The effect of different types of virtual influencers on consumers' emotional attachment

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ABSTRACT

A virtual influencer (VI) is a computer-generated, imagery-based digital character. It has become one of the hottest marketing trends, motivating researchers to investigate how consumers perceive VIs. However, consumers' emotional attachment and benefit seeking behaviour to different types of VIs has remained under-investigated. Therefore, considering the level of perceived humanness and appearance realism, this research examines how consumers' emotional attachment and benefit seeking differs across the three types of VI (i.e., mimic-human VI, animated-human VI, and non-human VI). We further propose that VIs may influence consumer emotional attachment and different benefit seeking behaviour through social presence because, specifically, when a VI shows a higher level of social presence, a higher level of emotional attachment and stronger benefit seeking behaviour will result. The experimental studies lend support to our theorization. This research provides insights into the different types of VIs in marketing literature and extends the context of social presence theory.

1. Introduction

A virtual influencer (VI) is a computer-generated character that is often visually indistinguishable from a human and interacts with the world from the first-person perspective as a social media influencer (Choudhry et al., 2022). VIs have advantages over humans (e.g., absence of scandals), and their social media content is easily managed (Statista, 2022). In the United States, 58 % of respondents have followed a VI, and the popularity of these avatars is highest among Gen Z, 75 % of whom admit to following VIs (Statista, 2022). Lil Miquela (@lilmiquela), one of the best-known VIs, had 3 million followers on Instagram and 3.6 million followers on TikTok in August 2022 (Statista, 2022). With these statistics revealing the substantial marketing power of VIs, are consumers emotionally attached to them? If so, how? What benefits do consumers seek from them?

Scant research has attempted to systematically analyse the effect of different types of VIs. Most literature has focused largely on VIs in general or on mimic-human VIs, with only a few focus on animated-human and non-human VIs. While many VIs look like humans in appearance, animated-human and non-human VIs are no less influential. Because animated-human and non-human VIs can offer a rich variety of styles and storylines and have gained a large volume of social media followers, they have great potential in marketing (Virtual Humans, 2022a). For example, @Janky and @Guggimon together had 2.3 million followers on Instagram in 2020 (Ong, 2020). However, the theoretical difference between different VI types, especially mimic-human (i.e., human-like VIs), animated-human, and non-human VIs, is lacking. Given the increasing importance of influencer marketing, a better understanding of the effect of the categorization of VI types on consumer responses can help researchers clarify the theoretical difference of the various types of VIs in influencer marketing literature and assist companies in improving the outcome of relevant investments.[3]

Moreover, previous research on VIs has mainly focused on the effects of VIs on consumer response from behavioural and cognitive

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perspectives (e.g., parasocial interaction, purchase intention, source credibility) (Choudhry et al., 2022; Rosário & Loureiro, 2021). Studies have paid much less attention on the affective perspective, such as emotional attachment. Emotional attachment is vital in marketing research not only because it extends the understanding of VI on consumer perception but also because it is closely related to brand attachment, which leads to consumer loyalty and eventually helps companies achieve sustainable financial performance (Audi et al., 2015; Li, Xiong, Mariuzzo, & Xia, 2021). However, the mechanism of the effect of different types of VIs on emotional attachment remains unknown. Moreover, the behavioural perspective of VI literature is mostly limited to purchase intention and usage intention (e.g., Gerlich, 2023; Kim et al., 2020), but little attention has been paid to a deeper understanding of behavioural response such as benefit seeking for different type of VIs. We focused on four benefit seeking of following VIs, which are authenticity (VIs are genuine, relatable, and the desire to connect with them on a personal level), information (actively seeking information from influencers), envy and entertainment (seeking entertainment and fanticising over other's lifestyle), and inspiration (liking the visual or aesthetic aspect of contents) (Lee et al., 2022; Lou et al., 2023).

To fill these gaps, we investigate two research questions. *How does consumers' emotional attachment and benefit seeking behaviour differ across mimic-human, animated-human, and non-human VIs? What is the underlying mechanism of the effect of VIs on emotional attachment and benefit seeking?*

This research classifies VIs into three categories on the basis of their level of perceived humanness and appearance realism: mimic-human, animated-human, and non-human VIs. Building on the prior studies, we propose that consumers will perceive the three types of VIs differently in terms of emotional attachment and benefit seeking behaviour (Choudhry et al., 2022; Oh et al., 2018; Lee et al. (2022)). Moreover, we argue that social presence is the primary underlying theoretical mechanism of the effect of VIs on emotional attachment and benefit seeking behaviour. Social presence theory explains how digital interfaces influence the sense of "being with others" and how these interfaces differ in their ability to convey psychological perception and distance (Biocca et al., 2003). For example, students' sense of being with a professor differs depending on the way the professor communicates. A professor can communicate with students via email, voice recording and video recording (e.g., online teaching), or face-to-face teaching. Students' sense of being with the professor will vary from low to high, and in turn, the level of social presence will vary from low to high. In line with social presence theory, we refer to *social presence* as the sense of being with VIs in a virtual environment such as social media (Biocca et al., 2003), and we propose that animated-human and non-human VIs will show a higher level of social presence than mimic-human VIs.

This research contributes to the VI literature in two folds. First, we shed light on the indirect effect of different VI types on emotional attachment and theoretically position social presence as the mediator. This proposition is based on the logic that different VIs engender different levels of social presence; a stronger social presence gives rise to stronger emotional attachment, and therefore VIs showing a stronger social presence will generate stronger emotional attachment. While previous research has mostly examined social presence in the context of live streaming e-commerce, online teaching, and communication interface such as the design of the software and technical device (e.g., Jin et al., 2021; Keil & Johnson, 2002), we bring the theoretical lens of cognitive aspect of social presence theory to the context of VI, which strengthens VI literature. Prior research has different views on the effect of anthropomorphism on social presence, and we try to solve controversy of the effect of anthropomorphism on social presence by revealing that mimic-human VI has lower level of social presence than animated- and non-human VIs because of heavier cognitive load and uncanny valley effect for mimic-human VIs. Second, we demonstrate that social presence is also a theoretical mechanism of the effect of VIs on a novel touch of behavioural perspective, i.e., benefit seeking. We suggest that

consumers prefer to seek hedonic benefits such as authenticity and envy and entertainment for animated and non-human VIs and prefer to seek utilitarian benefits such as information for mimic-human VIs, and social presence can strengthen the motive for hedonic benefit seeking behaviour because closer psychological distance can make people feel more relaxing and trigger more pleasure seeking behaviour. Fig. 1 presents the conceptual framework.

2. Literature review

2.1. VIs

From an influencer marketing perspective, VIs are a different form of influencer than human influencers because little is known in terms of how and why consumers might react differently to VIs (e.g., Sands et al., 2022). The market share of global influencer marketing was valued at a record 16.4 billion USD in 2022 (Statista, 2022). As a marketing tool, VIs have the advantages of content control, storytelling, and absence of scandals but are disadvantaged by the high cost of generating and operating an avatar and consumers' concern about avatars' authenticity (Statista, 2022). Therefore, understanding consumers' responses to VIs is an important issue for marketing researchers. We can distinguish three perspectives (behavioural, cognitive, and affective) from the research on VIs.

The first stream of VI research derives from the behavioural perspective, which focuses mainly on four topics: (1) Consumer engagement, such as likes, spread, comments, comment-like rate, and engagement rate (Choudhry et al., 2022; de Brito Silva et al., 2022; Sands et al., 2022; Kim et al., 2020); (2) parasocial interaction (individuals' imagined one-way relationship with VIs that results in an illusion of intimacy such as a "real" interpersonal relationship) (Mei, 2021; Molin & Nordgren, 2019); (3) word of mouth and VI following (sharing of ideas, experiences, and opinions with other users) (Sands et al., 2022; Stein et al., 2022); and (4) purchase rate (purchase behaviour or intention) (Luo et al., 2019; Thomas & Fowler, 2021; Gerlich, 2023).

The second stream of VI research is from the cognitive perspective that centres on four dimensions: (1) source credibility, e.g. expertise, trustworthiness, attractiveness, and similarity (Cornelius et al., 2021; Rosário & Loureiro, 2021; Yang et al., 2022); (2) perceived authenticity of VI, e.g. concerns about falsity and ethics (Conti et al., 2022; Sands et al., 2022); (3) disclosure of the identity of VIs, e.g. whether and when to disclose a VI's identity to the audience) (Mozafari et al., 2021; Wolff, 2022); and (4) information quality, e.g. value, usefulness, and breadth of information domains (Engström, 2022; Wandoko & Panggati, 2022).

The third stream of VI research is from the affective perspective and focuses on consumers' emotional attitude towards VIs. Understanding the affective perspective is important because it is a central category for social media influencers (Engström, 2022).

However, most research focuses on behavioural and cognitive perspectives of VIs, with the affective perspective receiving less attention. An exception is Zhang and Wei's (2021) study, which examines the perception of a VI's coolness, which means that consumers perceive a VI as aesthetically pleasing, fun, and interesting. When perceived as cool, VIs can engage consumers by establishing an identity of being different and original (Zhang & Wei, 2021).

Additionally, past research of the behavioural perspective is limited to purchase behaviour and consumer interaction, which is relatively shallow and not reveal the deeper motive of following the VIs, such as what benefits consumers seek from different types of VIs.

Moreover, prior research has not examined the mechanism of the effect of different types of VIs on affective consumer response, and there are conflictive findings on the effect of anthropomorphism on consumers' behavioural response and social presence, such that people felt a higher level of co-presence when interacting with an avatar presenting a lower anthropomorphism level than the one with the highest visual
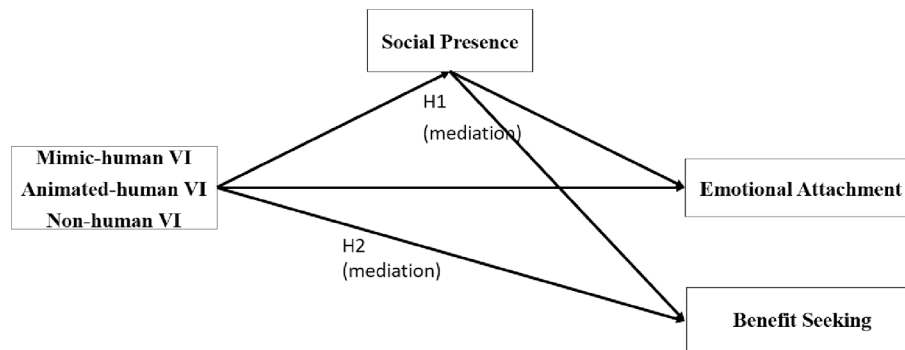
Fig. 1. Conceptual framework.

fidelity (e.g., Nowak & Biocca, 2003) while perceived anthropomorphism has a positive effect on the social presence of virtual service assistant (e.g., Munnukka et al., 2022).

2.2. Categorization of VIs

The categorization of VIs in the literature can be summarized using two key criteria: creation purpose and visual characteristics. Creation purpose refers to whether the influencers represent specific brands and classifies them into two typologies, namely, incarnate avatars and innate influential avatars (de Brito Silva et al., 2022). Incarnate avatars, as exemplified by Lu of Magalu and Dai of Dailus, are designed to embody specific brands, maintaining brand identity through constant digital presence. In contrast, innate influential avatars focus on constructing a life story, acting as replicable models for human followers, and remain detached from primary brands.

Visual characteristics pertain to the level of anthropomorphism and the reality of the appearance of virtual influencers (VIs). Studies based on visual characteristics categorize VIs into mimic-real human VIs (visually indistinguishable from real humans), animated human VIs (drawn in the likeness of a human but as an animated character), and non-human VIs (personas of animals, inanimate objects, or otherworldly beings) (Choudry et al., 2022; Mouritzen et al., 2023; Yang et al., 2022; Wolff, 2022; Berryman et al., 2021). Mouritzen et al. (2023) further refine the non-human VIs based on the level of reality in their appearance, classifying hyper-realistic non-human VIs, such as John Pork (high in reality, low in perceived anthropomorphism), and unrealistic non-human VIs, such as Good Advice Cupcake (low in virtuality, low in perceived anthropomorphism).

