The effectiveness of virtual vs. human influencers in digital marketing: Based on perceived psychological distance and credibility

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Abstract

This study investigates the differential impacts of virtual and human influencers on consumer purchase intentions, focusing particularly on the roles of perceived psychological distance and credibility. Utilizing image recognition algorithms, two influencers with facial similarities were stringently selected, and surveys from 427 consumers on their perceptions of the products endorsed by these influencers were analyzed. Results show human influencers outperform virtual ones, yet the latter still positively affect purchase intentions, revealing their potential as effective marketing tools. The study further reveals that perceived psychological distance can independently mediate the relationship between influencer type and purchase intention, and also acts in tandem with perceived credibility in this mediation. This research not only offers empirical insights into the comparative effectiveness of virtual versus human influencers in digital marketing but also advances understanding of the psychological mechanisms underpinning consumer behavior in the digital era.

Keywords: human-like virtual influencers; perceived psychological distance; perceived credibility; purchase intention

Introduction

Human-like virtual influencers (VIs), characterized as computer-generated imagery (CGI) entities, have gained significant attention in China due to their highly anthropomorphic appearance and ability to interact with humans and influence behavior, much like human influencers (HIs) in the social media realm (Casarotto, 2021; Li, Lei, Zhou, & Yuan, 2023). The collaboration with VIs offers brands a safeguard against issues that may tarnish their image, such as scandals or public image collapse, prompting an increasing adoption of this strategy (Koles, Audrezet, Moulard, Ameen, & McKenna, 2024). Thus, brands (e.g., Chanel) have begun to engage in commercial partnerships with VIs.

Despite the integration of VIs into the social media landscape, the exploration of their impact on consumer purchasing intentions is still in its infancy, with limited research focusing on aspects like source credibility (Chaihanchanchai, Anantachart, & Ruangthanakorn, 2024; H. Kim & Park, 2023), parasocial relationships (Yap & Ismail, 2022), authenticity (M. Kim & Baek, 2023; Lou et al., 2023), and blame attribution (H. Kim & Park, 2023). This research gap is critical, given the rapid expansion of social media and the dominance of influencer marketing as a key strategy (Hermanda, Sumarwan, & Tinaprillia, 2019). Endorsements by influencers are proven to significantly enhance brand awareness (Masuda, Han, & Lee, 2022; Saima & Khan, 2020; Weismueller, Harrigan, Wang, & Soutar, 2020). Additionally, some studies comparing the endorsement effectiveness between VIs and HIs have highlighted a notable disparity in user attitudes towards their endorsements (Deng & Jiang, 2023; Franke, Groeppel-Klein, & Müller, 2023; Li et al., 2023; Ozdemir, Kolfal, Messinger, & Rizvi, 2023). This divergence underscores the need for a deeper understanding of the factors influencing consumer receptivity to different types of influencers.

Previous literature has shown that two concepts play important roles in effective marketing: perceived psychological distance and perceived credibility. Perceived psychological distance refers to the subjective perception of the closeness or distance of an entity relative to oneself (Trope & Liberman, 2010) , a determinant in the consumer-influencer relationship. A shorter psychological distance typically correlates with stronger consumer engagement and trust, thereby enhancing the influencer's persuasiveness (Chae, 2018). Perceived credibility, encompassing trustworthiness, expertise, and attractiveness (Ohanian, 1990), profoundly influences consumer attitudes and behaviors, affecting the perceived authenticity and reliability of the influencer's messages (D. Y. Kim & Kim, 2021). Higher levels of credibility are associated with greater trust and a higher propensity for endorsement-driven purchases (Weismueller et al., 2020). The differential impact of these factors when comparing VIs and HIs is noteworthy. Although HIs may naturally exhibit a lower psychological distance due to their tangible presence, VIs can effectively mitigate this gap through strategic narrative and content creation. Similarly, credibility may vary markedly between these types of influencers, influenced by their perceived authenticity and reliability.

Thus, this paper aims to elucidate the nuanced differences in consumer responses to endorsements by VIs and HIs, particularly examining how perceived psychological distance and credibility affect consumer purchase intentions. This study endeavors not only to enrich the academic discussion on

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influencer marketing but also to offer actionable insights for practitioners, aiding them in more effectively tailoring their strategies when choosing between VIs and HIs for endorsements. Ultimately, this research seeks to bridge the theoretical and practical divides in the rapidly evolving field of influencer marketing.

