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"Threatened and empty selves following AI-based virtual influencers": comparison between followers and non-followers of virtual influencers in AI-driven digital marketing

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Abstract

Artificial intelligence (AI)-based virtual influencers are now frequently used by brands in various categories to engage customers. However, little is known about who the followers of these AI-based virtual influencers are and more importantly, what drives the followers to use AI-based virtual influencers. The results from a survey support the notion that compensatory mechanisms and the need to belong play important roles in affecting usage intentions of AI-based virtual influencers. Specifically, the study finds that usage intentions are mediated and moderated by compensatory mechanisms that arise from the perception of AI-based virtual influencers' functional benefits and existential threats to human identity. Furthermore, the need for belonging moderates the effects of the following status (following versus non-following) on perceived personalization benefits of AI-based virtual influencers and behavioral intentions to use AI-based virtual influencers. This study provides important implications for academia delving into the social, cultural, and philosophical implications of AI-based virtual influencers for human societies as well as for brands that plan to use AI-based virtual influencers and gain a better understanding of their customers in AI-driven digital marketing.

Keywords Virtual influencers · Feeling artificial intelligence (AI) · Need to belong · Empty self · Threats to human identities · Human–AI interaction (HAII) and Human-Robot-Interaction (HRI)

1 Introduction: the virtual influencer phenomenon

Marketing academics and practitioners have for long acknowledged the important roles that influencers play in the diffusion of information and innovation. In recent years, many brands have partnered with AI-based virtual influencers to broaden their reach and engage their followers. A virtual influencer is a computer-generated image (CGI) or animated digital character that exists entirely online (Bringe 2022). Virtual influencers often have social media accounts that are made to look human with specific personalities, features, and preferences. For instance, the most popular virtual influencer as of November 28, 2023, is Lil Miquela, a 19-year-old robot who lives in Los Angeles and has over 2.7 million followers on Instagram. Lil Miquela is also present on other digital platforms such as TikTok, Twitter, and Discord. Lil Miquela was voted in 2018 as one of the Top 25 Influential People on the Internet (TIME Magazine 2018) and is reported to have earned over $10 million dollars for Brud, the company that invented her through paid partnerships with global brands such as Calvin Klein and Samsung Galaxy (Petrarca 2020). Lil Miquela is not an exception of virtual influencers abound in the marketplace. For example, Shudu is a virtual influencer for Christian Louboutin, Maya is a virtual influencer for Puma, and Blawko is a virtual influencer for AliExpress (U, 2022). In fact, the market for AI-based virtual influencers was estimated to be around $4.6 billion in 2018 and presumed to grow at a compound annual growth rate (CAGR) of 26% from 2019 to 2025 (The Influencer Marketing Factory 2023).

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Surprisingly, there are only a couple of articles in academia that have exclusively focused on AI-based virtual influencers since most studies mention virtual influencers under the broader umbrella theme of online influencers. Recent studies outline the opportunities and challenges that exist for marketers using virtual influencers (Jin 2023; Sands et al. 2022a, b). Another study (Sands et al. 2022a, b) compares artificial intelligence (AI)-based influencers with human influencers and finds that the need for uniqueness and psychological distance influence outcomes such as perceived personalization and perceived commercialization.

The present study takes a slightly different approach in that (1) it adopts the viewpoint of a brand partnering with AI-based virtual influencers as well as (2) it ultimately discusses cultural, social, and philosophical implications of AI-based virtual influencers for human societies. Since AI-based virtual influencers already have a network of followers, it is important for brands to understand why followers may be more likely to use information from AI-based virtual influencers. Therefore, the main objectives of this study are (1) to understand why followers versus non-followers of AI-based virtual influencers might be likely to use information from AI-based virtual influencers; and (2) to discuss social, cultural, and philosophical implications of the differences between followers versus non-followers of AI-based virtual influencers for Human–AI Interaction (HAII) theory and practice. To this end, the study builds on (1) the emerging literature on human-centered AI in Human–AI Interaction (HAII) (Shin 2023; Shin and Ahmad 2023; Jin and Youn 2023) and AI threats to human identities in Human–AI Interaction (HAII) (Jin 2023; Liang and Lee 2017; Singh et al. 2021a, b; Youn and Jin 2021); and (2) the established psychology literature on the need for belongingness (Baumeister and Leary 1995; Alabri 2022) of the empty self (Cushman 1990; Reeves et al. 2012).

2 Conceptual frameworks, research questions, and hypothesis development

2.1 Need to belong in the age of "feeling artificial intelligence"

The need to belong has been conceptualized as the desire for interpersonal attachments and a fundamental human need that underlies various cultural institutions, from religion to marriage, and is associated with emotional well-being (Baumeister and Leary 1995; Greenwood et al. 2013). While the need to belong can be conceptualized as a fundamental human need, the extent to which this need is present varies across individuals. With regard to its relevance to media consumption, Greenwood and Long (2011) finds that individuals with a heightened need for belonging are associated with

increased imagined intimacy with media figures. Wong et al. (2019) find greater desire to belong has a significant effect on use of Instagram. More recent studies have also found that the need to belong is a critical predictor of engagement with social media platforms and social media influencers. For instance, a study by Lee et al. (2021) finds that individuals with higher levels of fear of missing out (FoMo), mainly caused by higher need for belonging (Alabri 2022), are more likely to engage with social media influencers.