In the same thread of categorization based on visual characteristics, we draw on perceived anthropomorphism to categorize VIs into three groups: mimic-human, animated-human, and non-human types. Previous studies, such as Choudry et al. (2022) and Mouritzen et al. (2023), have provided a descriptive categorization of VIs, delving into the drivers for engaging with them, the unique elements of VIs, and consumers' reactions. However, these studies did not delve into the mechanism underlying consumers' response to different types of VIs, leaving unanswered questions about why people may prefer a specific type of VI over the others. Our work contributes to the literature on VI categorization by examining the mechanism through which various types of VIs influence emotional attachment and benefit seeking behaviour. VIs differ from human influencers and virtual conversational agents (e.g., Alexi, Siri) in two ways. First, VIs differ in perceived humanness in terms of visual appearance, while human influencers do not; second, VIs have both visual appearance and voice, while virtual conversational agents have only voice. Thus, visual appearance is the categorization standard because it is unique only to VIs. Mimic-human VIs are the closest to real human figures and simulate human behaviour and appearance (da Silva Oliveira & Chimenti, 2021; Moustakas et al., 2020). Animated-human VIs look like humans but are more like caricatures with simplified

human features in appearance (Moustakas et al., 2020). Finally, non-human VIs are all other non-human figures (Andersson & Sobek, 2020). Fig. 2 shows examples of the three VI types.

2.3. Emotional attachment

Emotional attachment is an emotion-laden bond that includes constructs such as affection, liking, passion, content, and connection (Thomson et al., 2005). In this research, we define emotional attachment as the feelings of closeness and affection that help sustain meaningful relationships with VIs. Research in marketing frequently uses the concept in the context of, for example, loyalty and word of mouth (Vlachos et al., 2010), branding (Grisaffe & Nguyen, 2011), willingness to pay (Xia et al., 2022; Jiménez & Voss, 2014), and social media users (Wang et al., 2016). However, whether individuals form an emotional attachment to VIs similar to that to other objects remains unclear. Prior research suggests that consumers apply the same rubric of interpersonal relationships to their relationships with robots and VIs (Fournier, 1998). Thus, individuals' emotional attachment to VIs should be influenced by the antecedents of emotional attachment.

According to previous research, the antecedents of emotional attachment include self–object congruence, self-expressiveness, engagement and involvement, anthropomorphism, and trust. Self––object congruence refers to objects such as products and brands that are congruent (vs. incongruent) with individuals' self-concepts (Wang et al., 2016). Self-expressiveness is people's motive to express their self-identity through available avenues, such as brand and product consumption (Wang et al., 2016). Engagement and involvement refer to the cognitive processing of an object, affective perception of the object, and activation level such as the amount of time spent on the object; more involvement influences the affective dimension of engagement (Qaiser et al., 2021). Anthropomorphism entails the perception that the humanized object has a mind of its own with associated consciousness, intentions, and emotions (MacInnis & Folkes, 2017). Last, trust in virtual artificial intelligence is also a predictor for emotional attachment (Singh, 2021). We show how these antecedents are linked to characteristics of VIs, the effect of VIs on emotional attachment, and the theoretical mechanisms of such effect in the following section.

3. Hypotheses testing

3.1. Effects of VIs on emotional attachment

We derive how the three types of VIs affect emotional attachment differently by illustrating the linkage of the differences of VIs in four dimensions (marketing positioning, perceived trust and credibility, uncanny valley effect, and social presence) with the antecedents of emotional attachment. We will explain the linkages in the following four parts.
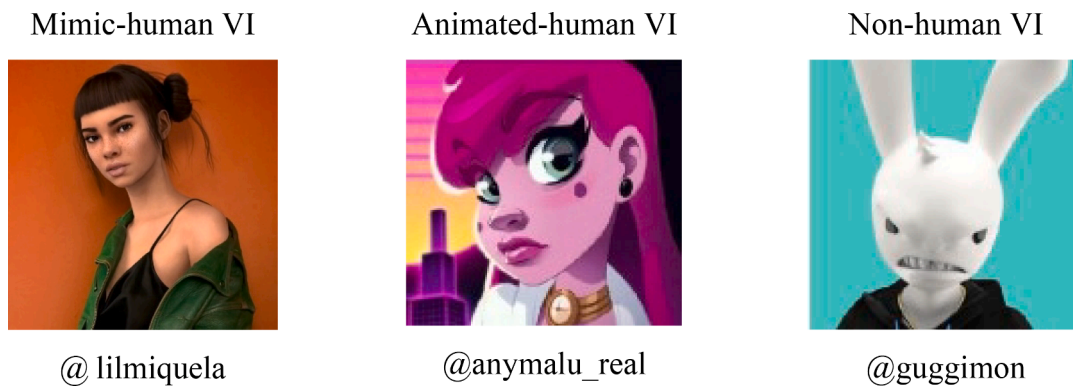
Mimic-human VI	Animated-human VI	Non-human VI
@ lilmiquela	@anymalu_real	@guggimon

Fig. 2. Examples of the three VI categories.

3.1.1. Marketing positioning and self–object congruence and self-expressiveness

We propose that the marketing positioning of animated-human and non-human VIs will elicit more emotional attachment than mimic-human VIs. The perception of virtual influencers as replacements for real human influencers can affect how they are viewed in terms of social interactivity and positioning. Some audiences may perceive VIs as less authentic and interactive compared to real individuals, leading to lower perceived social interactivity (Kim & Wang, 2023).

Moreover, robots must fulfil people's social-emotional needs (Stock & Merkle, 2018). Applying this to VIs, we consider three social-emotional element needs: perceived humanness, perceived social interactivity, and perceived social presence of VIs (Tinwell et al., 2011; Van Doorn et al., 2017). The positioning of VIs as high end or premium can be a deliberate branding strategy. VIs often have a polished and idealized appearance, and they may be used to represent luxury brands or products (Hudders & Lou, 2023). The list of top virtual influencers from 2022 to 2024 includes 47 influencers worldwide (AJmarketing, 2023; Communication University of China, 2023; Influencer Marketing Hub, 2023; Statista, 2023; Virtual humans, 2022). For animated-human VIs (19), 78.9 % (17) are positioned as entertainment (which includes dance, music, art, sport, and gaming), and 15.8 % (3) are positioned as lifestyle and fashion. Among mimic-human VIs (20), 65 % (13) are positioned in beauty, fashion, and lifestyle, while 35 % (7) are positioned in entertainment (encompassing music, gaming, interaction with real people, and escapism from everyday life), and 20 % (4) are positioned in technology. As for non-human VIs (8), half are positioned in lifestyle and fashion, and the other half in entertainment (including music, dance, interaction, and escapism from everyday life). As can be seen, animated and non-human Vis are more often positioned as entertainment while mimic-human VIs are more frequently positioned as novel, high tech, and fashion. Different marketing positionings differ in perceived social interactivity such that high-end positioning (e.g., luxury, fashion, technology) is close to consumers' ideal life but distant from their actual life, and thus, such positionings may elicit a parasocial relationship and less perceived interactivity (Mei, 2021). By contrast, low-end positioning (e.g., mass market, entertainment, gaming) is closer to consumers' actual and personal life and thus elicits more perceived interactivity (Wu, 2000).

Regarded as technological, novel, aloof, and fake (e.g., Andersson & Sobek, 2020), mimic-human VIs are not self-expression tools used by consumers. By contrast, the popularized usage of emojis and meme pictures demonstrates the need for using animated-human and non-human figures as a way to express the self and communicate because they provide additional signalling value, such as an individual's innovativeness, open-mindedness, or conformity to the latest trends (Arsenyan & Mirowska, 2021). Self-expression with mimic-human VIs is perceived low because VIs are typically created with a specific set of capabilities and may not have the flexibility or depth of expression that

real humans possess. They often lack the ability to convey genuine emotions and experiences (Gerlich, 2023). Given that self-expression is an important antecedent of emotional attachment (Wang et al., 2016), we suggest that mimic-human VIs elicit a lower level of emotional attachment than animated-human and non-human VIs. Therefore, depending on the different marketing positioning and the function of self-expressiveness, mimic-human VIs elicit less perceived interactivity and thus engender less emotional attachment than animated-human and non-human VIs.

3.1.2. Perceived credibility and trust

We suggest that perceived trust and credibility are theoretically different from emotional attachment because they are cognitive factors, according to information processing theory, whereas emotional attachment is an affective factor. Although a higher level of human likeness could lead to higher scores on perceived credibility (e.g., Nowak & Rauh, 2008), we suggest that the lesser perceived humanity the VI has, the more it serves an interactive and entertaining function with the audience.

Consumers also perceive VIs as unpleasant and unrealistic when their appearance and behaviour are too close to reality (Molin & Nordgren, 2019). Moreover, the heightened perceived trust and credibility arising from information processing demand increased cognitive load and thoughtful effort due to the novelty of mimic-human VIs, resulting in a greater reliance on a slow and effortful mind-set (Rottenstreich et al., 2007). Whether mimic-human VIs induce a slow and effortful mindset, while animated-human and non-human VIs evoke a fast and unconscious mindset, is context-based. The context in which these virtual influencers are presented and the nature of the content they deliver can influence viewers' cognitive processing and mindset. Mimic-human VIs, striving for a high degree of realism, may prompt viewers to engage in more conscious and effortful cognitive processing. In contrast, animated-human and non-human VIs, which may be more stylized or less human-like, could be processed more quickly and automatically.

The type of content delivered by virtual influencers can significantly influence cognitive processing. If the content involves complex or relatable human scenarios, viewers might adopt a slower, more deliberate mindset to process the information. Conversely, entertaining or visually engaging content may lead to a faster, more automatic mindset (Kahneman, 2017). For example, a bee influencer could provide a recommendation that suits its appearance and identity, such as protecting the environment and global warming. A bee would not recommend daily fashion. An animated VI would be more likely to recommend fashion though, for example Barbie. A mimic-human VI such as Lil Miquela works with top fashion and technological brands, and such contexts are more complicated to proceed.

The purpose for which individuals engage with virtual influencers matters. For example, if the goal is to gain information or insights, viewers might approach mimic-human VIs with a more thoughtful

mindset. If the goal is entertainment or relaxation, animated-human and non-human VIs might induce a faster, more automatic mindset (Rottenstreich et al., 2007). Viewer expectations and prior experiences with virtual influencers play a role. If an audience is accustomed to realistic representations, they may engage in a more critical and effortful analysis. On the other hand, viewers expecting entertainment or escapism might adopt a quicker, less analytical mindset.

In general, people find it easier to proceed the animated and non-human VIs. To compare with, mimic-human VIs suffer from the confusion caused by the uncanny valley, unauthenticity and the blurred boundaries between real and fake (Conti et al., 2022). Therefore, mimic-human VIs elicits less emotional attachment than animated-human and non-human VIs.

3.1.3. Uncanny valley effect and anthropomorphism

We suggest that when disclosing the identity information of a VI, mimic-human VIs trigger the uncanny valley effect, such as a feeling of eeriness and discomfort, and can elicit a lower level of anthropomorphism than animated-human and non-human VIs. The disclosure of chatbot identity (i.e., chatbots are not real humans but computer-generated figures) before the machine–customer conversation reduces purchase rates by more than 79.7 %, and this mechanism may be the subjective human feelings against machines (Luo et al., 2019). Indeed, people perceive human-like bots as less empathetic than non-human-like bots because of their uncanniness (Kim et al., 2019; Mozafari et al., 2021). Although previous research suggests that mimic-human VIs elicit a high level of anthropomorphism (e.g., Yang et al., 2022), the uncanny valley effect deteriorates the effect of anthropomorphism on the emotional bond.

By contrast, animated-human and non-human VIs are more easily accepted by and more familiar to consumers because of their longer history, such as in cartoons. Thus, they are less likely to result in the uncanny valley effect and are likely to engender a higher level of anthropomorphism because they are commonly humanized with a mind of their own. Moreover, such anthromorphism is not negatively affected by the uncanny valley effect, which leads to a stronger emotional bond. Thus, animated-human and non-human VIs will elicit a higher level of emotional attachment than mimic-human VIs.

Currently, there is no conclusive result regarding the precise extent to which anthropomorphism can trigger the Uncanny Valley (Kätsyri et al., 2015). Moreover, it is certain that not every mimic-human virtual influencer is guaranteed to evoke discomfort among humans. The Uncanny Valley effect is not a universally experienced or absolute reaction. But compared with animated and non-human VIs, mimic-human VIs, which aim to closely resemble real humans, are often considered more likely to trigger the Uncanny Valley effect, because animated and non-human virtual entities may have more obvious distinctions from real humans, potentially reducing the discomfort associated with the Uncanny Valley (Kim et al., 2019). The perception of proximity to reality is a key factor, and as mimic-human VIs strive for greater similarity to humans, they may encounter a higher risk of unsettling viewers due to the Uncanny Valley effect. As mimic-human VIs strive for realism, even subtle imperfections or deviations from natural human appearance can become more noticeable. These imperfections, rather than enhancing the realism, can contribute to the eerie feeling associated with the Uncanny Valley.