Literature review

Research on virtual influencers

Recent studies have increasingly concentrated on the distinctive role of VIs within the digital marketing domain. Researchers have observed that consumers are attracted to VIs due to their potential to mitigate loneliness and enhance mood (Jauffret & Landaverde Kastberg, 2019; Mirowska & Arsenyan, 2023). This emotional engagement is crucial for understanding consumer interactions with VIs. Factors such as visual appeal, enigma, and novelty also play significant roles in attracting and maintaining consumer interest (Choudhry, Han, Xu, & Huang, 2022; Jang & Yoh, 2020).

Although the VIs industry in China is still emerging, its rapid expansion and potential have garnered recognition, with businesses increasingly investing in VI-related initiatives (Kong, Qi, & Zhao, 2021). (Huang, Kim, & Lennon, 2022) has highlighted managerial benefits of VIs, including easier management and cost-effectiveness compared to traditional celebrities. The commercial value of VIs has been emphasized, particularly finding higher levels of consumer trust in visually appealing VIs in sectors like cosmetics and skincare (Lee, Sun, Chen, & Jhu, 2015).

Research has also examined the influence of VI characteristics on consumer behavior. Studies have shown the positive impact of gender congruity between VIs and the products they endorse on purchase intentions (Beldad, Hegner, & Hoppen, 2016). Furthermore, (Mohanty, 2021) focused on the persuasive power of facial realism in VIs, suggesting that increased facial realism enhances social presence and subsequently, brand sentiment. (H. Kim & Park, 2023) explored how the desirability of VIs influences purchase intentions through mimetic desire and brand affinity . However, comparative analyses between virtual influencers (VIs) and human influencers (HIs) are limited and often inconclusive. Studies such as (Arsenyan & Mirowska, 2021; Deng & Jiang, 2023) have investigated user reactions and behavioral parallels on social platforms, finding that VIs evoke considerably less appearance anxiety among viewers. (Liu & Lee, 2022) applied attribution theory to explore perceptions of accountability in endorsement successes or failures, and (Stein, Linda Breves, & Anders, 2022) investigated differences in parasocial interactions with VIs and HIs.

Moreover, emerging studies on the endorsement efficacy of VIs compared to HIs have begun to surface. (Franke et al., 2023) reported that while VIs raise awareness of advertising novelty, consumers generally hold more favorable attitudes towards HIs in promotional settings. Conversely, (E. A. Kim, Kim, Shoenberger, et al., 2023) highlighted the pivotal role of information credibility in VIs endorsements, applicable to both human-like and animal-like VIs. (Li et al., 2023) found that VIs, in contrast to HIs, tend to diminish endorsement effectiveness due to reduced sensory perception and perceived credibility among consumers. In conclusion, while existing literature provides valuable insights into the appeal and impact of VIs, further research is necessary to comprehensively understand the unique advertising effects and underlying mechanisms of VIs versus HIs.

The present study

In tackling the recognized knowledge gap within the field of digital influencer impact assessment, our study employs a data-driven approach to illuminate the subtle variations in perceived psychological distance, credibility, and purchase intentions between VIs and HIs. This inquiry also seeks to shed light on how these factors shape consumer purchasing decisions in today's digital influencer-dominated environment.

Our methodological approach began with a rigorous and scientifically-informed selection procedure, ultimately yielding two distinct influencers for scrutiny. We then applied Welch's t-test to assess the direct effects between the two influencer types. Furthermore, we incorporated a bootstrap analysis framework to methodically examine the mediating and serially mediating roles of perceived psychological distance and credibility in this relationship. This holistic analytical strategy is designed to reveal profound insights into the shifting landscape of influencer marketing and its implications for consumer behavior.

Research methods

Participants

We developed an online survey through wjx.cn (A professional online questionnaire survey in China). A total of 475 humans participated in our survey. After removing the incomplete questionnaires, we finally obtained 427 (including 174 males and 253 females) valid samples, meeting the minimum sample size requirements of Hair Jr, Black, Babin, and Anderson (2010). It could be found that 56.7% of participants are between the ages of 18 and 30, and 86.4% hold a bachelor's degree. Meanwhile, 92.3% of participants said they had bought products or services recommended by social media influencers.