An AI companion is defined as "a robot or a virtual conversational agent that possesses a certain level of intelligence and autonomy as well as social skills that allow it to establish and maintain long-term relationships with users" (Lim 2012, p. 2). AI-based bots and conversational agents powered by machine learning have boosted the potential of AI as social companions such that AI companions mitigate the loneliness of people seeking emotional and social support, thus fulfilling their need to belong (Chaturvedi et al. 2023). An AI-based virtual influencer is an emerging type of AI companion in customer relationship management. Emerging themes in AI-enabled technologies entail "*feeling AI, emotional AI, empathetic AI,* and *affective computing*" (Huang et al. 2019). Feeling AI is equipped with "the ability to recognize, simulate, and react to emotions appropriately, as humans do" (Huang and Rust 2022, p. 211), thus expanding the capability of AI beyond mechanical and repetitive tasks to encompass emotional and empathetic tasks. It is crucial to ensure "AI systems run transparently, perform equitable, value privacy, and effectively fulfill human needs", thus supporting human values and preserving human rights (Shin 2023). The human-centered AI framework emphasizes the importance of building a sociotechnical and humanistic AI system beyond simple algorithms or machine learning techniques (Shin and Shin 2023). Therefore, it is crucial for brands to create and deliver AI companions that can provide long-term emotional and functional support to users (Chaturvedi et al. 2023; Pesty and Duhaut 2011; Yen et al. 2023). The current research tested the role of users' need to belong as an emotional component in the emerging domain of Human–AI Virtual Influencer Interaction.

2.2 Benefits and threats of AI

While AI-based virtual influencers appear as humanoids, they are in essence a form of digital communication. Viswanathan and Jain (2013) find that individuals often use information from digital media to rationalize their decision-making. For instance, studies have found that when shoppers are exposed to online reviews, it has a significant effect on the probability of purchase (Jin and Youn 2022; Maslowska et al. 2017). Similarly, in the context of AI-based virtual influencers, it is important to understand how individuals perceive potential benefits and threats that emanate from

an AI-powered bot. For example, there is much debate in the popular media and in academia about the benefits and threats of AI for individuals and society (Puntoni et al. 2021; Youn and Jin 2021). One of the perceived threats of AI is people's fears of job replacement or even elimination by AI technologies. In relation to this threat, AI awareness refers to "awareness that AI machines such as robots and algorithms may replace their current work in the future" (Brougham and Haar 2018; Liang et al. 2022, p. 3). On the other hand, an important aspect of AI technologies is their functionality to offer personalized information to consumers (Sands et al. 2022a, b). While personalization can be seen as a benefit of AI, it can also be seen as a threat where machines and their developers perhaps know too much about the individual, thus harming the psychological safety of the individual and causing privacy concerns (Kronemann et al. 2023). In the context of Human–AI Virtual Influencer Interaction, consumers may express privacy concerns since AI-based virtual influencers powered by machine learning and deep learning technologies, unlike human influencers, have the capacity to access and process big data on individual consumers' preferences and behavioral patterns. Furthermore, individuals who have a stronger need for belongingness may view AI-based robots as a potential threat to their social connections with other humans (Liang and Lee 2017). Therefore, followers and non-followers of AI-based virtual influencers may be different with regard to perceived benefits and threats of AI to humanities. Based on the conceptual frameworks discussed so far, this research first asks the following research question (RQ) regarding the comparison between followers versus non-followers of AI-based virtual influencers.

RQ Are there differences between followers and non-followers of AI-based virtual influencers with regard to (1) AI-based virtual influencers' perceived existential threat to human identities, (2) AI awareness, (3) perceived functional benefits of AI-based virtual influencers' personalization, (4) the need to belong, and (5) behavioral intention to use AI-based virtual influencers in the near future?

2.3 AI and threatened selves

The dark side of AI and its existential threats to human identities have become an important agenda in the HAII literature (Cao et al. 2023; Shin 2023; Shin and Ahmad 2023; Youn and Jin 2021). Human oversight is an integral principle of designing human-centered AI (Shin 2023; Shin and Ahmad 2023). The need for a human-centered framework for AI research and practice has emerged to address the ethical, practical, and legal issues with generative AI chatbots such that AI can ultimately augment, empower, and enrich human experiences rather than replacing human capacity (Shin and Ahmad 2023). One of the key attributes of

AI-powered chatbots that has received significant attention from AI researchers and developers is anthropomorphism. Anthropomorphism influences the perception of human users about whether they are conversing with a human or an algorithm (Shin 2022). For example, robots with high levels of anthropomorphism (Jin and Youn 2021; Lee et al. 2006) have blurred the boundaries between what is viewed as "machine" and what is defined as "human" and may undermine people's trust in their own human identities and uniqueness (Jin 2023; Singh et al. 2021a, b; Youn and Jin 2021). Thus, the humanoid nature of AI-based virtual influencers may impose threats to human identities (Jin 2023).

Human–robot interaction (HRI) has received growing attention in light of the crucial role it plays in the burgeoning market for intelligent personal service and entertainment robots (Bruemmer and Swinson 2003; Singh et al. 2021a). HRI, taking cues from Human–Computer Interaction (HCI), introduces autonomy, physical proximity, and ability to take decisions in addition to HCI techniques for a robotic system, thus making HRI a distinct domain for theory and research (Singh et al. 2021a). Prior research on human–robot interaction (HRI) has investigated identity threat as a mediator by examining the relationship between the type of interaction (humanoid robots versus human employees) and compensatory consumption (Mende et al. 2019). In the HRI domain, the representation of AI-powered robots and the attribution of human-like characteristics to them can influence human users' behaviors and attitudes toward towards these artificial agents (Jin 2023; Lee et al. 2006; Spatola and Cherif 2023). Experimental studies show that interaction with humanoid service robots elicit higher consumer discomfort such as threats to human identity, which in turn induces the enhancement of compensatory consumption (Mende et al. 2019). Therefore, AI-powered, humanoid virtual influencers' threat to human identities can be hypothesized as the underlying process driving behavioral intention to use AI-based virtual influencers as a compensatory consumption behavior. The proposed mediation model is visually presented in Fig. 1.

H1 AI-based virtual influencers' perceived threat to human identities mediates the relationship between the following status (following versus non-following of virtual influencers) and behavioral intention to use AI-based virtual influencers in the near future.