Moreover, people have certain expectations when they encounter representations of humans (Eco et al., 1988). Animated and non-human virtual influencers, by design, are often more stylized or obviously non-human. Viewers may not expect them to look exactly like real humans, reducing the potential for discomfort. On the other hand, mimic-human virtual influencers are intentionally created to be highly realistic, raising expectations that might not be fully met. When an entity appears almost human but falls short in some aspects, it can create a sense of cognitive dissonance in viewers. The brain struggles to reconcile the near-human appearance with the subtle differences, leading to a feeling of unease.

3.1.4. Social presence, engagement and involvement

We also suggest that the different findings of consumers' perception of the social presence of VIs depend on the industry category. We propose that the social presence of mimic-human VIs is lower than that for animated-human and non-human VIs in the entertainment industry because this industry is characterized by care-providing and interactivity and can influence the perceived social presence – the more care-providing and interactive the task/objective is, the higher its engagement and social presence level will be (Oh et al., 2018; Tu, 2000). Moreover, an important antecedent of social presence is online communication (Oh et al., 2018). Mimic-human figures are less commonly used in private online conversations in entertainment, whereas animated-human and non-human figures are more frequently used in communication (e.g., emojis, memes, interactive games). The more intense usage in communication can enhance consumers' engagement and involvement with the corresponding VIs (Bozkurt et al., 2020). Thus, because mimic-human VIs are perceived as having lower social presence, they will elicit lower engagement and emotional attachment than animated-human and non-human VIs.

In summary, with a relatively higher-end and aloof marketing positioning; reliance on a cognitive, slow, and effortful mind-set elicited by perceived trust and credibility; a stronger uncanny valley effect; and a lower level of engagement from a lower level of social presence, mimic-human VIs engender a lower level of emotional attachment than animated-human and non-human VIs.

3.2. VI and social presence

3.2.1. What is social presence?

We argue that mimic-human VIs elicit less emotional attachment than animated-human and non-human VIs as a result of social presence. Short et al. (1976) were the first to formally introduce social presence theory to examine the efficacy of telecomminucations media. Social presence is about how the "sense of being with another" is influenced by digital interfaces (Biocca et al., 2003, p. 456). For example, face-to-face communication elicits the highest level of social presence because it generates the strongest feeling of being with a "real" person; text messages have the lowest level of social presence because they contain the least number of cues (only a verbal cue) of being with others (Oh et al., 2018). Social presence theory suggests that media differ in the ability to convey the psychological perception that other people are physically present depending on whether media can transmit visual and verbal cues (Calefato & Lanubile, 2010). Research has mostly applied this theory to e-commerce, technology design, and online teaching (e.g., Koponen & Rytsy, 2020; Tu, 2000). We apply social presence theory to a VI context because different types of VIs differ in their ability to convey a psychological perception and thus generate a different level of the sense of being with the corresponding VI.

3.2.2. Antecedents of social presence and VI

According to social presence theory, social presence comprises three dimensions: (1) social context, (2) online communication, and (3) interactivity in the online computer-mediated communication environment (Tu, 2000). First, social context means that the task types, perceptions of privacy, topics, and social relationships could affect the social presence. Public social contexts decrease social presence, while private social contexts increase it (Tu, 2001). Mimic-human VIs tend to more commonly appear in public social contexts, such as on platforms like Instagram where they may act as brand endorsers (Arsenyan & Mirowska, 2021). Furthermore, mimic-human VIs are considered effective in building brand image and boosting brand awareness, but lack the persuasive ability to incite purchase intention due to a lack of authenticity, a low similarity to followers, and their weak parasocial relations with followers (Lou et al., 2023). On the other hand, animated and non-human virtual influencers are described as appearing more frequently in private social contexts, like communication with friends or

on personal social networking sites (SNSs). This difference in context contributes to variations in the sense of social presence experienced by users when interacting with these types of virtual influencers (Tu, 2001). Mimic human VIs in public contexts may generate a lower sense of social presence, while animated and non-human VIs in private contexts may lead to a higher sense of social presence (Tu, 2001).

Second, online communication is the attribute and application of online language – for example, online communication should start with an introduction (Tu, 2000). Online communication often emphasizes authenticity and genuine connections. Mimic-human VIs, being entirely computer-generated and lacking real emotions or experiences, may be perceived as less authentic compared to human influencers or even animated-human VIs. Users often seek genuine interactions, and the lack of authenticity can deter engagement with mimic-human VIs. This perception can deter individuals from engaging with them in online communications. Moreover, mimic-human avatars are less frequently employed in online dialogues related to entertainment because they may fall into the "uncanny valley," making them less appealing and relatable in private social contexts where people seek more natural and comfortable interactions, whereas animated-human and non-human avatars are utilized more often in communication, such as smiley, emoticons, emoji, and stickers to express the emotional and semantic function (Bai et al., 2019). Additionally, consumers are more familiar with animated-human and non-human figures, as they have been around for longer and are widely used in various platforms and communication channels (Neeley & Schumann, 2004). Familiarity and positive past experiences with these virtual influencer types may make users more inclined to engage with them, reducing the opportunity for mimic human virtual influencers to gain traction in online communication. The heightened usage of the animated- and non-human avatars in communication can boost consumer engagement and interaction with the respective virtual influencers (Bozkurt et al., 2020).

Thirdly, interactivity means immediate response, the potential for feedback, and the opportunity to interact with an agent by giving it some information (Skalski & Whitbred, 2010). When people do not receive the expected immediate response, they will experience a low level of interactivity, which leads to reduced perceptions of social presence (Tu, 2001). Immediate response and feedback contribute to higher social presence (Oh et al., 2018). For mimic-human VIs, achieving real-time, interactive responses that closely mimic human behaviour and conversation is technically challenging (Pan & Hamilton, 2018). Mimic-human VIs may lack the ability to process and respond to user input quickly and naturally, resulting in delays and reduced immediacy in feedback, and consumers may doubt the authenticity of VIs due to their lack of reality and limited cognitive abilities (Gerlich, 2023). Moreover, In the design and development of mimic-human VIs, there may be a greater emphasis on achieving a realistic appearance and visual appeal rather than allocating resources to enhance interactive capabilities (Chow, 2023). This design focus can limit the investment in interactivity features. In addition, mimic-human VIs often operate based on pre-scripted or pre-programmed responses. These responses are predetermined and lack the spontaneity and real-time adaptability seen in animated and non-human virtual influencers, leading to lower interactivity (NAKS Digital Consulting, 2023).

By contrast, as non-human entities, animated- and non-human VIs are not constrained by replicating human behavior, enabling a broader range of interactive features and behaviors to be designed and implemented. The advanced Natural Language Processing (NLP) can be employed to process and understand user queries (Sannygangwar, 2023), enabling these VIs to respond in a manner that feels dynamic and interactive – a good example is the Good Advice Cupcake providing answers to fans using kind words (Virtual Humans, 2022c). Through pre-programmed or AI-driven responses, they can offer a wide array of responses promptly, maintaining user engagement and creating a sense of continuous interaction (Sannygangwar, 2023). Animated- and non-human VIs are also more likely to provide responses to consumers;

examples include Hatsune Miku posting fan interaction messages on Twitter (Twitter, 2019). To summarize, mimic-human VIs have lower level of social presence than animated- and non-human VIs because of public social context, less utilization in online communication and lower level of interactivity.

3.2.3. Anthropomorphism, uncanny valley and social presence

The categorization of VIs is based on the level of perceived anthropomorphism. Most of the past research has focused on the anthropomorphised agents, virtual service assistant, and chatbot, and suggests that anthropomorphism of non-human agents can increase the social presence level such as Kim et al., (2020), Lee et al., (2023), Konya-Baumbach et al., (2023), and Munnukka et al., (2022). These cases are different from our research because in these research consumers know that the communication object is a non-human agent while ours suggest that the VI and avatars may confuse consumers in terms of the influencer's real identity, especially for mimic-human VIs.

Anthropomorphism has a significant influence on social presence, particularly in online interactions involving virtual entities like chatbots (e.g., Kim et al., 2020; Konya-Baumbach et al., 2023; Lee et al., 2023). When users perceive anthropomorphism in these digital agents, they experience a heightened sense of social presence, making the interaction more personal, warm, sociable, and engaging. Anthropomorphism, often related to human-like language cues and emotional expressions, enhances the sense of co-presence and interaction with users, influencing the effectiveness of virtual interactions.

In terms of the research focusing on the anthropomorphism of avatar and virtual human, Dubosc et al. (2021) revealed that avatar's facial anthropomorphism is different from chatbot such that the varying level of anthropomorphism of avatar does not have a significant difference on the perceived social presence of the avatar. Moreover, the higher level of anthropomorphism of avatar for virtual human is not very attractive but more unusual and iconic for people, and instead less anthropomorphism leads to higher level of engagement and social presence while higher anthropomorphism does not lead to higher engagement and social presence because the higher expectations are not met (Nowak & Biocca, 2003).

As we can see, anthropomorphism is an antecedent of social presence, but cognitive resource can also influence the perception of social presence (Oh et al., 2018) such that people who are high in need for cognition (NFC) showed a linear increase in social presence as the level of interactivity increased, while those low in NFC exhibited a ceiling effect wherein social presence increased between low and medium levels of interactivity (Fortin & Dholakia, 2005). The social cognitive research suggests that social presence affects automatic response but does not affect intentional response which is dependent on cognitive resources (Morgan et al., 2022).

Based on the results from avatars in the virtual environment and the cognitive aspect, we suggest that anthropomorphism of VI does not linearly increase the social presence, but has a reversed U shape, such that the anthropomorphism positively influence the level of social presence but extremely high level of anthropomorphism elicits a lower level of social presence. Moreover, from the cognitive perspective, mimic-human VIs with higher anthropomorphism can confuse people in terms of the VIs real identity (e.g., "what are they?", "are they real or unreal"; Choudhry et al., 2022), which can bring more burden on people's cognitive load and take more cognitive resource, and lead to lower level of social presence. To support this argument, Lou et al. (2023) found that most followers perceive virtual influencers as uncanny and authentically fake. The following section will introduce how uncanny valley decreases the social presence for mimic-human VIs.

The Uncanny Valley effect refers to the phenomenon where a human-like object or entity that appears almost but not exactly like a real human can evoke a sense of unease or discomfort in observers (Kim et al., 2019). In the context of mimic-human VIs, the Uncanny Valley effect can lead to a decrease in social presence levels. When a VI is designed to closely

resemble a human but falls short in certain subtle aspects, it can trigger the Uncanny Valley effect. Viewers may notice imperfections or discrepancies in facial expressions, movements, or other human-like features that don't align with their expectations of a real human. This dissonance between the mimic-human VI's appearance and the viewer's perception of what a human should be like can lead to discomfort and a reduced sense of social presence. The discomfort arising from the Uncanny Valley effect can disrupt the viewer's ability to fully engage or connect with the virtual influencer on a social or emotional level (Arsenyan & Mirowska, 2021). It creates a sense of "otherness" or strangeness that can be off-putting, inhibiting the development of a genuine sense of social presence (Lay, 2015). As a result, the level of immersion and the feeling of interacting with a relatable, socially present entity diminishes, ultimately impacting the overall user experience and engagement with the mimic-human VIs. Thus, non-human and animated-human VIs can lead to a higher level of social presence than mimic-human VIs.

3.3. Mediation role of social presence

We investigate the underlying mechanism of the influence of different types of VIs on the emotional attachment to them. We propose that social presence is a mediator, because the "sense/feeling" of being with a VI is related to affective perspective. Specifically, social presence can influence emotional attachment, and different types of VIs increase or decrease the emotional attachment depending on the level of social presence.

Social presence of a medium can directly influence the emotional attachment level because it contributes to the level of psychological intimacy (Short et al., 1976). Because of its capacity to shorten the psychological distance between consumers and brands, social presence serves as a motivation to improve psychological closeness and intimacy (Yoo & Alavi, 2001). The level of social presence can positively influence emotional attachment because the psychological intimacy derived from social presence leads to sentiment (Collins & Feeney, 2004; Kahn et al., 2015; Lazarus & Smith, 1988). In addition, a direct constituent of emotional attachment is social presence, which facilitates communication and nurtures the relationship with real people (Huston et al., 2019).

