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How Visual and Mental Human-Likeness of Virtual Influencers Affects Customer–Brand Relationship on E-Commerce Platform

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Abstract

Virtual influencers (VIs) on e-commerce platforms are becoming increasingly popular, enhancing the consumer experience. This study examines the consumer–brand relationship (CBR) with VIs through the perspective of social presence. Data from 1041 e-commerce platform users (e.g., Douyin, RED, Weibo) were collected and analyzed using Structural Equation Modeling (SEM). The findings reveal that both the visual and mental human-likeness of VIs significantly strengthen CBR, with social presence acting as a mediator. Additionally, the interaction between visual and mental human-likeness positively impacts social presence, which in turn enhances CBR. Moreover, consumers' need for uniqueness moderates the relationship between social presence and CBR, providing valuable insights for virtual influencer strategies in e-commerce. This research suggests the feasibility of leveraging VI design both visually and mentally to capture new trends in developing effective virtual campaigns with digitization and metaverse technologies. This study extends the stream of research VIs use for interactive marketing, highlighting the role of parasocial relationships in interactive marketing. These findings can provide managers with a better understanding of VI design from both visual and mental aspects.

Keywords: e-commerce platform; virtual influencer; human-likeness; consumer–brand relationship; social presence



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1. Introduction

Social media influencers such as YouTubers and bloggers gain popularity with their social media content and add value to consumer–brand relationships with interactive marketing [1]. The market size of the Influencer Marketing Industry was estimated at nearly USD 21.1 billion in 2023 [2]. AI-driven influencers become increasingly popular in practice, attracting brand fans from traditional brand communities [3] and a host of Generative AI-powered technologies that enable the emergence of virtual influencers (VIs) to continue.

Current research on AI applications has focused on their anthropomorphism or intelligence [4,5] by drawing from uncanny valley theory [6,7]. Whilst uncanny valley theory has a direct bearing on the discomfort feelings caused by excessive human-like appearances [8] or minds [9,10], successful marketing in online settings results in effective interaction between consumers and the focal brand. However, few studies on VIs have investigated how

the influencer as a brand ambassador relates to consumers and how consumers perceive the environment of consumer–brand interaction as friendly and intimate.

This study aims to investigate consumer–brand relationships in the context of VIs on e-commerce platforms with a social presence perspective. We make three contributions to interactive marketing literature. First, we seek to explain how VIs can build consumer–brand relationships with a new perspective of social presence. Second, we make a case that need for uniqueness negatively moderate the relationship between the social presence of the VIs and consumer–brand relationship. Third, this study examines both visual and mental human-likeness of VIs in different social media platforms, given that the literature has scarcely examined the mental conditions.

2. Literature Review

With the growing prominence of artificial intelligence (AI) technology, marketers have been considering how to exploit the effects of traditional social media influencers in the AI context, which explains the proliferating usage of Vis [11]. VIs have been widely applied to different kinds of industries, including luxury brands, food, cars and sports [12,13]. Inspired by the prosperous development of VIs, scholars also recognize its importance in marketing research.

Current studies on VIs can be roughly divided into two categories: the antecedents and outcomes of VI adoption [11]. Therefore, the latter is critical to types of VIs that help us to obtain a clear scope of this topic. Arsenyan and Mirowska (2021) compared two types of VIs (human- and anime-like) with humans [14]. Meanwhile, Sands et al. (2022) focused on social media influencers created with AI and compared the effects of human influencers in terms of outlooks [3]. Considering that anthropomorphism is one of the essential factors in AI technology adoption [15], a key construct worth exploring is the appearance of Vis [16,17]. However, thus far, very little research addresses human-likeness factors [18].

2.1. Influencer Endorsement

Endorsement serves as a key advertising mechanism by leveraging influential figures to distribute brand information and transfer their desirability to the brand [19,20]. Endorsement has been widely adopted by brand managers as a useful way of advertising, as valuable information can be efficiently distributed by well-connected endorsers [19]. In other words, consumers will regard an endorser as a representative of the brand and transfer the desirability of the endorser to the brand. Thus, managers endeavor to entice consumers to buy endorsed brands and products [20].

Social media influencers represent a distinct type of endorser, characterized by high audience engagement and perceived authenticity, fostering native advertising and trust [16,21]. An influencer is a kind of endorser and is more effective in the word-of-mouth (WOM) phenomenon compared with celebrities [21,22]. As influencers own a group of fans and keep sharing their daily life with their fans, they exploit social media to engage their audience, which becomes a salient characteristic of popular influencers [16]. For instance, influencers on social media are similar to attractive friends around us because their colorful life seems close to ours. This situation enables native advertising, which means influencers discreetly advocate brands or recommend products [23]. They earn by posting their opinions towards popular targets on social media without signaling advertisement [3]. Accordingly, they earn money through ad rates paid by companies and attract other followers because they seem so close to us that they could be our friends who might be less likely to cheat on us [24]. Therefore, influencers are often valued by both companies and consumers, thereby

building a bridge between these two essential parts of business and promoting a better consumer–brand relationship.