2.4 Need to belong and empty selves

According to Cushman (1990), "the "*empty self*" is a version of the self that emerged in the West in the last half of the twentieth century due to a confluence of sociocultural, psychological, economic, and demographic changes" (Reeves et al. 2012, p. 675). "The empty self is soothed

Fig. 1 The mediating effect of virtual influencers' threat to human identity (H1)

X: Independent Variable (IV)
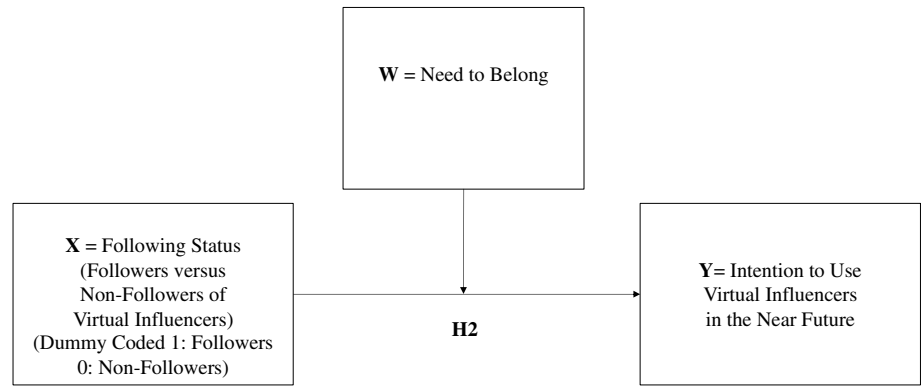M: Mediating Variable (MeV)
Y: Dependent Variable (DV)
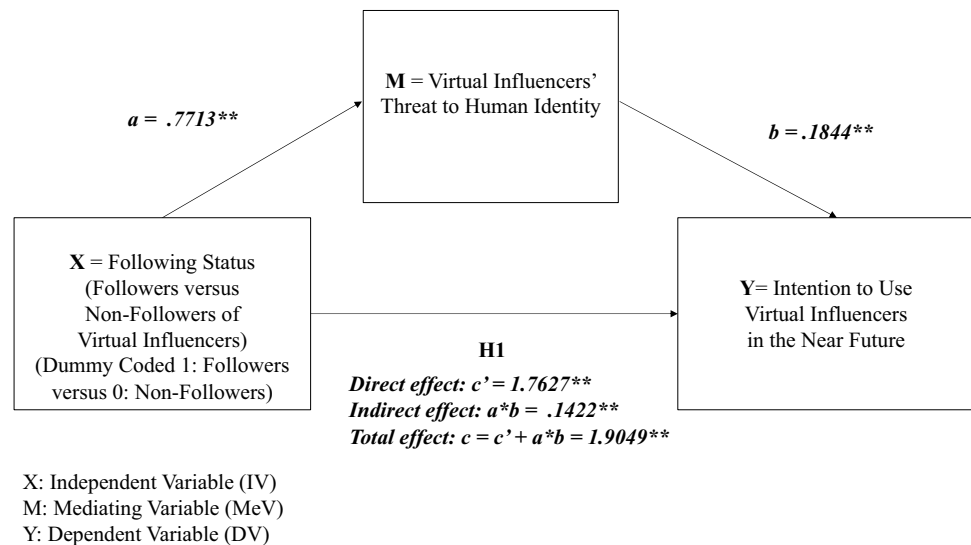
and made cohesive by becoming 'filled up' with food, consumer products, and celebrities" (Cushman 1990, p. 599), thus implicating the relevance of the empty self to compensatory consumption mechanisms in marketing and branding. Furthermore, "the empty self is plagued by a loss of a shared sense of community and meaning, isolation, values confusion, depression, low self-esteem, and poor relationships with others, among other characteristics" (Reeves et al. 2012, p. 675), which signifies its relevance to need to belong and desire to compensate for social exclusion in AI-driven digital transformation and AI-driven digital marketing. Socially excluded consumers feel psychologically empty and consequent motivation to "fill up" this emptiness (Henley 2002) results in certain behaviors that can "metaphorically provide a sense of inner filling and temporarily lessen the negative feeling of emptiness" (Su et al. 2019, p. 809). Lonely people who lack social connections with other humans and who have a higher need for belonging tend to compensate by connecting with non-human agents (Epley et al. 2008; Hu et al. 2023). In the context of HAII, for example, some conversational AI chatbots are programmed to show empathy and provide psychological therapeutic suggestions to users, thereby fulfilling their needs for belonging and social interaction (Jin and Youn 2023; Skjuve et al. 2021). Therefore, it can be hypothesized that there will be two-way interaction effects between the following status and the need to belong on intention to use AI-based virtual influencers. More specifically, it is reasonable to predict that non-followers of virtual influencers will show low behavioral intention to use AI-based virtual influencers in the near future regardless of the level of need to belong. In contrast, followers of virtual influencers will show higher behavioral intention to use AI-based virtual influencers when their need to belong is higher. The proposed moderation model is visually presented in Fig. 2 (top).

H2 The need to belong moderates the relationship between the following status (following versus non-following of virtual influencers) and behavioral intention to use AI-based virtual influencers in the near future.

