-s24/>.
- MCMC. (2023). Internet users survey 2022. Retrieved from Malaysian Communications and Multimedia Commission: <https://www.mcmc.gov.my/skmmgovmy/media/General/IUS-2022.pdf>.
- Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. Cambridge, MA: MIT Press.
- Meng, F., & Wei, J. (2016). What factors of online opinion leader influence consumer purchase intention? *International Journal of Simulation: Systems, Science and Technology*, 16(3).
- Miao, F., Kozlenkova, I. V., Wang, H., Xie, T., & Palmatier, R. W. (2022). An emerging theory of avatar marketing. *Journal of Marketing*, 86(1), 67–90.
- Mouritzen, S. L., Penttinen, V., & Pedersen, S. (2024). Virtual influencer marketing: The good, the bad and the unreal. *European Journal of Marketing*, 58(2), 410–440.
- Muniz, F., Stewart, K., & Magalhães, L. (2024). Are they humans or are they robots? The effect of virtual influencer disclosure on brand trust. *Journal of Consumer Behaviour*, 23(3), 234–1250.
- Na, Y., Kim, Y., & Lee, D. (2024). Investigating the effect of self-congruity on attitudes toward virtual influencers: Mediating the effect of emotional attachment. *International Journal of Human Computer Interaction*, 40(18), 5534–5547.
- Nagano, M., Ijima, Y., & Hiroya, S. (2023). Perceived emotional states mediate willingness to buy from advertising speech. *Frontiers in Psychology*, 13.
- Natarajan, T., Balasubramanian, S. A., & Kasilingam, D. L. (2018a). The moderating role of device type and age of users on the intention to use mobile shopping applications. *Technology in Society*, 53, 79–90.
- Natarajan, T., Balasubramanian, S. A., & Kasilingam, D. L. (2018b). Understanding the intention to use mobile shopping applications and its influence on price sensitivity. *Journal of Retailing and Consumer Services*, 37, 8–22.
- Naveen, L., Khan, M. I., Saleh, M. A., & Subudhi, R. N. (2025). The influence of mobile augmented reality on consumer behavior: Insights into affective, cognitive, and behavioral responses. *Computers in Human Behavior*, 165.
- Nikhashemi, S. R., Knight, H. H., Nusair, K., & Liat, C. B. (2021). Augmented reality in smart retailing: A (n) (a) symmetric approach to continuous intention to use retail brands' mobile AR apps. *Journal of Retailing and Consumer Services*, 60.
- Njeguś, A., Živković, R., & Ilijevski, L. (2016). The effects of hotel website stimuli on customer's cognition, emotion and intention: Based on extended SOR model. In *International scientific conference on ICT and E-business related research* (pp. 492–496).
- Peng, L. F., Hassan, Z., & Basit, A. (2018). Store attributes: A sustainable strategy to influence customer satisfaction and purchase intention. *Indonesian Journal of Management and Business Economics*, 1(1), 19–41.
- Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology*, 19(1), 124–205.
- Pires, G., Stanton, J., & Eckford, A. (2004). Influences on the perceived risk of purchasing online. *Journal of Consumer Behaviour*, 4(2), 118–131.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *The Journal of Applied Psychology*, 88(5).
- Purwandari, B., Ramadhan, A., KongkHidayanto, N., Husniyyah, A. F., Faozi, F. H., Wijaya, N. H., & Saputra, R. H. (2022). The effect of interaction between followers and influencers on intention to follow travel recommendations from influencers in Indonesia based on follower-influencer experience and emotional dimension. *Information*, 13(384), 1–21.
- Qalati, S. A., Vela, E. G., Li, W., Dakhan, S. A., Thuy, T. T., & Merani, S. H. (2021). Effects of perceived service quality, website quality, and reputation on purchase intention: The mediating and moderating roles of trust and perceived risk in online shopping. *Cogent Business & Management*, 8.
- Qin, H., Harun, A. D., Mamun, M. R., Peak, D., & Prybutok, V. (2024). Assessing user benefits and privacy concerns in utilitarian and hedonic mobile augmented reality apps. *Industrial Management & Data Systems*, 124(1), 442–482.
- Rauschnabel, P. A. (2018). Virtually enhancing the real world with holograms: An exploration of expected gratifications of using augmented reality smart glasses. *Psychology & Marketing*, 35(8), 557–572.
- Rouibah, K., Lowry, P. B., & Hwang, Y. (2016). The effects of perceived enjoyment and perceived risks on trust formation and intentions to use online payment systems: New perspectives from an Arab country. *Electronic Commerce Research and Applications*, 19, 33–43.