Marketers increasingly favor influencers over traditional celebrities due to their relatability, perceived credibility, and less invasive marketing approach [22]. Conventionally, famous artists, super idols and sports stars are commonly invited to advocate brands and products [25]. However, the prevalence of social media highlights the need to determine why marketers are turning to social media influencers, including vloggers and ‘Instafamous’ personalities [26]. These ‘micro-celebrities’ are slowly replacing traditional advertisement and celebrity endorsement. Previous studies have shown the worthiness of using influencer endorsers over celebrity endorsers, because influencers are not only similar to ordinary people but also satisfy their desired identification [22,27]. Given that influencers focus more on how to build up fan foundations on social media rather than delving into professional areas as celebrities do, they have to set up trendy images by proactively sharing ideas or recommending something elegant to be a ‘fashion blogger’ or a ‘fit girl’ [28]. As they cultivate specific images and constant exposure in front of an audience, it seems that they are not only close to the audience but are also credible [29]. In this way, consumer trust lowers their defense mechanism; thus, product recommendation from influencers is not as invasive as traditional advertisement [30,31].

The effectiveness of influencer marketing stems from influencers acting as online opinion leaders who shape consumer attitudes and decisions through indirect, socially driven mechanisms [32]. Influencers on social media benefit from this powerful platform to reach followers with convenience and effectiveness [33]. Social media platforms such as YouTube, Facebook and Twitter have assisted brands such as Coke, Dove, GoPro, McDonald’s, Samsung Mobile, Nike Football, Oreo, KFC, PlayStation, Converse and Red Bull in effectively marketing their products [34]. However, considering that everyone knows social media is meritorious, the problem narrows down to how brands and products with social media can be efficiently targeted [35]. Based on the diffusion of innovation theory, social media influencers act as online opinion leaders to affect consumers’ attitude indirectly and further alter their purchase decision making [36]. Existing research has demonstrated that influencers shape consumer attitudes through multiple indirect mechanisms. Influencers serve as aspirational reference groups, affecting purchase decisions by shaping followers’ ideal self-concepts and lifestyle aspirations [37]. Through subtle narrative storytelling and lifestyle content, influencers create unconscious emotional brand associations that enhance purchase intentions, even without explicit product recommendations [38]. This indirect influence occurs through social proof and informational social influence rather than direct persuasion attempts [39]. Thus, advertising using social media influencers will have profound benefits.

2.2. Development and Application of Virtual Influencers

Gaines (2019) proposes a term ‘hyperconnectivity revolution’ to illustrate the rise of a new era thanks to the prosperity of information technology and artificial intelligence [40]. Humans are strongly connected not only to each other but also connected to virtual intellectual properties (IPs) [14]. Accordingly, social media acts as an ideal platform for the public to gain more information regarding Vis [21]. Considering that the advancement in AI technology has enabled influencers to present with vividness, this phenomenon allows influencers to interact with audiences on social media. A VI refers to an artificial identity with sizeable social followers who is regarded as a trustworthy tastemaker [16]. As VIs are born with Internet-based features, they better align with the advantages of the online spreading of information, which leads to higher electronic Word of Mouth (eWOM) [41]. Recent research has increasingly focused on the psychological mechanisms underlying

AI-driven influencer marketing. Sands et al. [3] have shown that consumers' psychological responses to VIs differ from their reactions to human influencers, particularly in terms of perceived authenticity and trustworthiness. Gerlich [42] also proves that VIs are perceived trustworthy and credible by consumers. While VIs can create strong emotional connections with consumers through consistent personality portrayal and regular engagement, they also trigger unique cognitive processing patterns related to the awareness of their artificial nature [18]. This dual-processing phenomenon has been found to influence not only immediate purchasing decisions but also long-term brand perceptions and loyalty [43]. Research suggests that consumers who are more technologically savvy tend to develop stronger parasocial relationships with VIs, possibly due to their better understanding and appreciation of the technology behind these AI-driven entities [18]. Moreover, the psychological impact of VIs appears to be particularly strong among younger generations who have grown up with advanced digital technologies [44]. Whereas traditional influencers are mostly human opinion leaders, the distinction blurs between human influencers and VIs, because AI technology has enhanced both the visual and mental similarities of these two types of influencers [3]. However, VIs largely appeal to enterprises and brands due to their relative success. Companies are willing to shoulder the price although adopting a virtual influencer remains costly, because this type of advertising attracts extra attention and can avoid unexpected scandals that negatively affect brands [11].

As academic research has been increasingly focusing on VIs, a few antecedents have been investigated, including visual analysis, comparison with human beings [3,11] and intelligence levels [16]. As for the consequence of VI adoption, trust attitude, brand transgression effect and similar notions have also been illustrated. One of the significant ways in which VIs can succeed in appealing to humans is their ability to manifest humanness with artificial experience as social actors [45]. This scenario is possible owing to the following expected outcome: as social media provides an opportunity for information receivers (generally the public or consumers) to express their voice, it actualizes bidirectional communication and thus shifts from the 'top-down' mode to a 'bottom-up' one [45,46]. In this regard, consumers' awareness of self-expression and self-likeness is triggered and their needs are met by influencers who adopt a distinctive persona [33]. However, little is known about how human-likeness of VIs will affect consumers' perception and its consequence on human social behavior as well as consumer-brand relationships. To this end, this research aims to identify the following key outcomes: consumer-brand relationships based on existing literature from human-robot interactions and technology mediation.