2.5 Empty selves benefiting from AI-based virtual influencers' personalization

Perceived personalization refers to a consumer's recognition that information is personalized and tailored for that specific consumer (Vesanen 2007). Personalization is positively correlated with persuasive power as it appeals to the needs and interests of the individual consumers (Smink et al. 2020). A personalized human–robot interaction (HRI) can increase the acceptance of robots through positive effects on the user experience (UX) (Pollmann et al. 2023). AI-based virtual influencers' personalization can be operationally defined as how much and how easily AI-based virtual influencers can be tailored to individual customers' preferences, histories, and ways of shopping (Smink et al. 2020; Zeithaml et al. 2000; Xu et al. 2011). Empirical research shows that AI-based virtual influencers are perceived as being able to personalize contents or recommendations (Sands et al. 2022a, b) and consumers are becoming increasingly comfortable with AI recommendation systems (Kim et al. 2021). Consumers' perceived personalization benefits of AI-based virtual influencers can mediate the relationship between the following status and behavioral intention to use AI-based virtual influencers. While perceived personalization can be hypothesized as an underlying process, the need to belong can be hypothesized as a moderator because AI-based virtual influencers may enable consumers to feel their personal needs can be fulfilled by customized and tailored AI-based technologies, which can induce behavioral

Fig. 2 The moderating effect of need to belong (H2)

X: Independent Variable (IV)
W: Moderating Variable (MoV)
Y: Dependent Variable (DV)
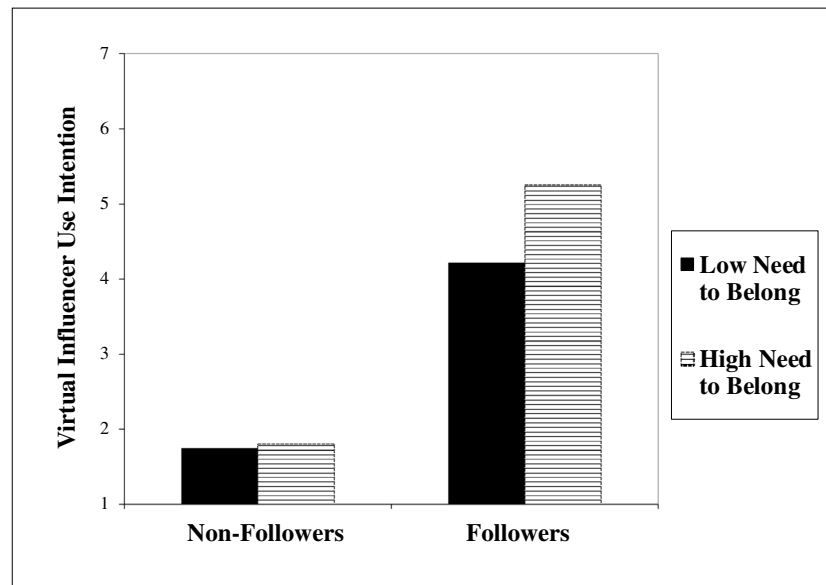
intention to use virtual influencers. The proposed moderated mediation model is visually presented in Fig. 3 (top).
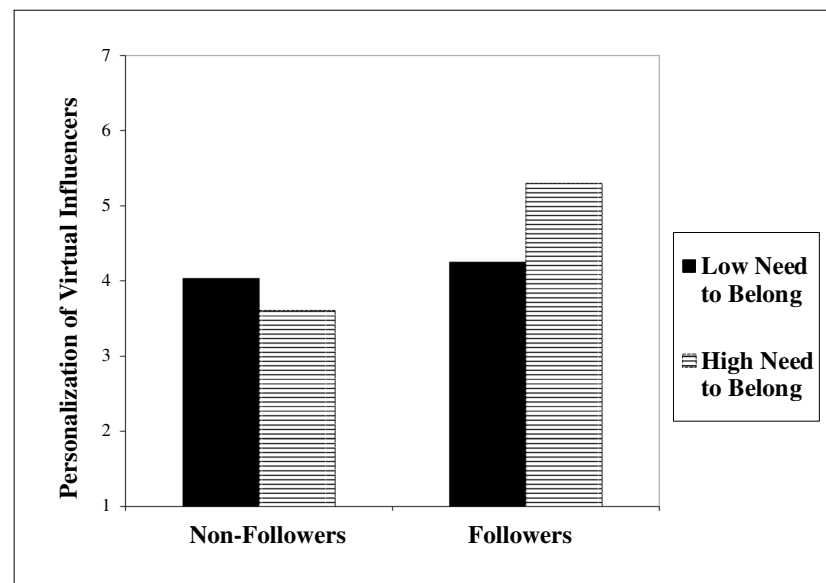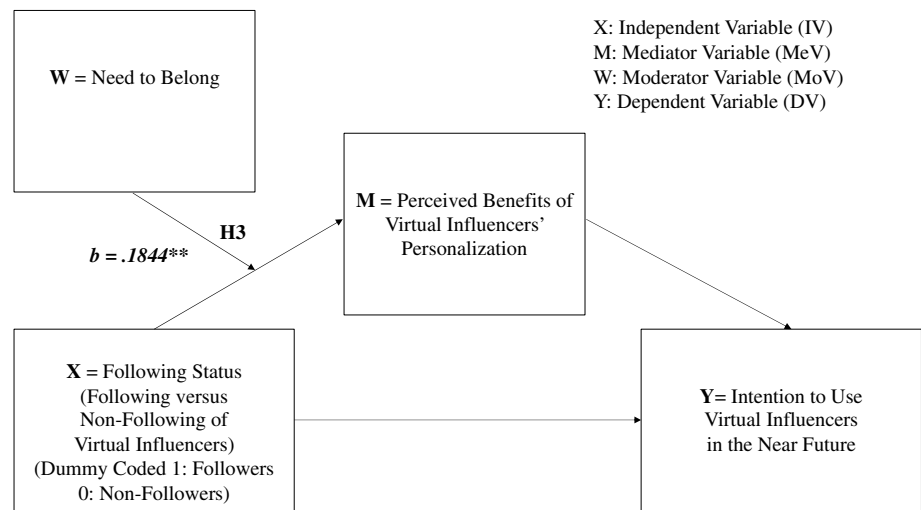
H3 The mediating effect of perceived benefits of personalization of AI-based virtual influencers on the relationship between the following status (following versus non-following of virtual influencers) and behavioral intention to use AI-based virtual influencers in the near future is moderated by the need to belong.