- Ryu, S., & Ryu, S. (2021). *Feeling excited and fluent: How consumers respond to the visual appeals of products in an online shopping environment*. Information Technology.
- Sands, S., Ferraro, C., Demsar, V., & Chandler, G. (2022). False idols: Unpacking the opportunities and challenges of falsity in the context of virtual influencers. *Business Horizons*, 65, 777–788.
- Shamim, K., & Islam, T. (2022). Digital influencer marketing: How message credibility and media credibility affect trust and impulsive buying. *Journal of Global Scholars of Marketing Science*, 32(4), 601–626.

- Shang, Q., Ma, H., Wang, C., & Gao, L. (2023). Effects of background fitting of e-commerce live streaming on consumers' purchase intentions: A cognitive-affective perspective. *Psychology Research and Behavior Management*, 16, 149–168.
- Shao, Z. (2024). From human to virtual: Unmasking consumer switching intentions to virtual influencers by an integrated fsQCA and NCA method. *Journal of Retailing and Consumer Services*, 78.
- Sharma, T. G., Hamari, J., Kesharwani, A., & Tak, P. (2020). Understanding continuance intention to play online games: Roles of self-expressiveness, self-congruity, self-efficacy, and perceived risk. *Behaviour & Information Technology*, 41(2), 348–364.
- Shiu, J. Y., Liao, S. T., & Tzeng, S. Y. (2023). How does online streaming reform e-commerce? An empirical assessment of immersive experience and social interaction in China. *Humanities and Social Sciences Communications*, 10(224).
- Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. *European Journal of Marketing*, 53(11), 2322–2347.
- Song, M., Hong, Z., Wang, Y., & Duan, Y. (2024). Friend or assistant? Matching effects between virtual influencer role types and well-being patterns based on construal level theory. *Journal of Vacation Marketing*. <https://journals.sagepub.com/doi/abs/10.1177/13567667241286528>.
- Stein, J., Breves, P. L., & Anders, N. (2024). Parasocial interactions with real and virtual influencers: The role of perceived similarity and human-likeness. *New Media & Society*, 26(6), 3433–3453.
- Tamilmani, K., Rana, N. P., Prakasam, N., & Dwivedi, Y. K. (2019). The battle of Brain vs. Heart: A literature review and meta-analysis of “hedonic motivation” use in UTAUT2. *International Journal of Information Management*, 46, 222–235.
- Thomas, V. L., & Fowler, K. (2021). Close encounters of the AI kind: Use of AI influencers as brand endorsers. *Journal of Advertising*, 50(1), 11–25.
- Tian, X., Fan, H., & Zhao, Z. (2023). Research on consumers' purchase intention of Taobao live E-commerce platform. In *8th international conference on industrial and business engineering* (pp. 1–10). Association for Computing Machinery.
- Tong, X., Chen, Y., Zhou, S., & Yang, S. (2022). How background visual complexity influences purchase intention in live streaming: The mediating role of emotion and the moderating role of gender. *Journal of Retailing and Consumer Services*, 67.
- Tussyadiah, I. P., Wang, D., Jung, T. H., & Tom Dieck, M. (2018). Virtual reality, presence, and attitude change: empirical evidence from tourism. *Tourism Management, Tourism Management*, 66, 140–154.
- Um, N. (2023). Predictors affecting effects of virtual influencer advertising among college students. *Sustainability*, 15(8). <https://doi.org/10.3390/su15086388>
- Utami, A., Ekaputra, I. A., Japutra, A., & Van Doorn, S. (2022). The role of interactivity on customer engagement in mobile e-commerce applications. *International Journal of Market Research*, 64(2), 269–291.
- Wang, T., & Tian, M. (2023). Exploring consumer perceived risk and purchase intention of water-saving appliances: A moderated dual-mediation model. *Frontiers in Psychology*, 13, 1–15.
- Xiang, L., Zheng, X., Lee, M. K., & Zhao, D. (2016). Exploring consumers' impulse buying behavior on social commerce platform: The role of parasocial interaction. *International Journal of Information Management*, 36, 333–347.
- Xu, H., Li, X., Lovett, J. C., & Cheung, L. T. (2025). ChatGPT for travel-related services: A pleasure–arousal–dominance perspective. *Tourism Review*. <https://doi.org/10.1108/TR-07-2024-0570>
- Yan, J., Xia, S., Jiang, A., & Lin, Z. (2024). The effect of different types of virtual influencers on consumers' emotional attachment. *Journal of Business Research*, 177.