3. Theory

The application of anthropomorphism on social media has long caught scholarly attention [47,48]. The comparison between VIs and real humans can be conceptualized as human-likeness, which has been divided into visual and mental categories [18]. Considering that visual-likeness represents the outer look, whereas mental-likeness stands for the inner connection, these two aspects have effects on consumers through separate mechanisms and likely mismatch each other. This potential mismatch resonates with the uncanny valley theory [6,7], which posits that agents exhibiting almost identical human traits cause unease. Visual-mental incongruity in VIs may thus heighten eeriness, attenuating social presence. As VIs' appearance is usually generated by AI, this feature leads to a problem regarding to what extent should they mimic human beings or be like real people [14]. VIs' mindset is also controlled by AI, which enables them to show their thinking similar to humans. Previous research typically reveals these two properties exclusively. However, VIs' display not only of their outlooks but also their intelligent-generated contents necessitates the identification of both visual- and mental-likeness to enhance the understanding of

human-likeness. As VIs are salient with their artificial appearance, which spontaneously triggers consumers to relate them to real humans, discovering the effects of human-likeness can contribute to both theories and marketing application of VIs.

Social presence was first denoted by Short et al. (1976) as depicting the subjective feeling of being in the company of a ‘genuine’ individual and being able to comprehend their sentiments and reflections [49]. Therefore, enhancing social presence is among the key objectives of network communication systems [50]. The sense of social presence influences consumer perception through visual cues such as facial expressions, gestures, and physical appearance [51]. Through this significant factor in advertising, both scholars and practitioners focus on its antecedents and consequences, including visual representation and stereoscopy, which relate to both outer and inner cues, respectively [52]. Similarly, social presence in our framework is expected to be a key outcome of both visual and mental human-likeness and an important trigger of a positive consumer–brand relationship. Figure 1 shows the conceptual framework.

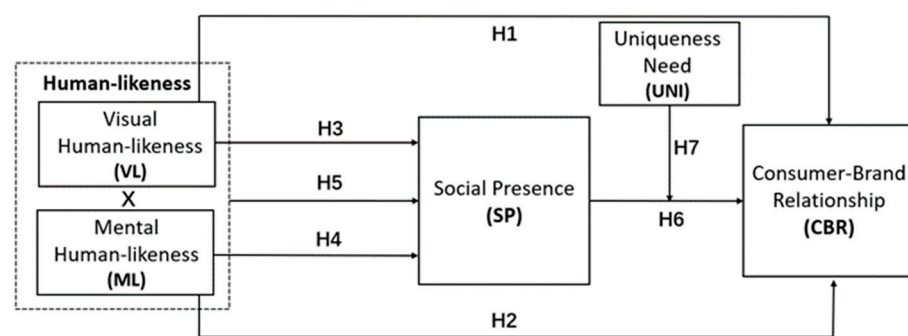


Figure 1. Conceptual framework.

3.1. Consumer–Brand Relationship

Consumers are likely to consider brands to be active partners in their relationships because some brands display human characteristics [53]. As the metaphor that regards a brand as a person suggests a brand has its own personality, consumers can predictably build up relationship with brands [54]. Human-likeness of brands triggers consumers’ perception of personalization and tends to interact with brands imitating their interpersonal relationship. The literature focuses on the effect of brand anthropomorphism on consumer–brand relationships [55], but little attention has been paid to influencers of brands regarding the anthropomorphism phenomenon [56]. As spokesmen play important roles in brand advertising, a need arises to investigate the impact of anthropomorphized influencers on consumer–brand relationships [57]. Parasocial relationship theory further explains this dynamic: consumers project interpersonal bonds onto VIs, perceiving them as authentic social actors [18]. These one-sided relationships transfer affinity to associated brands. However, although influencer anthropomorphism strategies’ impact on consumers’ perceptions of brands as relationship partners has been widely acknowledged, a lack of empirical research persists on the underlying mechanisms. According to social psychology research, consumers tend to consider representatives as parts of brands, which leads to the same conception of influencers as the brands they stand for [58]. In this regard, many brands have adopted human-like influencers to incorporate human-likeness into their brand identity to enhance consumer–brand relationships [59]. For example, M&Ms and the Michelin brand have both adopted human-like influencers known as Mr. Peanut and the Michelin Man, respectively [60]. Thus, the first two hypotheses are stated as follows:

H1. *Perceived visual human-likeness of VIs positively influences consumer–brand relationships.*

H2. *Perceived mental human-likeness of VIs positively influences consumer–brand relationships.*