As mentioned previously, mimic-human VIs make consumers sense the least level of social presence, because they mostly appear in public social contexts such as on Instagram and endorse big brands (e.g., Samsung; P2P, 2022); as such, they generate a lower interactivity level, such as not replying to comments and being admired and perceived as a 'attention receiver' or 'attention centre'. In addition, most concerns and comments about mimic-human VIs focus on the authenticity of the content and the manipulative intent of VIs (e.g., Andersson & Sobek, 2020). Research on the uncanny valley effect also suggests that the too-humanized features of mimic-human robots make people feel more frightened and have a lesser sense of "being with them" (Kim et al., 2019).

By contrast, animated-human and non-human VIs make consumers feel more social presence because they often commonly appear in private social contexts, such as in communication with other users, and have a higher interactivity level by being shared on SNS because some animated-human and non-human VIs work as entertainers and pleasers (e.g., @Noonoouri; Instagram, 2022). Because people are more familiar with animated-human and non-human characters, these figures engender a greater sense of "being with them" without concerns about the uncanny valley effect. Because social presence positively influences emotional attachment and mimic-human VIs have a lower social presence than animated-human and non-human VIs, we propose the hypothesis 1 below.

Hypothesis 1: *Social presence mediates the relationship between the type of VI and emotional attachment, such that a mimic-human VI decreases the perceived social presence level while animated-human and non-human VIs increase in the perceived social presence level; increased social presence*

increases the effect of VIs on emotional attachment.

3.4. Benefit seeking behaviour, social presence and VI

We will delve into the concept of consumer benefit-seeking behaviour, aiming to understand how consumers seek and perceive benefits for different types of VIs. Benefit seeking behaviour is a primary type of behavioural market segmentation because when consumers choose a product or service, their benefit seeking is the motivating factor that drives their purchase decision (Tyagi & Kumar, 2004). The benefits drive consumer behaviour more accurately than demographic characteristics or consumption volume (Haley, 1968). However, relatively little is known about why consumers choose to follow influencers and the benefits they derive from such engagements (Farrell et al.,2022).

We summarize the past research of the motives for consumers to follow social media influencers. Based on the uses and gratification theory, Croes and Bartels (2021) categorize six motivations that drive young adults to follow social influencers. These motivations encompass a spectrum of needs and desires, including information sharing, information seeking, trend-following, relaxing entertainment, companionship, and boredom/habitual pass time. Further enriching the understanding of consumer motivations, Farrell et al. (2022) propose a different categorization, identifying six distinct groups of benefits that influence consumers to follow influencers. These groups encompass deal seeking (aiming to save money), entertainment (seeking amusement and enjoyment), attractiveness (being drawn to physically attractive influencers), inspiration (seeking ideas and recommendations), power (admiring influencers' success and popularity), and source trust (valuing trustworthiness and reliability). Moreover, Lee et al. (2022) provide further insights by identifying four motives for following influencers, which include authenticity (the influencers are genuine, open, relatable, down-to-earth, likeable and engaging), consumerism (consumers actively seeking commercial and brand information from the influencers), creative inspiration (the aesthetic preferences and presentational visually pleasing objects), and envy (being envious of the influencers' lifestyle, wanting to be like them, and to fantasize over their unrealistic lifestyle). Expanding on motivations, Lou et al. (2023) contribute to this discourse by presenting an additional set of motivations for following VIs. Their study offers a benefit-seeking perspective, categorizing six distinct motives: novelty (related to curiosity and exploration of new technological applications), information (seeking knowledge related to VI or AI, influencer technology, or marketing strategies), entertainment (finding amusement and distraction), surveillance (staying updated on VI's daily lives), aesthetics (liking the visual or aesthetic aspects of influencer-generated content), and integration and social interaction (gaining a sense of belonging and bonding with a like-minded community).

The past research collectively underscores the diverse and multifaceted motivations that drive individuals to follow influencers. These motivations are either hedonic and emotional benefits such as seeking entertainment and inspiration, gaining a sense of belonging and companionship or utilitarian and practical benefits such as saving money and information seeking and sharing. In terms of the potential benefits consumer seek for VIs, we suggest that authenticity (being likeable and down-to-earth), information (commercial, technology and brand information from the influencers), inspiration (the visual or aesthetic design of the influencers' post), envy and entertainment (being envious of the influencers' lifestyle, to escape from the real life, and seeking enjoyment and relaxation) are four aspects that are suitable for VIs after reviewing the past research, because firstly, due to the novelty and short history of the invention of VIs it is not possible for consumers to seek the companionship or habitual benefit for it nor do consumers seek unique personality or values from a VI; secondly, all the other benefits following influencers can be summarized as emotional benefits such as being genuine and belongingness, hedonic benefits such as aesthetic, lifestyle and entertainment, and practical benefits such as

information seeking and technology updates; and thirdly, the novelty and trend following of VI is similar to the information seeking aspect and thus be combined to the information benefit.

We suggest that different VIs will elicit different benefits sought from them and social presence theory can explain the effect of VIs on benefit seeking behaviour as the theory underscores the importance of social presence in shaping user interactions, emotional connections, and engagement across diverse digital environments (e.g., Tsai et al., 2021; Tseng et al., 2019).

Firstly, the authenticity benefit means consumers follow influencers because the influencers are genuine, open with the followers, down-to-earth, likeable, engaging and relatable, and the desire to connect with influencers on a personal level (Lee et al., 2022). Consumers' authenticity motive most strongly predicts trust towards the VI's endorsement and post content (Lee et al., 2022). Authenticity is widely applied to consumers' benefit seeking for brands, such that consumers value brands that consistently deliver genuine and reliable products. So, authenticity builds a sense of credibility (Johnson, 2015). Furthermore, authenticity is achieved when brands are engaging deeply with audiences, building connections that feel personal, and making their customers feel heard and understood (Johnson, 2015). Even though all VIs in nature do not have an authentic persona to be perceived as real people whom consumers can relate to or identify with, animated- and non-human VIs are more genuine, down-to-earth, likable and engaging for the consumers than mimic-human VIs because consumers clearly know that the former is not human being but not certain whether the latter is a genuine human being, which makes it less genuine (Arsenyan & Mirowska, 2021).

Authenticity and inspiration are most strongly associated with happiness, and these two motives are stimulated by a need to fulfil affective inadequacies and enhance emotional wellbeing from engaging with the object (Lee et al., 2022). Authenticity and trustworthiness can be improved for influencers by being more connected to the needs of their followers (Campbell & Farrell, 2020). Animated and non-human VIs are better at enhancing the emotional attachment and connected to the followers than mimic-human VIs because of higher social presence level as illustrated previously. Social presence theory suggests that consumers seek authentic interactions even in virtual spaces and consumers are more likely to engage with virtual influencers that present themselves authentically (Herrington et al., 2013). The followers show willingness to accept the virtual personas, where curated flaws and self-justification have been found to mitigate the effect of the uncanny valley (Lou et al., 2023), so animated and non-human VIs are consistent in their identity such that they have clear appearance features to justify they are not humans. Mimic-human VIs are viewed as unsettlingly realistic, uncanny and authentically artificial, and thus they lack the ability to be present with the audience compared with other types of VIs due to a lack of authenticity, a low similarity to followers, and weak parasocial relations with followers (Lou et al., 2023). To illustrate the mediation role of social presence, according to Short et al. (1976), social presence is primarily composed of two main concepts: intimacy (Argyle & Dean, 1965) and immediacy (Wiener & Mehrabian, 1968). The higher level of social presence of animated and non-human VIs makes them more intimate and less psychologically distant for followers, and thus making them more engaging and connected, i.e., the consumers are more likely to seek the desire to connect with animated and non-human VIs on a personal level (authenticity benefit) than mimic-human VIs.

Secondly, information benefit suggests that consumers actively seek information from influencers, such as to new knowledge or information related to AI or VI technology (Lou et al., 2023). Mimic-human VIs are novel and outstanding, which could elicit the exploratory and uniqueness for identity, and it can boost the benefit seeking of information from mimic-human VIs because consumers are more likely to seek information from them than animated- and non-human VIs. Mimic-human VIs offer a higher level of innovation and frequently update their technological features compared to other types of VIs, resulting in a greater share of information, reviews, or insights regarding products or services (Gerlich, 2023). Consumers are inclined to prefer VIs who furnish valuable information and opinions. According to the social presence theory, delivering informative and valuable content generates a feeling of social presence, amplifying the perceived value of the interaction and benefits for consumers (Tseng et al., 2019). Thus, consumers are more likely to seek information benefit for mimic-human VIs than animated and non-human VIs and social presence level does not mediate the process.

Thirdly, envy and entertainment benefit means that consumers seek entertainment and fantasize over the lifestyle of VIs (Lee et al., 2022; Lou et al., 2023). People prefer VI over human influencer because of the "escapism effect", where the virtual influencer is expected to provide greater diversionary benefits from everyday human emotional experiences and require fewer cognitive resources in the form of emotional sense making (Mirowska & Arsenyan, 2023). Even though all virtual influencers can provide the benefit of escaping from real life for people, mimic-human VIs demand greater cognitive effort from individuals compared to other types of virtual influencers because understanding the intricacies of the uncanny valley features and navigating the resulting confusion while acknowledging the advanced technology necessitate more mental processing (MacDorman, 2019). Consequently, consumers are less likely to seek escapism and relaxation benefit from mimic-human VIs than other VI types. The 'escapism effect' can be linked with the envy and entertainment motive because it features escaping from consumers' life and fantasizing a different lifestyle. In addition, the closer psychological distance for the animated- and non-human VIs is more likely to elicit the envy and entertainment benefit seeking than mimic-human VIs. Based on social presence theory, when consumers perceive a VI as socially present and relatable, they are more likely to seek entertainment from the influencer's content (Lou et al., 2023). The feeling of closeness and interactivity that comes with a strong social presence can make the consumer more inclined to engage with the influencer's entertainment-focused content, such as videos, stories, or interactive experiences (Zhang & Liu, 2023). This increased motive for entertainment is driven by the desire to maintain a connection with the VI and enjoy the content they provide, ultimately enhancing the overall consumer experience (Kim, 2022). Due to the lower connection, lower authenticity and higher uncanny valley, consumers are less likely to seek envy and entertainment benefit for mimic-human VIs than animated and non-human VIs and social presence level mediates the process.

Eventually, the inspiration (aesthetic) benefit means liking the visual or aesthetic aspect of influencer-generated contents (Lou et al., 2023) and does not differ among the different types of VIs because all VIs highly value the look of the figures and invest much on the design of the look, i.e., all types of virtual influencers have the capacity to present visually appealing and creative content (Sokolov, 2019). Even non-human virtual influencers can be designed with aesthetically pleasing features and present creative, engaging content. Moreover, consumer preferences can vary, and some individuals may be equally inspired and aesthetically pleased by all types of virtual influencers. Preferences might not be strongly influenced by the anthropomorphic features of the VI (Mouritzen et al., 2023). Thus, there is no significant difference on the inspiration benefit seeking among different types of VIs. We propose the hypothesis 2 below. To clarify our arguments, we summarise the gaps, research questions, hypotheses, and contribution in Table 1.

Hypothesis 2: *Consumers are more likely to seek authenticity and envy and entertainment benefits for animated- and non-human VIs than mimic-human VI, and social presence mediates the process such that higher level of social presence leads to stronger authenticity and envy and entertainment benefit seeking behaviour, while consumers are more likely to seek information benefit for mimic-human VI than animated- and non-human VIs, and there is no significant difference on the inspiration benefit among different types of VIs.*

Table 1

Gaps, research questions & hypotheses.

Gap	Research question	Hypothesis	Contribution
Research on VIs has focused on behavioural and cognitive perspectives but not on the affective perspective, and the theoretical mechanism of the differences among VIs on emotional attachment remains unclear.	*What is the underlying mechanism of the effect of VIs on consumer's emotional attachment?*	H1 (Mediation)	Shedding light on the mechanism of the effect of different VI types on emotional attachment. Extending social presence theory by suggesting the importance of uncanny valley and heavier cognitive load caused by the confusion.
Research of VIs on behavioural perspective mainly focuses on purchase intention, which is relatively limited and shallow. Deeper understanding of VIs on consumer behaviour and the mechanism of it is unclear.	*What is the underlying mechanism of the effect of VIs on consumer's benefit seeking behaviour?*		Shedding light on the mechanism of the effect of VIs on a novel touch of behavioural perspective, i.e., benefit seeking. Extending social presence theory by suggesting the effect of the varying levels of social presence on consumers' benefit seeking behavior for different types of VIs.