3 Methods

3.1 Research design and participants

Data were collected using a cross-sectional self-report survey constructed on the Qualtrics platform. Participants were recruited from the CloudResearch Prime Panel. CloudResearch Prime Panel participants are more

Fig. 3 The moderated mediating effects of need to belong and personalization benefits (H3)

X: Independent Variable (IV)
M: Mediator Variable (MeV)
W: Moderator Variable (MoV)
Y: Dependent Variable (DV)

diverse and produce larger effect sizes compared to the MTurk population, which has been potentially overused and some of whose groups relevant to behavioral sciences are underrepresented (Chandler et al. 2019). Out of 500 USA residents recruited, 438 respondents successfully passed attention check test questions and completed the entire survey (gender composition: 45.7% females, 53.7% males, .5% others, .1% preferred not to answer; Age: *Mean* Age = 42.65, *Median* Age = 40.00, *SD* Age = 15.224; Ethnic composition: 66.7% White/Caucasian, 16.8% Black/African American, 7.2% Hispanic/Latin American, 5.1% Asian/Asian Indian, .9% American Indian/Alaska Native, .6% Native Hawaiian/Pacific Islander, 2.1% Mixed, .6% preferred not to answer).

3.2 Variables and measurements

The participants' following status (followers versus non-followers of AI-based virtual influencers) was measured with one question ("Have you ever followed AI-based virtual influencers on social media?") and was dummy coded: "Yes" (followers [1]) versus "No" (non-followers [0]).

Virtual influencers' threat to human identity, as a dependent variable for the multivariate analysis of variance (MANOVA: RQ1) and as a mediator for the mediation model (H1), was measured with five items modified from the existing measures (e.g., "AI-based virtual influencers make human influencers less important", "AI-based virtual influencers threaten human influencers'

very existence", "AI-based virtual influencers make human influencers worry about their own job security", Cronbach's alpha = .881) (Mende et al. 2019).

AI awareness, as a dependent variable for the MANOVA (RQ2), was measured with four items (e.g., "Given that AI is being widely used in the workplace, I'm concerned about my future in various industry sectors", " I think there is a possibility that my current job will be replaced by AI", "Given that AI is being widely used in the workplace, I'm concerned about my future in the organization", Cronbach's alpha = .907) (Brougham and Haar 2018).

Perceived benefits of AI-based virtual influencers' personalization, as a dependent variable for the MANOVA (RQ3) and as a mediator for the moderated mediation

model (H3), was measured with three items ("AI-based virtual influencers in online shopping can provide me with personalized deals/ads tailored to my specific needs", "AI-based virtual influencers in online shopping can provide me with more relevant promotional information tailored to my preferences or personal interests", "AI-based virtual influencers in online shopping can provide me with the kind of deals/ads that I might like", Cronbach's alpha = .914) (Lalicic and Weismayer 2021; Xu et al. 2011).

Need to belong, as a dependent variable for the MANOVA (RQ4) and as a moderator for the moderation model (H2) and the moderated mediation model (H3), was measured with three items ("I do not like being

Table 1 List of variables with the number of items, results of reliability testing (Cronbach's Alpha), and sample measurement items

Variable	Number of items	Cronbach's Alpha	Sample measurement items
Virtual influencer following status	1		"Have you ever followed AI-based virtual influencers on social media?"
			Dummy coded: "Yes" (followers [1]) versus "No" (non-followers [0])
Virtual influencers' threat to human identity (RQ1 and H1)	5	.881	"AI-based virtual influencers make human influencers less important",
			"AI-based virtual influencers threaten human influencers' very existence",
			"AI-based virtual influencers make human influencers worry about their own job security"
AI awareness (RQ2)	4	.907	"Given that AI is being widely used in the workplace, I'm concerned about my future in various industry sectors",
			"I think there is a possibility that my current job will be replaced by AI",
			"Given that AI is being widely used in the workplace, I'm concerned about my future in the organization"
Virtual influencers' personalization benefits (RQ3 and H3)	3	.914	"AI-based virtual influencers in online shopping can provide me with personalized deals/ads tailored to my specific needs",
			"AI-based virtual influencers in online shopping can provide me with more relevant promotional information tailored to my preferences or personal interests",
			"AI-based virtual influencers in online shopping can provide me with the kind of deals/ads that I might like"
Need to belong (RQ4, H2, and H3)	3	.823	"I do not like being alone",
			"I have a strong need to belong",
			"I try hard not to do things that will make other people avoid or reject me"
Intention to use virtual influencers (RQ5, H1, H2, and H3)	3	.945	"I intend to utilize AI-based virtual influencers in the near future",
			"I plan to use AI-based virtual influencers in the near future",
			"I will definitely use AI-based virtual influencers in the near future"

The participants' following status (followers versus non-followers of AI-based virtual influencers) was measured with one question and was dummy coded: "Yes" (followers [1]) versus "No" (non-followers [0]). All the continuous variables were operationalized and measured using the items from existing scales, using 7-point Likert scales (ranging from "Strongly Disagree" [1] to "Strongly Agree" [7])

alone", "I have a strong need to belong", "I try hard not to do things that will make other people avoid or reject me", Cronbach's alpha = .823) (Leary et al. 2013).

Intention to use AI-based virtual influencers, as the key dependent variable (RQ5, H1, H2, and H3), was measured with three items modified from the behavioral intention scale ("I intend to utilize AI-based virtual influencers in the near future", "I plan to use AI-based virtual influencers in the near future", "I will definitely use AI-based virtual influencers in the near future", Cronbach's alpha = .945) (Venkatesh et al. 2008).

The measurement items for all the variables and reliability test results are presented in Table 1.

3.3 Data analysis

Data analysis was conducted using SPSS and Hayes' PROCESS macro (version 4.2) (Hayes 2022).

4 Results

4.1 Descriptive statistics and bivariate correlation

Descriptive statistics and bivariate correlation matrix are presented in Table 2.