3.2. Social Presence

Whereas outer and inner cues correlate with appearance and thinking, respectively, Guadagno et al. (2007) found that virtual humans with greater behavioral realism would exert a more substantial impact than those with lower behavioral realism [51]. However, the influence of visual and mental likeness on social presence has been understudied. If the virtual avatars are characterized with humanized features, i.e., similar in appearance and thinking, consumers will react proactively to them because of their perceived social presence [61]. Short et al. (1976) also contended that certain forms of media were better at conveying such cues, highlighting that social presence was an intrinsic characteristic of the medium [49]. VIs have become prevalent in human networks, especially on social media platforms, owing to their capability to create ‘human-like experiences through artificial entities’ [45]. The provision of human-like features generates a feeling of social presence by incorporating social cues [55]. This attribute of social presence plays a significant role in their ability to effectively engage with humans. Prior research substantiates this claim by indicating that human-likeness influences social presence, purchase intentions and overall interaction effectiveness [62–64]. For example, uncanny valley effects may modulate this relationship: when high visual likeness pairs with low mental likeness (or vice versa), the resultant incongruity could suppress social presence despite individual human-like attributes.

Thus, the following hypotheses are proposed:

H3. *Perceived visual human-likeness of VIs positively influences their social presence.*

H4. *Perceived mental human-likeness of VIs positively influences their social presence.*

H5. *The interaction between perceived visual human-likeness and perceived mental human-likeness of VIs positively influences social presence.*

VIs can provide social advantages through their perceived social presence [65]. A study of avatar-based virtual shopping has shown that the impact of avatar-based social interaction is significantly mediated by the perception of social presence [66]. Virtual experience can also be enhanced by digital influencers offering comparable benefits on impersonal platforms [47]. Prior research has indicated that the way individuals perceive social presence can influence their emotions, perceptions and purchasing behavior [63,66,67]. Thus, comprehending how distinct technological elements affect the perception of social presence is vital in shaping the relationship between consumers and brands. Human-likeness features of VIs create a sense of social connection by making the virtual entity more relatable and engaging to consumers [68]. When consumers perceive higher levels of social presence from these human-like VIs, they experience the interaction as more natural and emotionally engaging. This enhanced social presence transforms digital interaction into a more meaningful social exchange, making the brand appear more accessible and relatable. The perception of social presence then enables consumers to form emotional connections not just with the virtual influencer, but also with the brand itself [69]. As the social presence of VIs instils a sense of human warmth to consumers, they tend to perceive their interaction with the brand as more friendly, inviting, convivial and reactive with anthropomorphized influencers [55]. Thus, brands that have adopted VIs with human-likeness are likely to create favorable relationships with consumers.

Therefore, we hypothesize the following:

H6a. *Social presence of VIs positively influences consumer–brand relationships.*

H6b. *Social presence mediates the influence of perceived human-likeness on consumer–brand relationships.*

3.3. Need for Uniqueness

The need for uniqueness in consumer research has been defined as ‘the trait of pursuing differentness relative to others through the acquisition, utilization, and disposition of consumer goods for the purpose of developing and enhancing one’s self-image and social image’ [70]. In their study on advertising messaging, Roy and Sharma (2015) found that consumers with low levels of need for uniqueness tend to purchase in response to demand scarcity appeal [71]. Consistent with previous studies [71,72] we suggest that the effect of social presence on consumer–brand relationships will depend on the level of the need for uniqueness. With a high need for uniqueness, consumers may find that VIs’ high social presence inhibits their capability to meet their desire for uniqueness. For those with a high need for uniqueness, VIs with a strong social presence may ignore the factors that make consumers unique. Thus, the following hypothesis was made:

H7. *The effect of VIs’ social presence on consumer–brand relationships is positively correlated with consumer–brand relationships is negatively moderated by need for uniqueness.*

4. Research Method

4.1. Data Collection

The data were collected with Credamo (<https://www.credamo.com> (accessed on 5 June 2024)), a popular online survey platform in China. This platform has been found credible and effective in previous research [73–75], and it offers excellent opportunities to gain access to survey respondents from highly representative industries and age groups.

Firstly, respondents were asked whether they have ever followed VIs and saw their advertising. Only participants who followed VIs were allowed to answer the survey questions that covered VI features (i.e., human-likeness including visual and mental), social presence, uniqueness, their sense of consumer–brand relationship and demographic information.

By January 2023, 1041 responses were received. To ensure the quality of the data, an answer-time threshold was set based on the number of questions and average answer time. Questions that took less than 180 s to complete were automatically rejected. The answer-time threshold of 180 s was established based on pilot tests, which determined that this duration is the minimum time required for a thoughtful and attentive completion of the questionnaire. Additionally, we carried out implemented attention checks, asking respondents to select a specific option in questions (e.g., ‘Please select “strongly agree” for this question.’). Inattentive or careless answers that did not demonstrate proper reading and understanding of the questions were automatically rejected. Among the valid respondents, 32.373% were males and 67.627% were females. Respondents on average followed VIs for half a year to one year. Table 1 summarizes the sample profile of this study.

Table 1. Respondents’ demographic details (N = 1041).