4. Experiments

4.1. Overview of Studies

The two hypotheses are tested across four studies. In Study 1, the VI type is manipulated. The study shows that mimic-human VI elicits a lower level of emotional attachment than animated-human and non-human VIs. Study 2 shows that mimic-human VI also elicits a lower level of social presence than animated-human and non-human VIs. In Study 3, the mediation role of social presence is examined (Hypothesis 1). Finally, Study 4 tests the mediation role of social presence of VIs on benefit seeking behaviour (Hypothesis 2).

4.2. Study 1

Study 1 was designed to test the effect of different types of VIs on emotional attachment level. The choice of the different VI representers is adapted from Arsenyan and Mirowska (2021). In this study, the choice of VIs is @Imma, @Liv in the future, and @Bee_nfluencer (@Imma represents mimic-human VI, @Liv in the future represents animated-human VI, @Bee_nfluencer represents non-human VI, see Appendix 1). These three profiles are almost equally popular based on the number of fans. Since in the real life, consumers browse the VIs on social media such as Instagram, we screenshot the images of their Instagram posts and attach them in our study, which imitates consumers' real-life scenarios of interacting with VIs. We expect to see that compared with mimic-human VI, non-human and animated-human VIs will elicit stronger emotional attachment level.

4.2.1. Procedure

One hundred and twenty-two participants were recruited from Prolific for standard payment. The study is a 3-condition single factor design (mimic-human VI, animated-human VI, non-human VI). Participants were given an introduction that they are going to do a survey about social media influencers. We first tested participants' mood (control variable) using the 7-point Likert scales adapted from Mohanty (2021) "To what extent are you feeling … enthusiastic, upset (reverse coded), active" (Cronbach's $\alpha = 0.53$). The reason of using mood as a control variable is that emotional attachment, social presence and mood are related but distinct constructs (Angelaki & Mavroidis, 2013; Wei et al., 2005). If mood is not controlled for, changes in mood could potentially influence the perceived level of emotional attachment, leading to inaccurate or confounded results. All studies in this research included mood as a control variable. Then, participants were randomly assigned to one type of VI condition and saw the Instagram posts from the corresponding VI after reading the following instruction.

> *"Now imagine you are on social media to spend some spare time. As you are scrolling through your social media feeds, you come across the following posts from the social media profile that you closely follow."*

After showing participants the Instagram posts, there was a short note disclosing that the influencer is not a real human but a computer-generated figure. We disclosed the identity of VI because in real life, ethical requirement would make businesses to disclose it in advertising (Prasad & Holzinger, 2013). Participants were asked a manipulation check question "what type of influencer have you seen? 1. A mimic-human female influencer (Imma), 2. An animated female influencer (Liv in the future), 3. A non-human bee VI (Bee_nfluencer)".

Measurements.

Emotional attachment. Participants were asked to recall the contents and impression of the VI and their emotional attachment about it. The emotional attachment scales were adapted from Jiménez and Voss (2014), such as "no/strong emotional bond" "no/strong emotionally connected" "not linked by feelings/linked by feelings" "no/strong feelings of attachment" (Cronbach's $\alpha = 0.95$).

Eventually, attention check question ("please choose 'somewhat agree' in the following options") and other control variables such as the effect of COVID-19, familiarity with the influencer, whether participants knew the influencer they saw, demographic questions such as age, gender, and English proficiency were collected. These control variables are used in the past VI literature such as Gerlich (2023). The data were analysed using SPSS 27 in all studies.

4.2.2. Results

Participants who did not pass the attention check question were excluded, which left 119 participants (49.6 % female; $M_{age} = 26.6$).

Manipulation checks. The manipulation of VI type is successful, because there is a significant relationship between participants' choice of the type of VI that they claimed to see and the actual allocation of the VI types (χ^2 (4, N = 119) = 155.50, $p < .001$).

Emotional attachment. The one-way ANOVA test showed a significant difference among three types of VI on emotional attachment (F (2,117) = 10.04, $p < .001$, $M_{mimic} = 1.99$, $M_{animated} = 3.27$, $M_{non-human} = 3.39$). Turkey's HSD test for multiple comparison showed that emotional attachment was significantly different between mimic and animated VI ($p < .001$, 95 % CI = [-2.10, - 0.46]), between mimic and non-human VI ($p < .001$, 95 % CI = [-2.22, - 0.58]). There was no statistically significant difference between animated and non-human VI ($p = .94$, 95 % CI = [- 0.93, 0.70]). Including the control variables as covariates in the analyses did not influence the pattern of results.

4.2.3. Discussion

The results prove that mimic-human VIs show significantly lower level of emotional attachment than animated-human and non-human VIs. The difference of emotional attachment between animated-human and non-human VIs is not significant but the emotional attachment towards animated-human VIs is slightly lower than non-human VIs. The next study will examine the effect of VI type on social presence.

4.3. Study 2

Study 2 tests the effect of different types of VIs on social presence level. Three types of VIs and the images were same as those in Study 1. The social presence scale composed of 3 dimensions, which are social context, online communication, and interactivity (Kreijns et al., 2021; Lee et al., 2006). We expect that the non-human and animated-human VIs will have greater social presence level than mimic-human VIs.

4.3.1. Procedure

One hundred and thirty-two participants were recruited from Prolific for standard payment. The study is a 3-condition single factor design (mimic-human VI, animated-human VI, non-human VI). Similar to Study 1, after checking mood (control variable) and a short introduction of the scenarios, participants were randomly assigned to see one of the three VIs with a disclosure message by the end. Then, participants were asked a manipulation check question about which VI they saw previously (same as the one in Study 1). We asked the participants to imagine their interaction and communication with the corresponding VI if they see it in the real life, which leads to the social presence measurement in the next part.

Measurements.

Social presence. Six items were adapted from Lee et al. (2006) to measure social presence level on 7-point Likert scale (social context dimension: "When you were browsing the posts, how much did you feel as if the influencer were a social being/how much attention did you pay to the influencer"; communication dimension: "how much did you feel as if the influencer were communicating with you", interactivity dimension: "how much did you feel involved with the influencer?/To what extent do you think the influencer post is … - machine-like/life-like; insensitive/sensitive"; Cronbach's $\alpha = 0.83$).

Eventually, same attention check question and other control variables as those in Study 1 were collected.

4.3.2. Results

One hundred and twenty-three participants were left for further analysis after excluding those who did not pass the attention check question (50.4 % female; $M_{age} = 29.9$).

Manipulation checks. The manipulation of VI type is successful, because there is a significant relationship between participants' choice of the type of VI that they claimed to see and the actual allocation of the VI types (χ^2 (4, N = 123) = 147.48, $p < .001$).

Social presence. The one-way ANOVA showed a significant difference among three types of VI on social presence (F (2, 121) = 4.20, $p = .02$, $M_{mimic} = 3.73$, $M_{animated} = 4.17$, $M_{non-human} = 4.49$). Turkey's HSD test for multiple comparison showed that social presence was significantly different between mimic and non-human VI ($p = .01$, 95 % CI = [-1.38, - 0.13]). There was no statistically significant difference between mimic and animated VI ($p = .21$, 95 % CI = [- 1.05, 0.18]) and between animated and non-human VI ($p = .45$, 95 % CI = [0.13, 1.38]). Furthermore, by re-coding VI type as dummy variables, a simple linear regression of VI type on social presence level showed that when setting mimic-human VI as the base line, animated-human and non-human VIs are significant on social presence ($\beta_{animated} = 0.17$, $p = .09$, $\beta_{non-human} = 0.29$, $p = .005$). Including the control variables as covariates in the analyses did not influence the pattern of results.

4.3.3. Discussion

The results prove that non-human VIs show significantly higher level of social presence than mimic-human VIs while animated VIs show insignificant higher level of social presence than mimic-human VIs. The pattern between VI type and social presence is similar to that between VI type and emotional attachment. The next study will examine the mediation role of social presence.

4.4. Study 3

In addition to a robust finding of Study 1 and 2, we aim to test Hypothesis 1, which suggests that the social presence mediates the effect of VIs on emotional attachment. The setting of VIs is same to the previous studies.

4.4.1. Procedure

One hundred and eighty-nine participants were recruited from Prolific in this study for standard payment. The study is a 3-condition single factor design (mimic-human VI, animated-human VI, non-human VI). Similar to the previous studies, after testing their mood (control variable), participants were randomly allocated to one of the three conditions and imagine they were seeing the Instagram posts of the corresponding VI on their SNS in daily life. In addition to the manipulation check question "what type of influencer have you seen", we added one more manipulation check question "to what extent do you think the influencer looks like a real human?" Then, participants indicated their emotional attachment level and social presence level to the corresponding VI. The scales of emotional attachment and social presence were the same to the previous studies. We also asked the perceived coolness of VIs as another control variable because perceived coolness and emotional attachment are related but represents a different aspect of the affective experience (Zhang & Wei, 2021). By controlling for perceived coolness, we aim to isolate the specific impact of social presence on emotional attachment without the influence of perceived coolness confounding the results. The question is "to what extent do you think the posts by the influencer are fun and entertaining?". Finally, we collected the attention check, control and demographic questions similar as those in Study 1 and 2.

4.4.2. Results

One hundred and eighty participants were left for further analysis after excluding those who did not pass the attention check question (48.3 % female, $M_{age} = 29.2$).

Manipulation checks. The manipulation of VI type is successful, because there is a significant relationship between participants' choice of the type of VI that they claimed to see and the actual allocation of the VI types (χ^2 (4, N = 180) = 252.09, $p < .001$). Moreover, the one-way ANOVA showed a significant difference among three types of VI on human likeness, specifically, mimic-human VI indicated the highest level of human likeness, animated-human VI indicated medium level of human likeness, and non-human VI indicated the lowest level of human likeness (F (2, 178) = 18.15, $p < .001$, $M_{mimic} = 4.91$, $M_{animated} = 3.23$, $M_{non-human} = 2.97$). The results indicate the manipulation of the VI type is successful.

Emotional attachment. Moreover, similar to the findings in Study 1, the one-way ANOVA showed a significant difference among three types of VI on emotional attachment (F (2, 178) = 8.95, $p < .001$, $M_{mimic} = 2.35$, $M_{animated} = 2.76$, $M_{non-human} = 3.54$). Turkey's HSD test for multiple comparison showed that the mean value of emotional attachment was significantly different between mimic and non-human ($p < .001$, 95 % CI = [-1.87, - 0.51]), and between animated and non-human ($p = .02$, 95 % CI = [-1.44, - 0.11]). There was no statistically significant difference between mimic and animated ($p = .32$, 95 % CI = [-1.09, 0.26]).

Social presence. Furthermore, similar to the findings in Study 2, the one-way ANOVA showed a significant difference among three types of VI on social presence level (F (2, 178) = 3.84, $p = .02$, $M_{mimic} = 3.81$, $M_{animated} = 4.03$, $M_{non-human} = 4.45$). Turkey's HSD test for multiple comparison showed that the mean value of social presence was significantly different between mimic and non-human ($p = .02$, 95 % CI = [-1.19, - 0.08]). There was no statistically significant difference between mimic and animated ($p = .62$, 95 % CI = [- 0.77, 0.34]) and between animated and non-human ($p = .16$, 95 % CI = [- 0.97, 0.12]).

Including the control variables as covariates in the analyses did not influence the pattern of results.