4.2 MANOVA model (RQ): differences between followers and non-followers

One-way multivariate analysis of variance (MANOVA) was conducted to determine whether there are differences between followers ($N_1 = 121$) and non-followers ($N_2 = 317$) of virtual influencers with regard to (a) perceived threat to human identities, (b) AI awareness, (c) perceived benefits of AI-based virtual influencers' personalization, (d) the need to belong, and (e) intention to use AI-based virtual influencers in the future. There was a significant effect of the following status on all the dependent variables, $F = 14.890$, $p < .001$, Wilks' lambda = .806, partial eta squared = .194, observed power = 1.00, thus properly answering the RQ. The results

Table 2 Descriptive statistics and bivariate correlation matrix

Variable	Mean (M)	Standard deviation (SD)	1. THI	2. AIA	3. VIP	4. NTB	5. UVI
1. Virtual influencers' threat to human identity (THI)	4.014	1.661	1				
2. AI awareness (AIA)	3.672	1.789	.463**	1			
3. Virtual influencers' personalization benefits (VIP)	4.510	1.704	.267**	.172**	1		
4. Need to belong (NTB)	4.308	1.729	.249**	.350**	.286**	1	
5. Intention to use virtual influencers (UVI)	3.705	1.984	.236**	.410**	.570**	.376**	1

**$p < .01$

Table 3 Significant univariate effects of followers/non-followers and pairwise comparison (RQ)

Dependent variable	F	Following status	Means (M)	Standard deviation (SD)	95% confidence interval		Pairwise comparison (mean difference)	Standard error (SE)
					Lower bound	Upper bound		
Virtual influencers' threat to human identities	13.852***	Non-followers	3.698	1.581	3.489	3.906	.761***	.204
		Followers	4.459	1.693	4.115	4.803		
AI awareness	25.476***	Non-followers	3.406	1.714	3.186	3.626	1.088***	.216
		Followers	4.494	1.658	4.131	4.857		
Virtual influencers' personalization benefits	16.102***	Non-followers	4.238	1.658	4.028	4.448	.825***	.206
		Followers	5.063	1.511	4.171	5.408		
Need to belong	17.140***	Non-followers	4.001	1.660	3.787	4.216	.869***	.210
		Followers	4.871	1.640	4.517	5.224		
Intention to use virtual influencers	65.552***	Non-followers	3.188	1.847	2.958	3.418	1.824***	.225
		Followers	5.012	1.566	4.633	5.391		

***$p < .001$

of additional univariate tests and pairwise comparisons are presented in Table 3.

4.3 Mediation model (H1): AI-based virtual influencers and threatened selves

The mediation effect of AI-based virtual influencers' threats to human identities as a continuous variable, on the relationship between the following status (followers versus non-followers of virtual influencers), as the categorical dummy variable, and behavioral intention to use AI-based virtual influencers in the future, as the dependent variable, was tested using PROCESS (version 4.2) Model 4 (Hayes 2022). The results revealed a significant indirect effect of threat to human identities on intention to use virtual influencers (effect = .1422, BootLLCI [upper bound confidence interval] = .0325, BootULCI = .2912 [lower bound confidence interval]), supporting H1. Furthermore, the direct effect of the following status on intention to use AI-based virtual influencers in the presence of the mediator was also found significant (effect = 1.7627, t = 8.4902, p = .000, Boot-LLCI [upper bound confidence interval] = 1.3545, Boot-ULCI = 2.1709 [lower bound confidence interval]). Therefore, virtual influencers' threat to human identities partially mediated the relationship between the following status and

intention to use AI-based virtual influencers, as presented in Table 4 (top) and Fig. 1.

4.4 Moderation model (H2): need to belong and empty selves

The moderation effect of the need to belong as a continuous variable, on the relationship between virtual influencer following status (followers versus non-followers), as the categorical variable, and intention to use AI-based virtual influencers in the near future, as the dependent variable, was tested using PROCESS (version 4.2) Model 1 (Hayes 2022). The results revealed a significant moderating effect of need to belong (b = .2457, t = 2.0033, p < .05), supporting H2. The nature of the moderating effect is graphically presented in Fig. 2 (bottom). For non-followers, the need to belong had no impact on intention to use AI-based virtual influencers in the near future. In contrast, for followers of virtual influencers, the need to belong had a significant impact such that those with higher need to belong indicated greater intention to use AI-based virtual influencers compared to those with lower need to belong, thus supporting the proposed two-way interaction effects of following status and need to belong on AI-based virtual influencer use intention, as presented in Fig. 2 (bottom).

Table 4 Mediation analysis (PROCESS Model 4: H1 [top]) and moderated mediation analysis (PROCESS Model 7: H3 [bottom])

Direct relationships (PROCESS Model 4)	Coefficient	t value	p value
Following status (FS) → AI-based virtual influencers' threat to human identity (THI)	.771	4.198	.000
AI-based virtual influencers' threat to human identity (THI) → intention to use AI-based virtual influencers (UVI)	.184	3.261	.001
Following status (FS) → intention to use AI-based virtual influencers (UVI)	1.763	8.490	.000
Indirect relationship (H1)	Coefficient	Confidence interval	
		Upper	Lower
Following status (FS) → AI-based virtual influencers' threat to human identity (THI) → intention to use AI-based virtual influencers (UVI)	.142	.033	.291
Direct relationships (PROCESS MODEL 7)	Coefficient	t value	p value
Following status (FS) → perceived benefits of AI-based virtual influencers' personalization (PBP)	.478	2.517	.012
Perceived benefits of AI-based virtual influencers' personalization (PBP) → intention to use AI-based virtual influencers (UVI)	.591	12.329	.000
Following status (FS) → intention to use AI-based virtual influencers (UVI)	1.387	7.749	.000
Following status (FS) * need to belong (NTB) → perceived benefits of AI-based virtual influencers' personalization (PBP)	.369	3.299	.001
Moderated mediation (H3)	Index of moderated mediation	Confidence interval	
		Upper	Lower
Following status (FS) * need to belong (NTB) → perceived benefits of AI-based virtual influencers' personalization (PBP) → intention to use AI-based virtual influencers (UVI)	.218	.058	.382