Variables		Frequency Counts	Percentage (%)
Gender	Male	337	32.373
	Female	704	67.627
Education	High school and below	17	1.633
	College degree	70	6.725
	Bachelor’s degree	786	75.504
	Postgraduate or above	168	16.138
Age	17–28	441	42.363
	29–50	559	53.699
	>50	31	2.978

Table 1. *Cont.*

Variables		Frequency Counts	Percentage (%)
How long have you followed the virtual influencer?	<0.5 year	118	11.335
	0.5 year–1 year	350	33.622
	1 year–1.5 years	281	26.993
	1.5 years–2 years	182	17.483
	>2 years	110	10.567

4.2. Measurement

A survey questionnaire was adapted from established scale items to measure the proposed constructs of this study. All scale items were measured on a 7-point Likert scale, where 1 means ‘strongly disagree’, and 7 means ‘strongly agree’. Human-likeness, including virtual and mental human-likeness, was measured by six items, respectively, and all items were adapted from the work of Stein et al. (2022) [18]. Social presence was measured by five items adapted from the work of Zibrek et al. (2019) [76]. Need for uniqueness was measured by four items adapted from the work of Sands et al. (2022) [3], and consumer–brand relationship was measured by three items adapted from the work of Algesheimer et al. (2005) [77] (see Appendix A).

Given that the data were collected in China, translating original English measurements into Chinese was necessary. To ensure the accuracy and fluency of statements, a back-and-forth translation method was adopted [78,79]. After three rounds of translation and content checking by one professor and three PhD students, the Chinese version of scale items was finalized. Three marketing experts and scholars were invited to verify the clarity of the scale items in the survey questionnaire. For further clarity and effectiveness of the questions, we conducted two rounds of prediction tests on two focus groups, including five consumers in each focus group who followed and watched advertisements of VIs. Based on respondents’ feedback in the prediction tests, minor changes were made to the content and format of the questionnaire.

4.3. Data Analysis

Guided by the instruction from Hair et al. (2017) [80], PLS was considered an appropriate choice as it places less demands on normality assumptions. PLS-SEM can help to understand the complex relationships between potential variables in the study and the predictive power of the model. PLS-SEM can minimize the variance among the considered variables and minimize the bias of parameter estimation, providing a flexible test method for mediation-mediated analysis [81]. Its reliability and popularity for data analysis have also been widely tested [82]. Thus, we adopted Smart PLS 3.0 software as an analysis tool to evaluate the SEM and test the hypotheses over 1041 respondents [83]. To validate the proposed hypotheses and enhance the reliability of significance estimates, confidence intervals, and bias detection, bootstrapping was used with 5000 sub-samples to estimate the structural model.

5. Result

5.1. Measurement Model Evaluation

To ensure data quality, invalid responses were screened and eliminated before analysis, including outliers, missing values and samples that are logically inconsistent. Then, Harman’s one-factor test was used to test the common method variance (CMV). The results of the principal component, including the analysis of all five constructs, showed that the variance interpretation rate of the first factor was 36.671%. Given that the standard for this data requirement is below 40%, the outcomes met the criteria, and no CMV-related

problems were observed. Although Harman's one-factor test has been widely used in many studies, it has certain limitations, such as lacking sensitivity or failing to detect bias unless common method variance (CMV) exceeds very high levels [84]. The second method is to test the correlation coefficient between constructs. Correlation coefficients higher than 0.9 indicate unacceptable CMB. The correlation coefficients between constructs shown in Table 2 suggest good reliability and validity of all variables. Thirdly, we examined a full collinearity test for the latent constructs to evaluate common method bias by checking the values of variance inflation factors (VIFs). As suggested by Kock (2015) [85], the value of VIFs should be less than 5. The results of VIF values demonstrated that the largest value was 2.947 and the lowest value was 1.400. Thus, common method bias is not a significant concern in this study.

Table 2. Measures and reliabilities (N = 1041).

	Constructs	Factor Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Visual Human-Likeness	1. VL1	0.764	0.892	0.897	0.650
	2. VL2	0.848			
	3. VL3	0.839			
	4. VL4	0.839			
	5. VL5	0.781			
	6. VL6	0.759			
Mental Human-Likeness	1. ML1	0.758	0.904	0.926	0.675
	2. ML2	0.840			
	3. ML3	0.831			
	4. ML4	0.832			
	5. ML5	0.845			
	6. ML6	0.822			
Social Presence	1. SP1	0.847	0.773	0.869	0.689
	2. SP2	0.855			
	3. SP4	0.787			
Consumer–Brand Relationship	1. CBR1	0.854	0.803	0.884	0.717
	2. CBR2	0.833			
	3. CBR3	0.852			
Need for Uniqueness	1. UNI1	0.880	0.863	0.904	0.703
	2. UNI2	0.858			
	3. UNI3	0.813			
	4. UNI4	0.800			

All the items' outer loadings were higher than 0.70. Cronbach's α for each construct was superior to the critical value of 0.70, ranging from 0.773 to 0.904. Since two of the five items measuring social presence were reverse-scored, the factor loading was found to be unsatisfactory after conversion. As a result, these items were deleted. Apart from internal consistency reliability, we followed the guidelines of Hair et al. (2017) [80] to test the factor's convergent validity. Average variance extracted (AVE) values for all constructs in the tested model were higher than 0.5; thus, the convergent validity for all seven constructs was satisfactory [86]. Table 2 illustrates these findings.