Stimuli

Previous research indicates that spokesperson appearance can significantly influence advertisement effectiveness (Russell, Swasy, Russell, & Engel, 2017; Xiao & Ding, 2014). To control for the facial influence of influencers on participant perception, we adopted facial similarity as a key metric for selecting a human influencer counterpart. An algorithm was employed to minimize facial discrepancy effects, involving two primary steps: face alignment via extraction of 68 facial landmarks and comparison of facial similarity through land-

mark feature distance calculation. For face alignment, we utilized an algorithm based on Ensemble of Regression Trees (ERT) proposed by Kazemi and Sullivan (2014) to accurately locate facial landmarks. This approach employs a combination of regression trees, resulting in exceptional performance in terms of both speed and precision. The essence of this algorithm is to establish a two-layer regression model. In model training, the data form is denoted as $\{(I_{\pi_i}, \hat{S}_i^{(t)}, \Delta S_i^{(t)})\}_{i=1}^{N}$. Where N is the number of pictures; I_{π_i} is the picture i in the data set, $\hat{S}_i^{(t)}$ is the positions of landmarks predicted by the t^{th} time of the first regression, and $\Delta S_i^{(t)}$ is the difference between the regression result of this layer and the real number. The iterative formula for the first layer of regression is as follows:

$$\hat{S}^{(t+1)} = \hat{S}^{(t)} + \gamma_t(I, \hat{S}^{(t)}) \quad (1)$$

$$\Delta S_i^{(t+1)} = S_{\pi_i} - \hat{S}^{(t+1)} \quad (2)$$

The first layer of regression obtains the most correct position of facial landmarks by iteratively updating the current shape vector with training images. As the regressor of each layer, γ_t is also a regression process, that is, the second layer regression of the algorithm. In order to train each level of γ_t, the model uses the gradient tree boosting algorithm to iteratively reduce the sum of the squared errors of initial shape and ground truth.

Subsequently, the similarity calculation involved measuring the Euclidean distance between facial features of the virtual and real individuals, with smaller distances indicating higher similarity.

In terms of the virtual influencer, AYAYI was selected as the stimulus due to its notable following of over 898 thousand by 2023 and a ranking within the top 5 on the China Business Network's Top50 list of virtual influencers. AYAYI's collaborations with established brands like Guerlain and LANEIGE further underscore its relevance.

Then, selection process for the human influencer entailed searching the "Fashion Woman" tag on Weibo, applying specific criteria (non-celebrity, active account, interaction with fans), and analyzing facial similarity. Jia Yubing, with over 558 thousand followers, exhibited the highest facial resemblance to AYAYI and was thus chosen.

Further, perfume was selected because beautiful faces frequently appear in advertising for trendy items like perfume (Englis, Solomon, & Ashmore, 1994) and according to the data released by Statista (2023)[1], the global market for perfume is worth about US $49 billion, suggesting that perfume has a commercial value. Based on the influencers selection results and product selection result, we created two stimulus advertisements. According to the Xiao and Ding (2014), we produced our stimulation advertising from real ads by replacing out the original faces for stimulus faces, removing the original brand name and logo, and leaving all other parts the same to provide participants a more realistic viewing experience. The advertising pictures are shown in Figure 1.

Figure 1: The advertising pictures (The left is the virtual influencer, the right is the human influencer).

Measures

All the survey items were measured with a 7-point Likert-type scale from 1 (Strongly disagree) to 7 (Strongly agree). Specifically, the perceived psychological distance was measured by three items, referencing the scale designed by Hernández-Ortega (2018) and Zhao, Wang, Tang, and Zhang (2020). Items included "This influencer is close to me", "I belong to the same group as this influencer", "I am similar to this influencer", where a higher score indicated a smaller perceived psychological distance, denoting a sense of closeness, belongingness, and similarity to the influencer. Perceived credibility was assessed across three dimensions: source trustworthiness, source attractiveness, and source expertise. Trustworthiness was measured by five items (dependable, honest, reliable, sincere, trustworthy), adapted from scales utilized in Sands, Campbell, Plangger, and Pitt (2022). Perceived attractiveness (beautiful, attractive, sexy, elegant, glamorous) followed scales from Muda and Hamzah (2021), while expertise (expert, experienced, knowledgeable, qualified, skilled) adopted measures proposed by Ohanian (1990). The purchase intention was measured by three 7-point items referring to D. Y. Kim and Kim (2021); Kudeshia and Kumar (2017); Vidyanata, Sunaryo, and Hadiwidjojo (2022). Items included: "How likely are you to purchase the product?", "How inclined are you to purchase the product?", "How willing are you to purchase the product in the future?". I Finally, after each ad exposure, participants rated the perceived influencer type (virtual or human) on a 7-point Likert scale (1 = Virtual Influencer, 7 = Human Influencer) (Li et al., 2023). This served as a manipulation check for influencer type.