4.5 Moderated mediation model (H3): empty selves benefiting from AI-based virtual influencers' personalization

Moderated mediation model, with the need to belong as the moderator, and perceived benefits of personalization of AI-based virtual influencers as the mediator, was tested using PROCESS (version 4.2) Model 7 (Hayes 2022). The index of moderated mediation (index = .2178, 95% confidence interval = BootLLCI [lower] = .0578, BootULCI [upper] = .3815) is significant, thus supporting H3. The results of moderated mediation analysis are presented in Table 4 (bottom) and the two-way interaction effects between the following status and need to belong on perceived benefits of AI-based virtual influencers' personalization are graphically presented in Fig. 3 (bottom). For those with lower need to belong, the following status had no effect on perceived benefits of AI-based virtual influencers' personalization. In contrast, for those empty selves with higher need to belong, followers' perceived personalization benefits of AI-based virtual influencers were higher than non-followers.

5 Discussion

5.1 Theoretical contributions

5.1.1 Diffusion of AI-powered virtual influencers

This study is perhaps one of the first to conduct a deep analysis on followers and likely users of AI-based virtual influencers. Using data gathered from a cross-sectional survey, the study reveals several important insights. Regarding the main research question (RQ) posed, there were statistically significant differences between current followers and non-followers of AI-based virtual influencers such that followers showed (1) higher perceived threats to human identities by virtual influencers; (2) higher AI awareness; (3) higher personalization benefits of AI-based virtual influencers; (4) higher need to belong; and (5) higher intention to use AI-based virtual influencers (as shown in Table 3). This research is one of the first attempts to empirically verify the differences between adopters and non-adopters of AI-based virtual influencers with regard to the variables relevant to the theoretical discourses about cultural, social, cognitive, and philosophical implications of AI technologies for human societies. With regard to theoretical contributions to the literature on diffusion of innovation (Rogers 2003), this research not only confirms different characteristics between early adopters and non-adopters of emerging technological innovations (i.e., AI-based virtual influencers) but also adds original findings about (1) perceived benefits and threats of AI-based virtual influencers as significant mediators; (2) need to belong as a

significant moderator, and (3) AI awareness to the literature on variables relevant to behavioral intentions to adopt AI-based technological innovation.

5.1.2 Existential threat to human identities and compensatory mechanism

Interestingly, AI-based virtual influencers' threat to human identities was a significant mediator of the relationship between the following status and behavioral intention to use virtual influencers as a compensatory mechanism (as presented in Fig. 1), thus adding empirical evidence about the role of human identity threat perception to provocative discourses on ideological approaches to AI technologies in human societies and contemporary Web 3.0 environments (Puntoni et al. 2021; Youn and Jin 2021). The extent to which people perceive the threats of AI-based virtual influencers was, ironically, positively correlated with behavioral intentions to adopt AI-based virtual influencers. Preliminary findings from this research can provoke even more sophisticated philosophical discourses on human intelligence versus artificial intelligence and transhumanism, referring to "a philosophical movement that deals with and promotes the development of technologies that aim to strongly enhance human psychological (especially cognitive) and physical capacities" (Neubauer 2021, p. 2). Can AI-based virtual influencers (1) replace human influencers; (2) enhance human cognitive and physical capacities, and (3) ultimately project the future version of transformed humans from the transhumanist perspective? What are the societal, political, and cultural implications of such transhuman beings and what are possible positive and negative consequences of such transformed beings? Thus, the current research may prompt relevant research investigations and further stimulate philosophical discussions about human beings versus artificial beings in the age of AI-empowered digital marketing and AI-driven digital transformation.

5.1.3 Need to belong in HAII and HRI

This survey research also examined how the need to belong moderates an individual's intention to use AI-based virtual influencers, thus reconfirming the role of need to belong previously examined in the context of consumers' interaction with traditional media figures (Greenwood and Long 2011) and social media influencers (Alabri 2022) as well as expanding the scope of research on need to belong to the novel domain of Human–AI Virtual Influencer Interaction. The moderating role of need to belong, as an emotional component, in the emerging realm of consumers' interaction with AI-based virtual influencers (as graphically shown in Fig. 2) is an original finding that also contributes to the literature on human-centered AI (Shin 2023; Shin and Ahmad

2023), HAII (Jin and Youn 2021, 2023; Shin et al. 2022), and "feeling AI" (Huang et al. 2019; Huang and Rust 2022). Furthermore, this research examined how this need may serve as a boundary condition in individuals' perceptions of the benefits and threats emanating from AI-based virtual influencers (as graphically shown in Fig. 3). The study provides data on how these perceptions ultimately affect an individual's intention to use AI-based virtual influencers, thus attempting to theoretically integrate the psychology literature on need to belong and the literature on diffusion of innovation in the emerging domain of HAII.

5.2 Practical and managerial implications

5.2.1 Implications for market strategy and market segmentation

The present study also has important implications for practitioners. The empirical data clearly reveal the important roles that need for belonging plays in affecting perceptions and the use of AI-based virtual influencers. It is, therefore, important for AI-based virtual influencers to have a persona that is welcoming and inclusive. Unless individuals who are looking for interaction on social platforms feel that they can associate themselves with the persona of a virtual influencer, they are unlikely to see the benefits that they might obtain from an AI-based virtual influencer and may, in fact, heighten the phobia about humanoid virtual influencers. From a marketing strategy point of view, it is important for organizations that use AI-based virtual influencers to be clear about the persona and positioning of their virtual influencer as well as to highlight the values of the segment they seek to target and persuade.