Thereafter, we checked the discriminant validity of the model. Discriminant validity is the 'extent to which a construct is truly distinct from other constructs by empirical standards' [80]. We followed the criterion of Fornell and Larcker's (1981) to examine the discriminant validity of the construct [87]. Table 3 shows that the square root values of all AVEs in the matrix diagonal were above all correlation coefficients, indicating sufficient discriminant validity.

Table 3. Discriminant validity (Fornell–Larcker).

	CBR	ML	SP	UNI	VL
CBR	0.847				
ML	0.407	0.822			
SP	0.533	0.561	0.830		
UNI	0.482	0.133	0.363	0.838	
VL	0.343	0.626	0.383	0.128	0.806

Note: Bold numbers on the diagonal are the square roots of the AVE for the constructs.

5.2. Structural Model Evaluation

We assessed the predictive accuracy of the model by checking the values of R^2 . The R^2 values (0.432 for consumer–brand relationship and 0.337 for social presence) of the endogenous variables in our model achieved moderate levels. According to the recommendation of Henseler et al. (2016) [88], we checked the standardized root mean square residual (SRMR) to assess the model fit criterion. As they suggested, the SRMR value should not be greater than 0.08. The SRMR value is 0.060, which reveals that the model fit criterion is sufficiently satisfied. The Q^2 values of 0.289 (consumer–brand relationship) and 0.213 (social presence) are higher than 0.

We used Smart PLS 3.0 to examine the significance of path relationships (see Table 4 and Figure 2). As shown in Table 4, virtual human-likeness has a positive and significant impact on the consumer–brand relationship ($\beta = 0.101$, $t = 2.325$, $p = 0.020$), supporting H1. In addition, mental human-likeness has a positive effect on consumer–brand relationship ($\beta = 0.158$, $t = 2.926$, $p = 0.004$), supporting H2. Virtual human-likeness is positively correlated with social presence ($\beta = 0.100$, $t = 2.231$, $p = 0.026$), and mental human-likeness is positively correlated with social presence ($\beta = 0.621$, $t = 11.299$, $p < 0.001$), supporting H3 and H4. The interaction of virtual and mental human-likeness has a positive impact on social presence ($\beta = 0.095$, $t = 2.958$, $p = 0.003$), which indicates support for H5. Social presence is positively correlated with consumer–brand relationship ($\beta = 0.254$, $t = 6.106$, $p < 0.001$). There is a specific indirect effect of social presence on the relationship between virtual human-likeness and consumer–brand relationship ($\beta = 0.025$, $t = 2.006$, $p = 0.045$), between mental human-likeness and consumer–brand relationship ($\beta = 0.158$, $t = 5.046$, $p < 0.001$), and between the interaction of virtual and mental human-likeness and consumer–brand relationship ($\beta = 0.024$, $t = 2.308$, $p = 0.021$); thus, H6 is supported. In addition, the moderating effect of need for uniqueness on the impact of social presence on consumer–brand relationship is significant ($\beta = -0.113$, $t = 3.126$, $p = 0.002$), thus supporting H7 (see Figure 3).

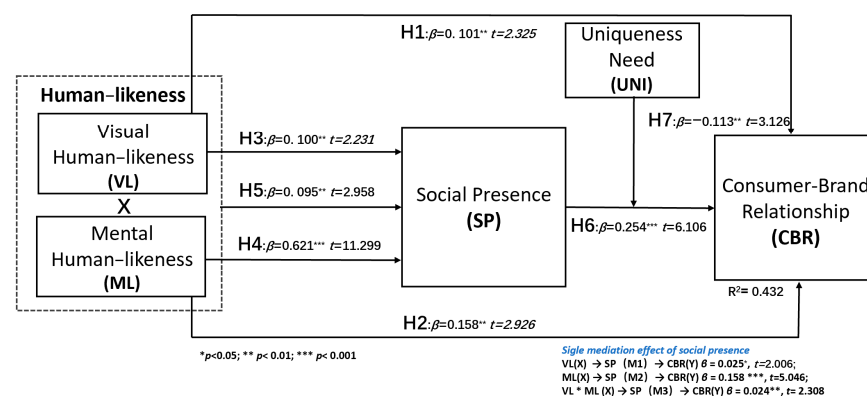
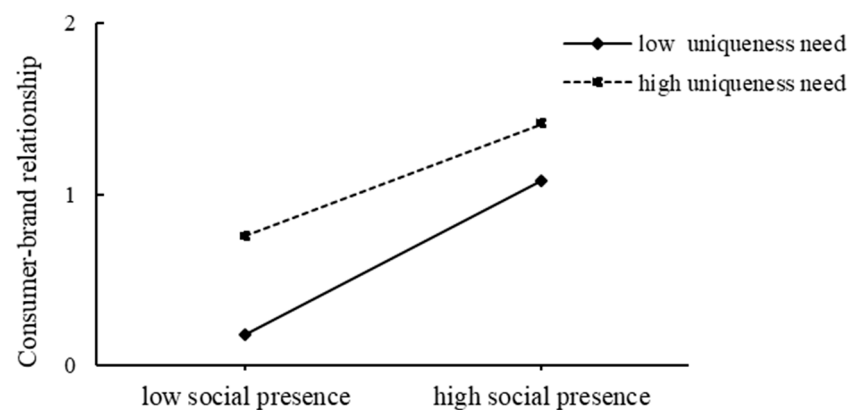
**Figure 2.** Structural model results.