Pre-test and procedures

To guarantee readability, clarity, and language equivalence, our questionnaire was prepared in the process of back-translation (initially developed in English before being translated into Chinese) (Weismueller et al., 2020). Then, we conducted a pre-test before the experiment actually began to make sure that each participant could grasp the questions in the questionnaire. The specific steps refer to Siqi and Yee

[1] *Size of the perfume market worldwide in 2016 and 2022*. https://www.statista.com/statistics/757533/global-perfume-market-size/.

(2021). First, we invited three experts to offer their professional judgment and experience on the items. Then we invited 30 responders to complete our survey and provide feedback on the phrasing and organization of the items. Finally, we made a few minor changes to the questionnaire to guarantee that all participants can comprehend the questions.

After observing two different types of stimulus advertisements in sequence, each of which was shown for 11 seconds, participants answered the online survey.

Results

Manipulation check

The manipulation check effectively validated our experimental design's ability to differentiate between the virtual and human influencer. Participants' perceptions of AYAYI (virtual influencer) and Jia Yubing (human influencer) were significantly distinct, with mean ratings of 2.523 ($SD = 1.212$) and 5.821 ($SD = 1.147$), respectively. This difference, corroborated by a t-value of -17.341 ($p < 0.001$), indicated a clear tendency to recognize AYAYI as virtual and Jia Yubing as human. The results unequivocally support the successful manipulation of influencer type, demonstrating participants' ability to discern between virtual and human influencers in the advertisements.

Reliability and validity

We calculated Cronbach's alpha to measure the internal consistency of the model and the alpha values of each variable and the model were all acceptable (above 0.70). Then, the results of KMO and Bartett's test of sphericity ($p < 0.001$), factor loading, CR, and AVE demonstrated that the questionnaire also had strong structural validity. The reliability and validity test results are shown in Table 2

Direct effects analysis

We conducted an independent samples t-test to explore differences in the perceptions of VI (coded as 0) and HI (coded as 1) across three variables: perceived psychological distance, perceived credibility, and purchase intention. Initially, Levene's Test for Equality of Variances revealed significant differences in variances for perceived psychological distance ($F = 53.489, p < 0.001$), perceived credibility ($F = 18.042, p < 0.001$), and purchase intention ($F = 40.842, p < 0.001$). This led to the rejection of the assumption of equal variances (Lim & Loh, 1996). Subsequently, Welch's t-test for Equality of Means was performed, uncovering significant differences between VIs and HIs. Figure 2 showed the difference in comparison of the average values. Specifically, for purchase intention, a significant mean difference was also noted ($MV = 4.719, SD = 1.461, MH = 5.352, SD = 1.137$), with $t = -7.068, df = 803.422, p < 0.001$, supporting that compared to HIs, VIs would lead to lower purchase intention. In terms of perceived credibility, similar patterns were observed ($MV = 3.394, SD = 0.783, MH = 3.715, SD = 0.692$), with a significant mean difference ($t = -6.348, df = 839.355, p < 0.001$), and a 95% confidence interval for this difference ranging from -0.420 to -0.222, thus showing that VIs led to lower perceived credibility than HIs. Lastly, for perceived psychological distance, participants exhibited a higher distance from VIs ($MV = 4.148, SD = 1.523$) compared to HIs ($MH = 5.159, SD = 1.169$), with $t = -10.881, df = 798.804, p < 0.001$. This finding suggested that compared to HIs, VIs would lead to greater psychological distance. These results statistically significant differences in the perceptions of VIs and HIs concerning perceived psychological distance, perceived credibility, and purchase intention. The consistently negative direction of the mean differences suggests that, on average, scores for VIs were lower than those for HIs in these aspects.

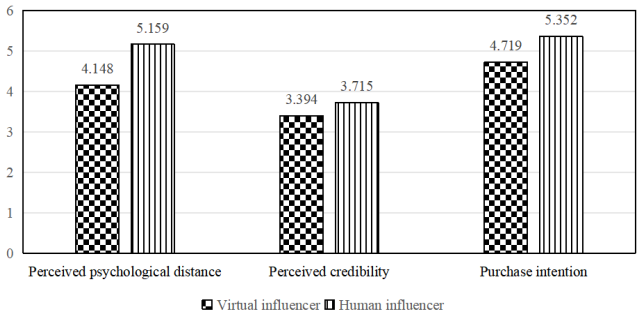


Figure 2: The values of perceived psychological distance, credibility, and purchase intention under VI and HI.