- Yang, F., Tang, J., Men, J., & Zheng, X. (2021). Consumer perceived value and impulse buying behavior on mobile commerce: The moderating effect of social influence. *Journal of Retailing and Consumer Services*, 63.
- Yang, H. P., Fan, W. S., & Tsai, M. C. (2024). Applying stimulus–organism–response theory to explore the effects of augmented reality on consumer purchase intention for teenage fashion hair dyes. *Sustainability*, 16(6).
- Yang, J., Chunterawong, P., Lee, H., Tian, Y., & Chock, T. M. (2023). Human versus virtual influencer: The effect of humanness and interactivity on persuasive CSR messaging. *Journal of Interactive Advertising*, 23(3), 275–292.
- Yang, K., Kim, H. M., & Zimmerman, J. (2020). Emotional branding on fashion brand websites: Harnessing the pleasure-arousal-dominance (P-A-D) model. *Journal of Fashion Marketing and Management*, 24(4), 555–570.
- Yang, L., & Shi, S. (2025). Sustaining front-seat passenger engagement: User experience and perceived interactivity of in-vehicle information systems. 13 pp. 47763–47775. IEEE.
- Yang, S., Isa, S. M., Wu, H., Thurasamy, R., Fang, X., Fan, Y., & Liu, D. (2022). Effects of stores' environmental components on Chinese consumers' emotions and intentions to purchase luxury brands: Integrating partial least squares-structural equation modeling and fuzzy-set qualitative comparative analysis approaches. *Frontiers in Psychology*, 13.
- Yang, X. (2024). Mobile learning application characteristics and learners' continuance intentions: The role of flow experience. *Education and Information Technologies*, 29, 2259–2275.
- Yap, Y., Tan, S., Tan, S., & Choon, S. (2023). Online grocery shopping intention: Elderly's perspective in Malaysia. *Heliyon*, 9.
- Yap, Y. R., & Ismail, N. (2022). Factors of virtual influencer marketing influencing generation Y consumers' purchase intention in Malaysia. *International Journal of Internet Marketing and Advertising*, 17(3/4), 437–458.
- Yu, J., Dickinger, A., So, K. K., & Egger, R. (2024a). Artificial intelligence-generated virtual influencer: Examining the effects of emotional display on user engagement. *Journal of Retailing and Consumer Services*, 76.
- Yu, S., Zhong, Z., Zhu, Y., & Sun, J. (2024b). Green emotion: Incorporating emotional perception in green marketing to increase green furniture purchase intentions. *Sustainability*, 16(12).
- Yu, X., Yang, Y., & Li, S. (2024d). Users' continuance intention towards an AI painting application: An extended expectation confirmation model. *PLoS One*, 19(5), 1–25.
- Yu, Y., Ahn, J., Kim, D., & Park, K. (2024c). Like it, buy it? Examining the role of bookmarking in the mediation of visual appeal and purchase intent from a dual-system perspective. *Industrial Management & Data Systems*, 124(5), 1877–1901.
- Yusoff, S. M., Marzaini, A. F., Hao, L., Zainuddin, Z., & Basal, M. H. (2025). Understanding the role of AI in Malaysian higher education curricula: An analysis of student perceptions. *Discover Computing*, 28.
- Zafar, A. U., Shahzad, M., Ashfaq, M., & Shahzad, K. (2023). Forecasting impulsive consumers driven by macro-influencers posts: Intervention of followers' flow state and perceived informativeness. *Technological Forecasting and Social Change*, 190.
- Zhang, W., Zhang, W., & Daim, T. U. (2023). Investigating consumer purchase intention in online social media marketing: A case study of Tiktok. *Technology in Society*, 74.
- Zhang, X., Shi, Y., Li, T., Guan, Y., & Cui, X. (2024). How Do virtual AI streamers influence viewers' livestream shopping behavior? The effects of persuasive factors and the mediating role of arousal. *Information Systems Frontiers*, 26, 1803–1834.
- Zhao, L., & Lu, Y. (2012). Enhancing perceived interactivity through network externalities: An empirical study on micro-blogging service satisfaction and continuance intention. *Decision Support Systems*, 53(4), 825–834.
- Zhao, Y., & Bacao, F. (2021). How does gender moderate customer intention of shopping via live-streaming apps during the covid-19 pandemic lockdown period? *International Journal of Environmental Research and Public Health*, 18(24).
- Zheng, X., Men, J., Yang, F., & Gong, X. (2019). Understanding impulse buying in mobile commerce: An investigation into hedonic and utilitarian browsing. *International Journal of Information Management*, 48, 151–160.
- Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking*. Cambridge, UK: Cambridge University Press.