Table 4. Results of the structural model.

	Hypotheses	Beta	T values	p Values	Results
H1	VL → CBR	0.101	2.325	0.020	Supported
H2	ML → CBR	0.158	2.926	0.004	Supported
H3	VL → SP	0.100	2.231	0.026	Supported
H4	ML → SP	0.621	11.299	0.000	Supported
H5	VL*ML → SP	0.095	2.958	0.003	Supported
H6	SP → CBR	0.254	6.106	0.000	Supported
	VL → SP → CBR	0.025	2.006	0.045	
	ML → SP → CBR	0.158	5.046	0.000	
	VL*ML → SP → CBR	0.024	2.308	0.021	
H7	UNI*SP → CBR	−0.113	3.126	0.002	Supported
	R ² SP = 0.337				
	R ² CBR = 0.432				

**Figure 3.** Moderating effect of need for uniqueness.

6. Discussion

This study extends research on virtual influencers (VIs) in interactive marketing by applying a social presence perspective. First, we confirm that social presence significantly impacts the consumer–brand relationship and our results are consistent with previous studies showing that social presence enhances consumer emotions, perceptions, and purchasing behavior (e.g., [63,66,67]). This underscores the unique role VIs play in fostering consumer engagement by simulating the relational attributes of a close companion, thereby strengthening brand connections.

Second, we found that both visual and mental human-likeness qualities significantly influence social presence, with a notable interaction between the two types of human-likeness. Interestingly, mental human-likeness exerts a stronger effect, aligning with Stein et al. (2022), who reported that mental human-likeness more significantly impacts parasocial relationships than visual human-likeness [18]. This finding has practical implications across various sectors and digital platforms, as the relative impact of human-likeness may shift based on context. For instance, in domains prioritizing emotional connection, such as healthcare or finance, emphasizing mental human-likeness could enhance consumer trust and engagement more effectively than visual characteristics, suggesting that VI strategies should be tailored according to industry-specific consumer expectations and platform characteristics.

Finally, our study finds that consumers' need for uniqueness negatively moderates the relationship between social presence and the consumer–brand relationship. This suggests that the need for uniqueness, often used to explain behavioral intention [89], influences the consumer–brand interaction process by limiting the effectiveness of VIs for consumers with

high uniqueness needs. Such nuances underscore the importance of adapting VI strategies to align with diverse consumer identities and cultural contexts.

6.1. Theoretical Implications

This research contributes to the evolving literature on virtual influencers (VIs) in interactive marketing by extending the application of social presence theory to this context. Our study suggests that the principle of social presence, which has been shown to facilitate consumer–brand relationships in traditional settings (e.g., [73,89,90]), is also valid and impactful in the realm of VIs. Specifically, VIs that successfully evoke social presence can serve as a bridge, fostering closer consumer–brand connections by emulating qualities of a trusted companion.

This study also supports and enriches a growing body of work on parasocial relationships within interactive marketing. Parasocial relationships, typically formed through an illusion of intimacy that mimics real interpersonal connections, play a crucial role in how consumers engage with VIs [18,91]. VIs with high mental human-likeness are often perceived as intimate friends, enhancing their social and relational value and strengthening consumer–brand bonds. This finding aligns with existing studies on parasocial engagement, demonstrating that mental attributes in virtual personas can be even more significant than visual traits in creating lasting consumer attachments.

This research also contributes to the theoretical discourse by exploring how consumer individuality, particularly need for uniqueness, moderates the effectiveness of social presence in fostering brand relationships. This finding suggests that need for uniqueness, a psychological concept often used to explain behavioral intentions, can introduce complexity into the consumer–brand interaction process by dampening the impact of social presence on brand relationships. For consumers with a strong desire for differentiation, the relational benefits derived from VIs may be limited, indicating the nuanced role of individual identity in digital interactions.

The findings build on contemporary research in interactive marketing by applying social presence theory to understand consumer–brand relationships within the context of virtual VIs. Recent studies suggest that social presence enhances consumer trust and relational bonds, which are crucial for effective digital branding [92]. In line with these findings, our study demonstrates that VIs with high mental human-likeness foster perceived intimacy, creating a social and relational value comparable to real influencers and positively impacting brand relationships [93]. This effect aligns with recent literature on parasocial relationships in digital marketing, which shows how consumers form pseudo-social bonds with VIs, similar to human interactions [94].