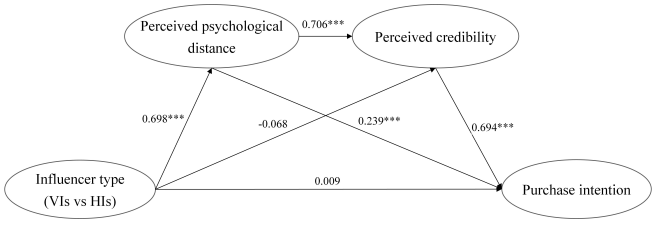
Mediation effects analysis

We employed a mediation analysis with Model 6 from the SPSS PROCESS macro (Hayes, 2013), using 10,000 bootstrap samples, to assess the indirect influence of influencer type (virtual influencer versus human influencer) on purchase intentions, mediated by perceived psychological distance and perceived credibility. Figure 3 displays the unstandardized coefficients for each path and Table 2 shows the results of the mediating effects test. The indirect effect through perceived credibility alone was not significant ($\beta = -0.047; CI = [-0.119, 0.028]$), indicating that perceived credibility does not mediate the relationship between influencer type and purchase intention independently of perceived psychological distance. However, the analysis revealed a significant indirect effect of influencer type on purchase intention through perceived psychological distance ($\beta = 0.167; CI = [0.116, 0.225]$). This finding suggests that the perceived closeness, group belongingness, and similarity to an influencer are significantly associated with the intention to purchase, with HIs likely perceived as closer and more relatable than VIs. Further, our chain mediation analysis revealed a significant indirect effect of influencer type on purchase intention through the sequential mediation of perceived psychological distance and perceived credibility ($\beta = 0.342, CI = [0.279, 0.409]$). This finding indicates that the type of influencer indirectly influences purchase intention through an initial impact on perceived psychological distance,

Table 1: The results of reliability and validity test.

Variable		Item	Factor loading	CR	Cronbach's alpha	AVE
Perceived distance psychological		PD01	0.813	0.843	0.874	0.642
		PD02	0.823			
		PD03	0.767			
Perceived credibility	Perceived trustworthiness	ST01	0.686	0.771	0.925	0.403
		ST02	0.610			
		ST03	0.659			
		ST04	0.601			
		ST05	0.615			
	Perceived attractiveness	SA01	0.843	0.852	0.917	0.536
		SA02	0.723			
		SA03	0.634			
		SA04	0.712			
		SA05	0.734			
	Perceived expertise	SE01	0.761	0.855	0.866	0.543
		SE02	0.763			
		SE03	0.777			
		SE04	0.608			
		SE05	0.760			
Purchase intention		PI01	0.602	0.613	0.917	0.346
		PI02	0.577			
		PI03	0.585			

which in turn affects perceived credibility, subsequently impacting purchase intention. Therefore, the results affirm the chain mediation role of perceived psychological distance and perceived credibility.



Note: $*p < 0.1; **p < 0.05; ***p < 0.001$.

Figure 3: Standardized coefficients for the relationships between perceived psychological distance, credibility, and purchase intention.

Discussion

In order to explore the differences in endorsement effects between human-like VIs and HIs, we selected two influencers with highly similar faces and analyzed the factors (i.e., perceived psychological distance and perceived credibility) that may lead to these differences, using independent Welch t-tests and chained multiple mediation effects tests.

First, the above results provide evidence that in the marketing industry, VIs and HIs have comparable functions. Specifically, our findings demonstrate that VIs will influence customers' purchase intention, in line with earlier studies (Schouten, Janssen, & Verspaget, 2021; Stein et al., 2022). The recent findings make a distinct contribution because Stein et al. (2022) did not examine the influence of influencer marketing from the perspective of spokesmen's faces. Our findings prove that despite the two influencers' appearances are highly similar, the purchase intention prompted by VI is less than that by HI. One possible reason is that because VIs are still in their infancy, consumers do not have enough confidence in them. However, our results still reveal that VIs have strong market potential, as their average purchase intention exceeds half of the measured score. Therefore, although the effect of VIs is weaker compared to HIs, the absolute effect of VIs (i.e. considered separately and not compared to other types of influencers) is positive. This means that although VIs may not be the most effective marketing tools, they are still effective.