5.2.2 Practical benefits and psychological threats of AI virtual influencers

Another important finding of this study is that consumers' perception of the benefits and threats that accrue from an AI-based virtual influencer can be shaped by helping the consumers identify themselves with the brand and the virtual influencer as the brand's endorser or spokesperson. In other words, individuals are evaluating not only the functional and utilitarian attributes of a virtual influencer but also the extent to which a virtual influencer plays a role in their lives either positively (e.g., emotional connection and support [Chaturvedi et al. 2023; Pesty and Duhaut 2011; Yen et al. 2023]) or negatively (e.g., social isolation, loneliness, and identity threat [Cox 2023; Jin 2023; Youn and Jin 2021]). While consumers today follow multiple personalities on social networking sites, their level of engagement is dependent on the extent to which they can identify themselves with the digital

personas and the positive or negative role these personas could play in consumers' own lives.

5.2.3 Tackling the loneliness epidemic in HAII

It's becoming increasingly important for AI designers to reflect on "the interactional affordances, the unique relational possibilities, and the wider social implications of AI systems" (Murray-Rust et al. 2023) as well as on fairness and transparency (Shin et al. 2022). In Human–AI Interaction and Human–AI Relations whereby deep understanding of interactions between humans and technological systems is crucial, considering "social, political, ethical, cultural, and environmental factors of implementing AI into daily human-to-computers interactions" from a humanist perspective has become an integral part of AI designers' roles (Wong 2018, p. 42). Empirical data and findings from the current research can provide insights on how to tackle the issue of "*threatened and empty selves*" in the age of AI-driven digital transformation (Cox 2023) where addressing the loneliness epidemic and identity threats is an important mission for AI theorists (Jin 2023; Youn and Jin 2021), AI designers/developers (Murray-Rust et al. 2023), marketers (Kiron and Unruh 2019), scholars (Merrill Jr et al. 2022), healthcare professionals (Yen et al. 2023), and educators (Benvenuti et al. 2023).

5.3 Limitations and direction for future research

5.3.1 Mixed-method design and characteristics of different categories of adopters

Several limitations of the current research need to be discussed as constructive suggestions for this line of future research. This is one of the earliest studies on AI-based virtual influencers and does have its limitations. For instance, the study is based on a quantitative cross-sectional survey and future studies can examine actual engagement behavior between consumers and AI-based virtual influencers using mixed-method design with field experiments, longitudinal panels, and qualitative in-depth interviews. While this study has focused on the need for belonging and perceived threats and benefits of AI drawing from previous studies (Alabri 2022; Sands et al. 2022a, b; Jin 2023; Jin and Youn 2021; Youn and Jin 2021), it is possible that there might be other factors that determine the adoption of AI-based virtual influencers such as materialism, consumerism, and creative inspiration (Lee et al. 2022) as well as perception of fairness and transparency of AI algorithms (Shin et al. 2022). Furthermore, it would be meaningful to examine the different factors that impact early adopters and late adopters of AI-based virtual influencers. According to the literature on product life cycle and diffusion of innovation, late adopters often

follow enthusiastic early adopters (Antony et al. 2023; Rogers 2003; Saari et al. 2022). It would be stimulating to see if and to what extent early adopters are able to influence late adopters' use of AI-based virtual influencers. For example, are early adopters able to significantly alleviate the notions of threat or phobia that late adopters might have about AI-based virtual influencers? In this context, it is important to conduct longitudinal studies that can capture the changing perceptions that different categories of adopters (e.g., tech enthusiast innovators, visionary early adopters, pragmatist early majority, conservative late majority, and skeptic laggards) (Rogers 2003) have about AI-based virtual influencers over time.

5.3.2 Brand-AI influencer-fit and ChatGPT-powered virtual influencers

In branding literature, the 'fit' between collaborating partners (e.g., between multiple brands in co-branding campaigns or between a brand and its celebrity endorser in advertisements) is an important factor that drives consumer decision-making (Moon and Sprott 2016; Walchli 2007). Future studies, employing mixed-methods design with surveys, experiments, and in-depth interviews, can examine the extent to which the fit between the brand and the persona of the AI-based virtual influencer endorser is a driver of human perception and consumer decision-making. The effectiveness of content marketing with AI-based virtual influencers would be an area of potentially high research interest in the near future. While AI-based virtual influencers today communicate with significant human support and intervention in the backend, it would be interesting to see how generative AI (GAI) algorithms such as ChatGPT (Fecher et al. 2023) embedded in AI-based virtual influencers enable large-scale personalization and diffusion of content.

5.3.3 The potential of AI-powered virtual influencers for multiple domains beyond branding

While the current research was mainly motivated by the branding and marketing literature in light of the success stories of AI-based virtual influencers in the domain of digital marketing and influencer marketing, the measurement items used in the survey questionnaire were rather generic than specific to marketing, which is a strength with regard to generalizability, but simultaneously a weakness with regard to the tie between the theoretical angle and the actual empirical data. Building upon the strength (the potential to be generalized beyond the marketing domain), follow-up studies can further extend the scope of research on AI virtual influencers to include various domains such as education (Gil-Quintana

and Vida de Leon 2021), religion (Myers et al. 2023), healthcare (Khadija et al. 2021; Sokolova and Perez 2021), and so forth beyond marketing and retailing. To address the limitation (too generic measurement items), follow-up studies need to construct survey questionnaires that specify the domain and context of AI-based virtual influencers as well as the purpose of using AI-based virtual influencers (e.g., AI-generated spokespersons for marketing; AI-generated celebrities for entertainment; AI tutors and mentors for education; AI gurus and spiritual leaders for religion; AI health consultants, AI-powered health chatbots, AI nurses, and AI fitness influencers for healthcare, etc.).

6 Conclusion

Despite several caveats, the present research provides empirical data on the different characteristics of followers and non-followers of AI-based virtual influencers as well as on the significant mediating mechanisms (perceived threats to human identities and perceived benefits of AI-based virtual influencers' personalization) and the moderating variable (need to belong) relevant to behavioral intentions to adopt AI-based virtual influencers. In conclusion, while this study makes important contributions, it also sets the direction for future work on AI-based virtual influencers in the emerging market and in AI-driven digital transformation.

Declarations

Conflict of interest No competing financial interests exist.

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