To provide a comprehensive theoretical foundation, we have engaged with alternative frameworks, including the uncanny valley hypothesis and human–computer interaction (HCI) theories. The uncanny valley hypothesis offers insight into potential discomfort or decreased authenticity that may arise as VIs approach high levels of human-likeness [95]. Meanwhile, HCI theories help us understand how varying degrees of human-likeness can shape consumer comfort, trust, and acceptance [96]. By integrating these frameworks, our study not only extends social presence theory but also broadens the theoretical understanding of how consumers interact with increasingly human-like digital agents, offering actionable insights for scholars and practitioners in the field of HCI and digital marketing.

6.2. Practical Implications

The findings of this study provide several strategic implications for interactive marketing and brand management, particularly in the design and deployment of VIs. First, the results offer guidance for managers in understanding the effects of visual and mental

human-likeness of VIs. Unlike traditional human influencers, VIs can be strategically designed to evoke a strong sense of social presence, which is likely to foster deeper consumer–brand relationships. This study supports the adoption of VIs as a viable alternative in online marketing, where well-crafted VIs can simulate companionship and enhance engagement, ultimately driving positive consumer outcomes.

Our findings further underscore the potential of VIs to align with broader trends in digital transformation and the metaverse, where visually and mentally engaging digital personas are increasingly relevant. By leveraging these elements in VI design, brands can stay at the forefront of digital innovation and consumer engagement. While prior research has often focused on comparing VIs with human influencers, this study highlights the feasibility of utilizing VIs as independent agents capable of delivering unique value in brand communications.

This study holds significance for policymakers and ethicists who oversee the responsible use of digital technology. As VIs become hyper-realistic, ethical considerations around consumer manipulation and transparency come to the forefront. The potential for VIs to mimic human-like interactions raises questions about authenticity and consumer consent. Therefore, the development of ethical guidelines and transparent policies will be essential to ensure that VIs are used responsibly, maintaining consumer trust and promoting ethical practices in the evolving landscape of digital marketing.

7. Limitations and Future Research

This study has several limitations that should be addressed in future research. For theoretical limitations, the sample is composed of Chinese users who have followed VIs, which may limit the generalizability of our findings to other cultural contexts. Future research could benefit from examining consumer responses across different cultural settings to enhance the applicability of our findings globally. Second, while this study primarily explores the positive effects of virtual influencers' visual and mental human-likeness on CBR, it does not address potential negative effects, such as consumer discomfort or reduced perceived authenticity. Future research could examine these aspects to offer a more balanced understanding of the impact of VIs on consumer perceptions and behaviors. Furthermore, the current study focused on typical digital interactions (e.g., social media feeds, videos). It did not explore how visual and mental human-likeness might exert differential effects within more immersive or AI-enhanced digital environments, such as Virtual Reality (VR) or Augmented Reality (AR). Future research should investigate these dynamics in richer technological contexts. For methodological limitations, the use of Credamo as a data collection platform may introduce demographic bias, as it likely attracts participants with higher digital literacy and specific socio-economic backgrounds. This potential bias may impact the sample's representativeness. Future studies could use a broader range of recruitment methods to capture a more diverse demographic, thus increasing the generalizability of results across various consumer groups. Our reliance on self-reported data also introduces the risk of social desirability bias, given that respondents were aware of the survey's focus on VIs. To address this limitation, future research could incorporate behavioral data to objectively assess consumer interactions with VIs.

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Appendix A. Measurement Scales

Visual human-likeness [18]

VHL1: [The virtual influencer] moves like a human.

VHL2: [The virtual influencer] looks like an artificial character.

VHL3: [The virtual influencer] seems machine-like.

VHL4: [The virtual influencer] looks like a human person.

VHL5: [The virtual influencer] looks life-like.

VHL6: [The character’s] facial expressions and gestures appear natural.

Mental human-likeness [18]

MHL1: [The virtual influencer] seems to have their own personality.

MHL2: [The virtual influencer] seems to be able to experience their own feelings.

MHL3: [The virtual influencer] seems soulless to me (r).

MHL4: [The virtual influencer] seems to possess a mind.

MHL5: [The virtual influencer] does not seem as if they would think (r).

MHL6: [The virtual influencer] seems to be able to reflect on their own behavior.

Social presence [67,76]

SP1: It feels like I am in the room with someone else present.

SP2: It feels like a virtual person is looking at me and knowing my existence.

SP3: I often think that virtual humans are not real (r).

SP4: The virtual person seems to be alive.

SP5: Virtual humans are just computerized images, not real people(r).

Need for uniqueness [3]

To what extent do you agree or disagree with the following statements about yourself?

UN1: I actively seek to develop my personal uniqueness by buying special products or brands.

UN2: I often look for one-of-a-kind products or brands so that I create a style that is my own.

UN3: The more common a product or brand is among the general population, the less interested I am in buying it.

UN4: When a product I own becomes popular among the general population, I begin using it less.

Consumer–brand relationship [77,97]

CBR 1. This brand says a lot about the kind of person I am.

CBR 2. This brand’s image and my self-image are similar in many respects.

CBR 3. The concept represented by this brand has an important meaning in my life.
Note: (r) denotes the reverse-coded items.

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