Mediation. To test the mediational hypothesis, two dummy variables were created based on the three-condition variable (mimic-human VI, non-human VI) with animated-human VI as the base line, and the following three regression equations were estimated (Baron & Kenny, 1986). First, social presence was regressed on the VI type. Second, emotional attachment was regressed on the VI type. Third, the emotional attachment was regressed on both the VI type and on social presence. As predicted, the VI type accounted for significant variation in social presence in the first equation in the expected direction ($R = 0.30$, $p = .02$; $\beta_{\text{mimic}} = -0.15$, $t(178) = -2.07$, $p = .04$; $\beta_{\text{non-human}} = 0.19$, $t(178) = 2.61$, $p = .01$). Also, VI type accounted for significant variation in the emotional attachment variable in the second equation in the expected direction ($R = 0.30$, $p < .001$; $\beta_{\text{mimic}} = -0.23$, $t(178) = -3.15$, $p = .002$; $\beta_{\text{non-human}} = 0.29$, $t(178) = 3.96$, $p < .001$). Finally, the social presence significantly influenced emotional attachment in the third equation, in which both the social presence and the VI type variables were simultaneously entered ($\beta = 0.62$, $t(177) = 10.85$, $p < .001$). In addition, when both social presence and the VI type were added in the equation, the effect of mimic-human and non-human VIs on emotional attachment became significantly lower ($\beta_{\text{mimic}} = -0.13$, $t(177) = -2.34$, $p = .02$; $\beta_{\text{non-human}} = 0.17$, $t(177) = 2.92$, $p = .004$), suggesting that social presence partially mediated the effect. The values of all the βs are shown in Fig. 3.

Furthermore, we conducted a mediation analysis with categorical variable (Model 4 in Process 3). Because there are three conditions in the categorical variable VI type, we created 2 dummy variables for animated and non-human VIs with the baseline as mimic-human VI. Bootstrapping with 10,000 resamples revealed an insignificant mediation for mimic-human versus animated-human VI (index = - 0.17, SE = 0.17, 95 % CI = [- 0.16, 0.51]) and a significant mediation for mimic-human vs non-human VI (index = 0.49, SE = 0.19, 95 % CI = [0.13, 0.88]). The indirect effect of mimic-human VI is significant ($\beta = -0.34$, SE = 0.16, 95 % CI = [- 0.67, - 0.03]). The indirect effect of non-human VI is significant ($\beta = 0.41$, SE = 0.16, 95 % CI = [0.08, 0.79]) (see Fig. 3). However, there is no significant mediation (indirect effect) for animated-human VI on emotional attachment through social presence ($\beta = -0.09$, SE = 0.16, 95 % CI = [- 0.41, 0.22]), and the effect of animated-human VI on social presence is non-significant ($\beta = -0.11$, $t(178) = -0.55$, $p = .58$). These results partially support H1.

4.4.3. Discussion

The results prove that the mediating variable, i.e., social presence, is only responsible for a part of the relationship between VI type and emotional attachment (MacKinnon, 2012). VI type appears to contribute significantly to the emotional attachment, with social presence in the causal path for a proportion of emotional attachment. The mimic-human VI significantly decreased social presence while non-human VI significantly increased social presence and social presence mediated the effect of mimic-human and non-human VIs on emotional attachment, but animated-human VI did not have a significant effect on social presence, nor the social presence mediated the effect of animated-human VI on emotional attachment. Eventually, the social presence associated with VI types could significantly increase the level of emotional attachment. The findings partially confirm H1 as social presence is a partial mediator for the effect of VI on emotional attachment and only works on mimic-human and non-human VIs.

4.5. Study 4

Study 4 aims to test H2, which suggests that the social presence
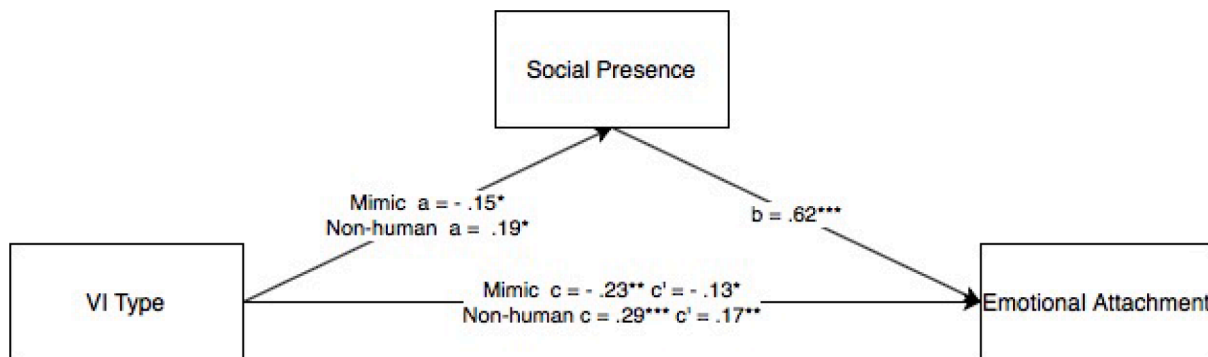
Note: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

- a is the coefficient of VI on social presence; b is the coefficient of social presence on emotional attachment; c is the coefficient of VI on emotional attachment; c' is the coefficient of VI on emotional attachment when VI and social presence are included in the regression on emotional attachment.

- Index of mediation: mimic vs animated: index = - .17, SE = .17, 95% CI = [- .16, .51]; mimic vs non-human: index = .49, SE = .19, 95% CI = [.13, .88].

- Indirect effect in mimic-human VI condition: $\beta = -.34$, SE = .16, 95% CI = [- .67, - .03].

- Indirect effect in non-human VI condition: $\beta = .41$, SE = .16, 95% CI = [.08, .79].

- Indirect effect in animated-human VI condition: $\beta = -.11$, SE = .20, 95% CI = [- .42, .29].

Fig. 3. Mediation. Note: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. a is the coefficient of VI on social presence; b is the coefficient of social presence on emotional attachment; c is the coefficient of VI on emotional attachment; c' is the coefficient of VI on emotional attachment when VI and social presence are included in the regression on emotional attachment. Index of mediation: mimic vs animated: index = - 0.17, SE = 0.17, 95 % CI = [- 0.16, 0.51]; mimic vs non-human: index = 0.49, SE = 0.19, 95 % CI = [0.13, 0.88]. Indirect effect in mimic-human VI condition: $\beta = -0.34$, SE = 0.16, 95 % CI = [- 0.67, - 0.03]. Indirect effect in non-human VI condition: $\beta = 0.41$, SE = 0.16, 95 % CI = [0.08, 0.79]. Indirect effect in animated-human VI condition: $\beta = -0.11$, SE = 0.20, 95 % CI = [- 0.42, 0.29].

mediates the effect of VIs on benefit seeking behaviour. This study uses the same VIs of previous studies.

4.5.1. Procedures

One hundred and nighty participants were recruited from Prolific in this study for standard payment. The study is a 3-condition single factor design (mimic-human VI, animated-human VI, non-human VI). Similar to the previous studies, after testing their mood (control variable), participants were randomly allocated to one of the three conditions and imagine they were on social media and seeing the Instagram posts of the corresponding VI, followed by the manipulation check question "what type of influencer have you seen". Then, participants were asked about their perceived social presence about the influencer, which was examined by six-item questions adapted from Yoo and Alavi (2001) and Short et al. (1976) (e.g., "To what extent do you feel that the influencer you saw is impersonal versus personal, unemotional versus emotional, remote versus immediate; to what extent is there a sense of warmth/ sociability in the influencer, to what extent do you perceive that you are in the presence of the influencer in the room with you", Cronbach's α = 0.87). Then, the scale of benefit seeking was measured.

Measurements

Benefit seeking. There are four dimensions measured within benefit seeking, which are authenticity (three items adapted from Lee et al. (2022) "what benefit do you seek from the virtual influencer? Because it is genuine/down-to-earth/likable"; Cronbach's α = 0.89), information (three items adapted from Lou et al. (2023) "to seek new information and knowledge", "to search for information", "to learn something new", Cronbach's α = 0.85), inspiration (three items adapted from Lee et al. (2022) and Lou et al. (2023) "to appreciate the aesthetic design of the influencer", "find the influencer attractive to look at", "to see photo styles that I like", Cronbach's α = 0.81), and envy and entertainment (four items adapted from Lou et al. (2023) "to fantasize over the influencer's unrealistic lifestyle", "to escape from my lifestyle", "to feel entertained", Cronbach's α = 0.75).

Finally, we collected the attention check, control and demographic questions similar as those in previous studies.

4.5.2. Results

Participants who failed the attention check and disagreed to be included for analysis were excluded, which left a final sample of 180 respondents (57.2 % female; M_{age} = 29.7).

Manipulation checks. The manipulation of VI type is successful, because there is a significant relationship between participants' choice of the type of VI that they claimed to see and the actual allocation of the VI types (χ^2 (4, N = 180) = 244.20, p <.001).

Social presence. The one-way ANOVA showed a significant difference among three types of VI on social presence (F (2, 178) = 15.82, p <.001, M_{mimic} = 3.28, $M_{animated}$ = 3.67, $M_{non-human}$ = 4.56). Turkey's HSD test for multiple comparison showed that the mean value of social presence was significantly different between mimic and non-human (p <.001, 95 % CI = [-1.83, - 0.73]), and between animated and non-human (p <.001, 95 % CI = [-1.45, - 0.34]). There was no statistically significant difference between mimic and animated (p =.22, 95 % CI = [-0.94, 0.16]).

Benefit seeking. The one-way ANOVA showed a significant difference among three types of VI on one dimension of benefit seeking, which is authenticity (F (2, 178) = 4.31, p =.02, M_{mimic} = 3.36, $M_{animated}$ = 3.64, $M_{non-human}$ = 4.21). Turkey's HSD test for multiple comparison showed that the mean value of authenticity was significantly different between mimic and non-human (p =.01, 95 % CI = [-1.55, -0.15]). There was no statistically significant difference between mimic and animated (p =.62, 95 % CI = [-0.98, 0.42]), between animated and non-human (p =.14, 95 % CI = [-1.28, 0.13]). The one-way ANOVA did not show a significant difference between VI type and other 3 dimensions of benefit seeking, which are information (F (2, 178) = 0.09, p =.91), inspiration (F (2, 178) = 0.99, p =.38), and envy and entertainment (F

(2, 178) = 0.99, p =.37).

Including the control variables as covariates in the analyses did not influence the pattern of results.

Mediation. To test the mediational hypothesis (H2), two dummy variables were created based on the three-condition variable (mimic-human VI, non-human VI) with animated-human VI as the base line, and the following three regression equations were estimated (Baron & Kenny, 1986). First, social presence was regressed on the VI type. Second, benefit seeking was regressed on the VI type. Third, benefit seeking was regressed on both the VI type and on social presence. As predicted, the VI type accounted for significant variation in social presence in the first equation in the expected direction (R = 0.39, p <.001; β_{mimic} = − 0.13, t (178) = -1.67, p =.09; $\beta_{non-human}$ = 0.30, t (178) = 3.79, p <.001). Also, VI type accounted for significant variation in the benefit seeking (authenticity) variable in the second equation in the expected direction (R = 0.22, p =.02; β_{mimic} = - 0.08, t (178) = -0.94, p =.35; $\beta_{non-human}$ = 0.16, t (178) = 1.93, p =.05).

Finally, the social presence significantly influenced benefit seeking in the third equation, in which both the social presence and the VI type variables were simultaneously entered (β = 0.42, t (177) = 5.50, p <.001). In addition, when both social presence and the VI type were added in the equation, the effect of mimic-human and non-human VIs on benefit seeking became significantly lower (β_{mimic} = 0.03, t (177) = 0.33, p =.74; $\beta_{non-human}$ = -0.12, t (177) = -1.44, p =.15), suggesting that social presence mediated the effect. The values of all the βs are shown in Fig. 4.

Similar to the procedures used in Study 3, we conducted a mediation analysis with categorical variable (Model 4 in Process 3) with 2 dummy variables as animated and non-human VIs and the baseline as mimic-human VI. Bootstrapping with 10,000 resamples revealed an insignificant mediation for mimic-human versus animated-human VI (index = 0.24, SE = 0.16, 95 % CI = [- 0.07, 0.57]) and a significant mediation for mimic-human vs non-human VI (index = 0.78, SE = 0.16, 95 % CI = [0.49, 1.12]). The indirect effect of mimic-human VI is significant (β = - 0.52, SE = 0.15, 95 % CI = [- 0.83, - 0.24]). The indirect effect of non-human VI is significant (β = 0.67, SE = 0.13, 95 % CI = [0.42, 0.95]) (see Fig. 4). However, there is no significant mediation (indirect effect) for animated-human VI on benefit seeking through social presence (β = - 0.15, SE = 0.14, 95 % CI = [- 0.43, 0.12]), and the effect of animated-human VI on social presence is non-significant (β = - 0.25, t (178) = -1.11, p =.27). These results partially support H2.