Then, we try to explain the reason behind this phenomenon though perceived psychological distance and perceived credibility. The findings demonstrate that while consumers' perceived credibility of VIs is lower than that of HIs, this trust has no bearing on purchase intention. It stands to reason that credibility is a sophisticated psychological emotion, a few factors (such as homogeneity) will influence customers feeling about the influencers(D. Y. Kim & Kim, 2021). Besides, consistent with Schouten et al. (2021), our findings prove that perceived psychological distance mediates the influencer type and purchase intention. Consumers also perceive that VIs are much more psychologically distant than HIs, which is consistent with earlier study (Sands et al., 2022). This may be be-

Table 2: Results of the mediation effects test.

Mediation path	Effect value	Boot SE	Boot LLCI	Boot ULCI
Influencer type → Perceived psychological distance → Purchase intention	0.167	0.027	0.116	0.225
Influencer type →Perceived credibility → Purchase intention	-0.047	0.037	-0.119	0.028
Influencer type → Perceived psychological distance →Perceived credibility → Purchase intention	0.342	0.033	0.279	0.409

cause the team behind the screen controls the relationship between VIs and followers, consumers will believe closer with the HIs.

Finally, we confirmed the particular mediation process between the influencer type and purchase intention. The results show that perceived psychological distance and perceived trustworthiness play a chain mediating role in the relationship between influencer type and purchase intention. As mentioned in Zhao et al. (2020), as customers feel more intimately connected to the spokesperson, their preference for the spokesperson will rise, fostering a sense of credibility that will ultimately boost the purchase intention potential. However, Zhao et al. (2020) ignored the important role of perceived psychological distance in this relationship, which makes our model richer and the results more reliable. Our results also reveal that reducing the perceived psychological distance of consumers towards VIs is key to improving purchase intention. One plausible explanation is that consumers are quite explicit about their interests and are conscious of the distinction "authentically fake" among VIs (Arsenyan & Mirowska, 2021; Zhou, Li, Li, & Lei, 2024). In all, despite the virtual influencer's advertising impact is not as strong as the human influencer's, it is still possible for the virtual influencer to function similarly to the latter in the market.

Conclusion

This research explores the differential consumer purchase intention influenced by VIs and HIs with similar appearances, elucidating the underlying reasons for these variances. The findings demonstrate that while HIs are more effective endorsers, VIs nonetheless possess significant market potential. This research contributes theoretically and practically in several ways.

In terms of the theoretical contributions, first, it pioneers in comparative analysis of the advertising impact of VIs and HIs, addressing a critical gap in the literature on social media influencer types and advertising effectiveness. Second, through the innovative use of face recognition technology to closely match a human influencer's appearance with a virtual counterpart, this research effectively controls for appearance effects on consumer perceptions and choices, thereby enhancing the study's reliability and validity. Furthermore, building upon previous works (Chae, 2018; Widyanto, Agusti, et al., 2020; Zhao et al., 2020), this study introduces a novel model, empirically validating the chain mediating effects of perceived psychological distance and credibility on the relationship between influencer type and purchase intention. While prior research has forecasted VIs as future marketing powerhouses (Appel, Grewal, Hadi, & Stephen, 2020; Arsenyan & Mirowska, 2021), this study offers a more nuanced perspective. It demonstrates that while VIs do exert a positive influence, their impact is relatively weaker compared to HIs. Nonetheless, their independent positive effect highlights their ongoing relevance in the marketing landscape.

From a practical standpoint, the study offers valuable insights for virtual influencer management. It underscores the importance of bolstering perceived credibility to enhance consumer purchase intentions, even when VIs closely resemble HIs. Additionally, the findings support strategic collaborations between brands and VIs, taking into account their impact on consumer purchases and benefits such as brand image stability and reduced marketing expenses. Moreover, the examination of virtual influencer advertising effectiveness can furnish valuable intelligence for both brands and virtual influencer teams, ultimately enhancing the influencer's market value.

However, this study is not without limitations. Firstly, our investigation solely encompasses HIs and VIs, neglecting the potential influence of other influencer types. Future research could broaden the scope by incorporating diverse influencer categories and considering demographic characteristics, such as gender, as variables. Additionally, a more comprehensive understanding of how various product attributes interact with influencer type and consumer behavior is needed. Secondly, while controlling for facial similarity among influencers, the reliance on static images in advertisements might restrict the generalizability of our findings to more dynamic advertising environments. Future work can focus on the different perspectives of consumers on various types of social media influencers in dynamic advertising video environments. Finally, this study focuses on psychological distance and credibility, potentially overlooking other factors of VIs (e.g., authenticity) that influence consumer behavior. Future research should consider these additional variables to provide a more nuanced understanding of the complex interplay between VIs and consumers.

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