4.5.3. Discussion

These results partially confirm Hypothesis 2.Consumers are more likely to seek authenticity benefits from animated-human and non-human VIs than from mimic-human VIs. Social presence mediates the effect of mimic-human and non-human VIs on authenticity benefits. The study rejects that consumers differ in seeking for information and envy and entertainment benefits among mimic-human, animated and non-human VIs. Additionally, there is no significant difference in inspiration among different types of VIs.

5. General discussion

This research categorizes VIs into three types (i.e., mimic-human VI, animated-human VI, and non-human VI) and examines how consumer emotional attachment and benefit seeking behaviour differ across them and the underlying mechanism of such effect. The results show that animated-human and non-human VIs engender stronger emotional attachment than mimic-human VIs (Study 1). Moreover, animated-human and non-human VIs have a greater social presence level than mimic-human VIs (Study 2). Furthermore, social presence partially mediates the relationship between VI type and emotional attachment level. Specifically, social presence mediates the effect of mimic-human and non-human VIs on emotional attachment, but it does not mediate the effect of animated-human VI on emotional attachment (Study 3).
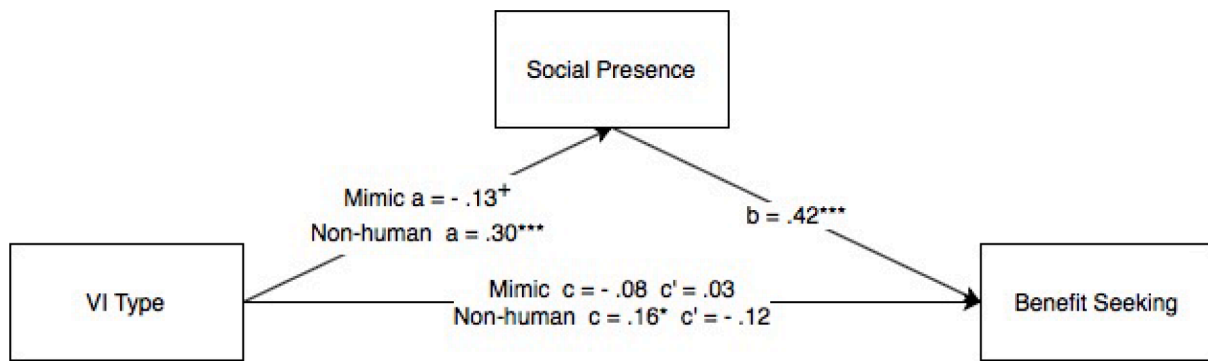
Note: *p < .05, **p < .01, ***p < .001.

- a is the coefficient of VI on social presence; b is the coefficient of social presence on benefit seeking (authenticity); c is the coefficient of VI on benefit seeking; c' is the coefficient of VI on benefit seeking when VI and social presence are included in the regression on benefit seeking.

- Index of mediation: mimic vs animated: index = .24, SE = .16, 95% CI = [- .07, .57]; mimic vs non-human: index = .78, SE = .16, 95% CI = [.49, 1.12].

- Indirect effect in mimic-human VI condition: β = - .52, SE = .15, 95% CI = [- .83, - .24].

- Indirect effect in non-human VI condition: β = .67, SE = .13, 95% CI = [.42, .95].

- Indirect effect in animated-human VI condition: β = - .15, SE = .14, 95% CI = [- .43, .12].

Fig. 4. Mediation. Note: *p <.05, **p <.01, ***p <.001. a is the coefficient of VI on social presence; b is the coefficient of social presence on benefit seeking (authenticity); c is the coefficient of VI on benefit seeking; c' is the coefficient of VI on benefit seeking when VI and social presence are included in the regression on benefit seeking. Index of mediation: mimic vs animated: index = 0.24, SE = 0.16, 95 % CI = [- 0.07, 0.57]; mimic vs non-human: index = 0.78, SE = 0.16, 95 % CI = [0.49, 1.12]. Indirect effect in mimic-human VI condition: β = - 0.52, SE = 0.15, 95 % CI = [- 0.83, - 0.24]. Indirect effect in non-human VI condition: β = 0.67, SE = 0.13, 95 % CI = [0.42, 0.95]. Indirect effect in animated-human VI condition: β = - 0.15, SE = 0.14, 95 % CI = [- 0.43, 0.12].

Thus, Hypothesis 1 is partially supported. Finally, social presence mediates the effect of mimic-human and non-human VIs on authenticity benefit seeking behaviour, but it does not mediate the effect of animated-human VI on authenticity benefit (Study 4), which partially supports Hypothesis 2.

5.1. Theoretical contributions

Overall, this research makes two contributions to the VI literature. First, we reveal that social presence is the primary underlying theoretical mechanism for the effect of VIs on emotional attachment and applies social presence theory to the VI context. As far as we know, we are the first to use social presence theory to explain the effect of VI type on emotional attachment, and reveal that mimic-human VIs engender lower emotional attachment than animated and non-human VIs because of the significantly lower level of social presence for mimic-human VIs and higher level of social presence for non-human VIs.

Prior research on VIs has found other underlying mechanisms on consumer attitudes and behaviours, including psychological distance (Sands et al., 2022), subjective human feeling against machines (Luo et al., 2019), source credibility (e.g., Molin & Nordgren, 2019), perceived trust (Wandoko & Panggati, 2022), and uncanny valley effect (Arsenyan & Mirowska, 2021). We extend the VI literature by highlighting the mediation role of social presence. Furthermore, the concept of 'social presence' is not consistent in the literature, for example, Sambo et al. (2010) suggest that social presence is "observation by others", Hofeditz et al. (2022) and Mohanty (2021) suggest that it is "the perceived level of awareness of other human users through a computer system; the salience of other people and social entity", Purington et al. (2017) and Schroeder and Epley (2016) suggest it is "personification, or the presence of a human-like mind and voice" and Jin et al. (2021) suggest it is "feeling of presence of oneself (self-presence)" in the social

media context. We construe the concept of social presence as the sense of being with the virtual influencer and find that increased perceived humanness decreases the perceived social presence for VIs. The way we define social presence builds on the view of Felnhofer et al. (2019), who suggest that social presence is when users feel present with the object, such as avatars and agents.

The current dimensions of social presence mostly focus on intimacy, immediacy, social contact and interactivity (Short et al., 1976), and we contribute to the social presence theory by showing that the cognitive factor is important for the ability to convey the sense of being with the others such that the uncanny valley effect, unfamiliarity and inconsistent perception and confusion of mimic-human VIs can increase the cognitive loading, which leads to lower social presence level. We extend the social presence theory by suggesting that the design of virtual figures can work as communication medium and consequently make consumers more attached to some figures but less attached to others.

Moreover, there are conflictive findings in terms of the effect of anthropomorphism of virtual influencers on social presence. On one hand, the increasing level of anthropomorphism and human-like/realistic appearance can have a positive effect on the social presence (Arsenyan & Mirowska, 2021; Mohanty, 2021; Mouritzen et al., 2023) and feeling of appealing (Lou et al., 2023). On the other hand, the realistic appearance can also make consumers feel uneasy (Mouritzen et al., 2023), and the human likeness can elicit less positive reaction (Nowak & Biocca, 2003). Our research solves this conflict based on the taxonomy of virtual influencer and finds that uncanny valley effect and heavier cognitive load elicited by mimic-human VIs can mitigate the effect of anthropomorphism on social presence. We contribute to the controversy by suggesting that the effect of anthropomorphism on social presence might be a reversed U shape in the VI context, such that anthropomorphism positively influences social presence level but extremely high level of anthropomorphism lowers the social presence

level.

Secondly, we reveal that social presence is the primary underlying theoretical mechanism for the effect of VIs on benefit seeking behavior, such that consumers seek different benefits for different types of VIs based on the level of social presence, i.e., consumers are more likely to seek authenticity benefit (the desire to connect on personal level and finding the object likeable) for animated and non-human VIs than mimic-human VI because of significantly lower level of social presence for mimic-human VIs and higher level of social presence for non-human VIs. The previous application of social presence in influencer marketing mainly focuses on the effect of human influencers, for example the livestreaming e-Commerce and consumers' purchasing intention of it (Huang et al., 2022; Jin et al., 2021). We extend the previous research of social presence by applying it to the VI context and reveal its mediation role for the effect of VI on benefit seeking behavior.

Consumer benefit-seeking behaviour is a crucial aspect of market segmentation, driving purchase decisions more effectively than demographic characteristics or consumption volume. However, there is limited knowledge regarding why consumers choose to follow influencers and the benefits they derive from such engagements. Past research about benefit seeking and motives to follow influencers and VIs summarize the general motives but did not distinguish the differences in benefit seeking behaviour across different types of VIs (Croes & Bartels, 2021; Farrell et al., 2022; Lee et al., 2022; Lou et al., 2023). However, we propose that the nature of the virtual influencer—whether mimic-human, animated, or non-human—can significantly impact the extent to which these benefits are sought and experienced. The level of social presence influences the authenticity benefit, with higher social presence enhancing the authenticity perception. Mimic-human VIs, due to their unsettling realism, struggle to elicit the same level of social presence with other types of VIs, and thus lead to lower authenticity benefit, whereas animated- and non-human VIs are perceived as more genuine and engaging compared to mimic-human VIs. This result supports the findings in the VI literature that mimic-human VIs are "authentically fake" (Arsenyan & Mirowska, 2021), and that followers know they are consuming staged content and narratives (Lou et al., 2023). Nevertheless, our results did not reveal significant difference on information, inspiration and envy and entertainment benefits seeking across different types of VIs.
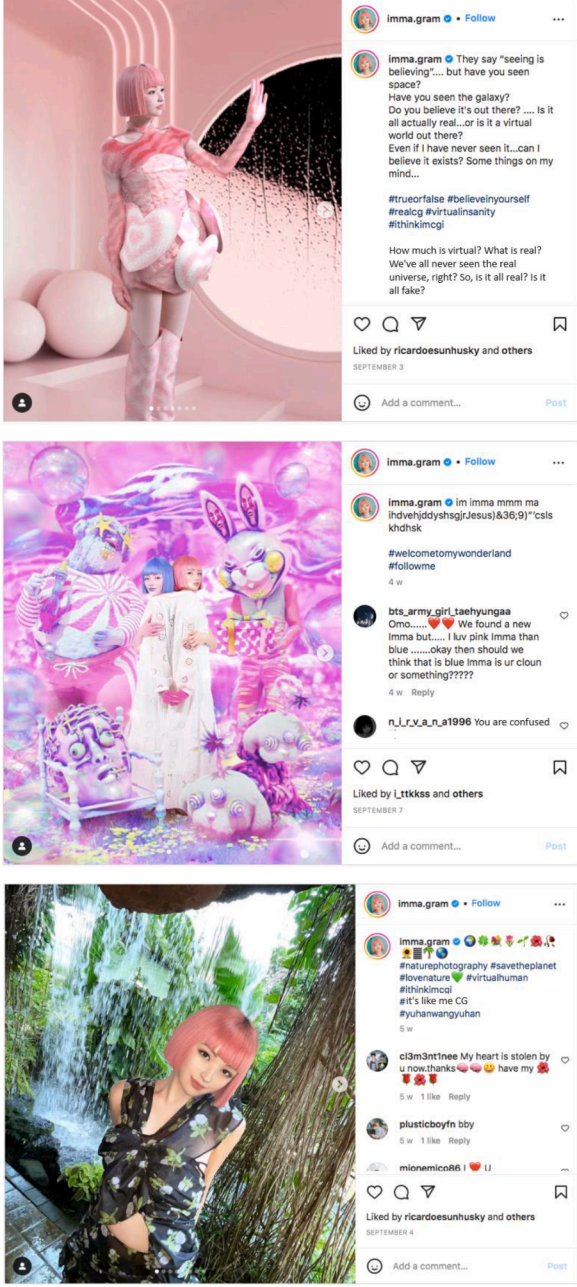
5.2. Managerial implications

The use of VIs to promote brands and products is growing in popularity (Cheung & Leung, 2021). The best VIs can attract millions of followers (Influencer Marketing Hub, 2022). Our findings provide practical suggestions for marketers for choosing appropriate types of VIs for their business. For example, when an industry features care-providing and entertaining consumers, animated-human and non-human VIs are likely to establish a stronger emotional bond with consumers than mimic-human VIs. The popularity of LinaBell, the fox of Shanghai and Hong Kong Disneyland, is an example consistent with our findings (Qu & Deng, 2022). Moreover, regardless of the type of VI that brands choose to use, increasing the level of social presence in the design can strengthen consumers' emotional attachment to the corresponding VI.
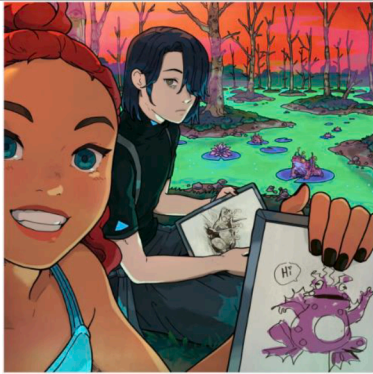
5.3. Limitations and future research

We used the general daily posts of the VIs in the studies, which mostly fall in the entertainment industry. Future research may test the effect of VIs in different roles and industries, such as caretaker, neutral, and interactive (e.g., chatbots). Moreover, the mediation effect of social presence for animated-human VIs is not significant on emotional attachment and benefit seeking. The reason may be that the medium level of perceived humanness is not as influential as its counterparts and thus may be perceived as vaguely positioned by consumers. Future research could investigate consumers' perception of animated-human VIs. In addition, future research could explore the boundary conditions such as product category or consumer traits to explain the effect of VIs on emotional attachment and benefit seeking, which could be interesting for marketers to better design their influencer marketing strategy.
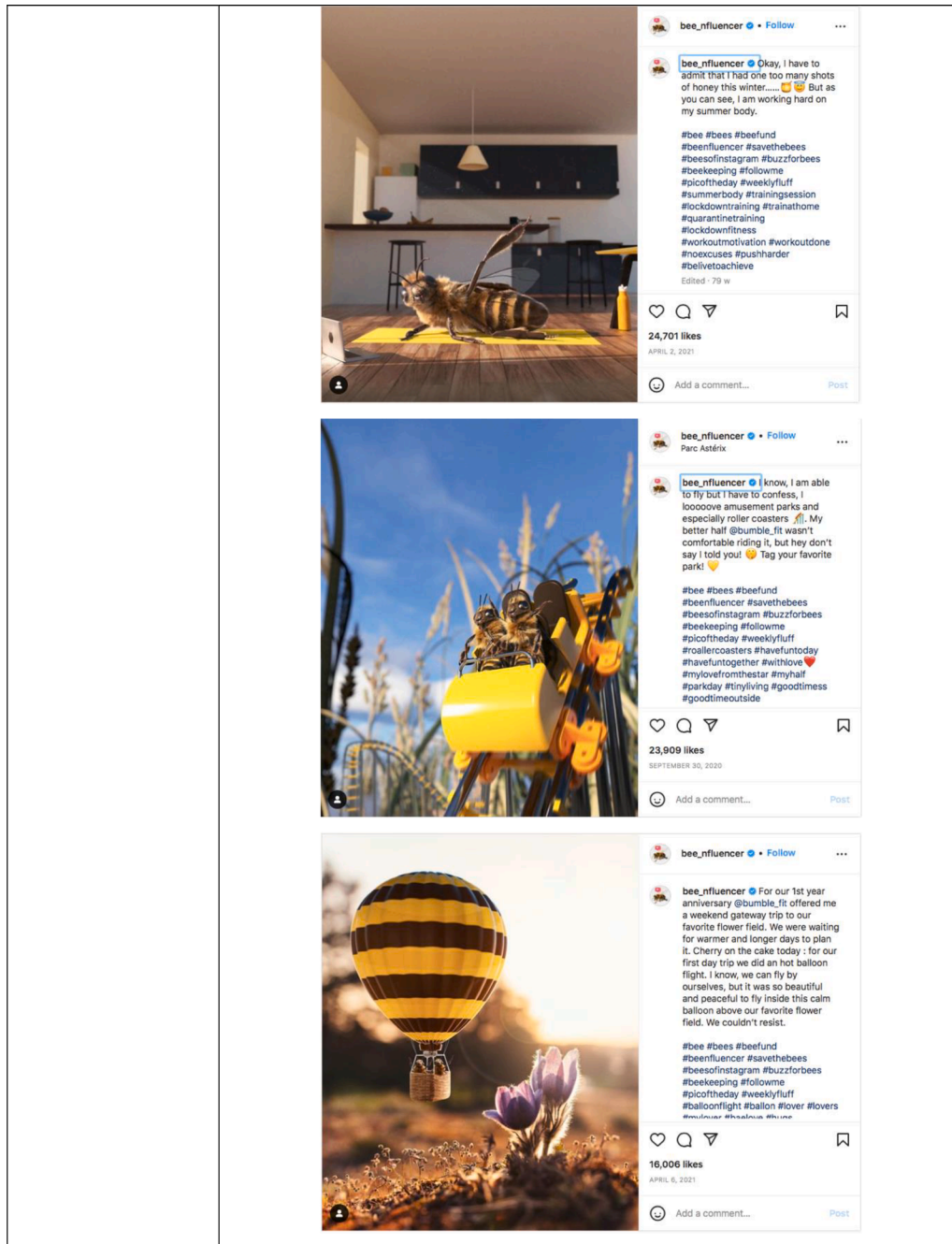
CRediT authorship contribution statement

Ji Yan: Conceptualization, Writing – original draft, Writing – review & editing. **Senmao Xia:** Writing – review & editing, Supervision, Resources, Conceptualization. **Amanda Jiang:** Writing – review & editing, Writing – original draft. **Zhibin Lin:** Validation, Supervision, Conceptualization.

Appendix 1

Type of VI	Instagram posts
Mimic-human VI (@Imma)	

Animated-human VI (@Liv in the future)		

| Non-human VI (@Bee_nfluencer) | |

References

AJmarketing. (2023). Top 20 Virtual Influencers to Follow in 2023. Retrieved from https://www.ajmarketing.io/post/top-20-virtual-influencers-to-follow.

Andersson, V., & Sobek, T. (2020). *Virtual avatars, virtual influencers & authenticity: A qualitative study from a consumer perspective.* [Master thesis, University of Gothenburg]. Gothenburg University Library. http://hdl.handle.net/2077/64928.

Angelaki, C., & Mavroidis, I. (2013). Communication and social presence: The impact on adult Learners' emotions in distance Learning. *European Journal of Open, Distance and e-Learning, 16*(1), 78–93.

Argyle, M., & Dean, J. (1965). Eye-contact, distance and affiliation. *Sociometry*, 289–304.

Arsenyan, J., & Mirowska, A. (2021). Almost human? a comparative case study on the social media presence of virtual influencers. *International Journal of Human-Computer Studies, 155*, Article 102694.

Audi, M., Al Masri, R., & Ghazzawi, K. (2015). The effect of celebrity endorsement on creating brand loyalty: An application on the lebanese cosmetic sector's demand. *International Journal of Business Management and Economic Research, 6*(5), 273–287.

Bai, Q., Dan, Q., Mu, Z., & Yang, M. (2019). A systematic review of emoji: Current research and future perspectives. *Frontiers in Psychology, 10*, 2221.

Bailis, R. (2019). *The state of influencer marketing: 10 influencer marketing statistics to inform where you invest.* Retrieved from https://www.bigcommerce.co.uk/blog/influencer-marketing-statistics/#what-is-influencer-marketing.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173.

Berryman, R., Abidin, C., & Leaver, T. (2021). A topography of virtual influencers. *The 22nd Annual Conference of the Association of Internet Researchers AoIR2021*.

Biocca, F., Harms, C., & Burgoon, J. K. (2003). Toward a more robust theory and measure of social presence: Review and suggested criteria. *Presence: Teleoperators & Virtual Environments, 12*(5), 456–480.

Bozkurt, S., Gligor, D. M., & Babin, B. J. (2020). The role of perceived firm social media interactivity in facilitating customer engagement behaviors. *European Journal of Marketing, 55*(4), 995–1022.

Calefato, F., & Lanubile, F. (2010). Communication media selection for remote interaction of ad hoc groups. *Advances in Computers, 78*, 271–313.

Campbell, C., & Farrell, J. R. (2020). More than meets the eye: The functional components underlying influencer marketing. *Business Horizons, 63*(4), 469–479.

Cheung, F., & Leung, W. F. (2021). Virtual influencer as celebrity endosers. *University of South Florida M3 Center Publishing, 5*(2021), 44.

Choudhry, A., Han, J., Xu, X., & Huang, Y. (2022). "I felt a little crazy following a 'doll'": Investigating real influence of virtual influencers on their followers. *Proceedings of the ACM on Human-Computer Interaction, 6*(GROUP), 1-28.

Chow, Y. (2023). Fad or future? Meet the virtual influencers taking over social media. Retrieved from https://www.stryvemarketing.com/blog/virtual-influencers/.

Collins, N. L., & Feeney, B. C. (2004). An attachment theory perspective on closeness and intimacy. In *Handbook of closeness and intimacy* (pp. 173-198). Psychology Press.

Communication University of China. (2023). "China Virtual Digital Human Influence Index Report in 2022" (in Chinese). Retrieved from https://rmh.pdnews.cn/Pc/ArtInfoApi/article?id=34152748.

Conti, M., Gathani, J., & Tricomi, P. P. (2022). Virtual influencers in online social media. *IEEE Communications Magazine, 60*(8), 86–91.

Cornelius, S., Leidner, D. E., & Bina, S. (2021). How influential are virtual influencers? Impact of visual realism on credibility. *ICIS 2021 TREOs, 29.*

Croes, E., & Bartels, J. (2021). Young adults' motivations for following social influencers and their relationship to identification and buying behavior. *Computers in Human Behavior, 124*, Article 106910.

Da Silva Oliveira, A. B., & Chimenti, P. (2021). " humanized robots": A proposition of categories to understand virtual influencers. *australasian. Journal of Information Systems, 25.*

De Brito Silva, M. J., de Oliveira Ramos Delfino, L., Alves Cerqueira, K., & de Oliveira Campos, P. (2022). Avatar marketing: A study on the engagement and authenticity of virtual influencers on Instagram. *Social Network Analysis and Mining, 12*(1), 130.

Dubosc, C., Gorisse, G., Christmann, O., Fleury, S., Poinsot, K., & Richir, S. (2021). Impact of avatar facial anthropomorphism on body ownership, attractiveness and social presence in collaborative tasks in immersive virtual environments. *Computers & Graphics, 101*, 82–92.

Eco, U., Santambrogio, M., & Violi, P. (1988). *Meaning and mental representations* (Vol. 496). Indiana University Press.

Engström, J. (2022). Virtual influencers: Antecedents and typologizing. *The SAGE Handbook of Social Media Marketing, 276.*

Farrell, J. R., Campbell, C., & Sands, S. (2022). What drives consumers to engage with influencers?: Segmenting consumer response to influencers: Insights for managing social-media relationships. *Journal of Advertising Research, 62*(1), 35–48.

Felnhofer, A., Kaufmann, M., Atteneder, K., Kafka, J. X., Hlavacs, H., Beutl, L., & Kothgassner, O. D. (2019). The mere presence of an attentive and emotionally responsive virtual character influences focus of attention and perceived stress. *International Journal of Human-Computer Studies, 132*, 45–51.

Fortin, D. R., & Dholakia, R. R. (2005). Interactivity and vividness effects on social presence and involvement with a web-based advertisement. *Journal of Business Research, 58*(3), 387–396.

Fournier, S. (1998). Consumers and their brands: Developing relationship theory in consumer research. *Journal of Consumer Research, 24*(4), 343–373.

Gerlich, M. (2023). The power of virtual influencers: Impact on Consumer behaviour and attitudes in the age of AI. *Administrative Sciences, 13*(8), 178.

Grisaffe, D. B., & Nguyen, H. P. (2011). Antecedents of emotional attachment to brands. *Journal of Business Research, 64*(10), 1052–1059.

Haley, R. I. (1968). Benefit segmentation: A decision-oriented research tool. *Journal of Marketing, 32*(3), 30–35.

Herrington, J., Parker, J., & Boase-Jelinek, D. (2013). *Social presence and participatory media in authentic learning.* Paper presented at the Open and Distance Learning Association of Australia (ODLAA) 2013 Distance Education Summit.

Hofeditz, L., Nissen, A., Schütte, R., & Mirbabaie, M. (2022). Trust me, I'm an influencer!-A comparison of perceived trust in human and virtual influencers. *ECIS 2022 Research-in-Progress Papers, 27.*

Huang, Z., Zhu, Y., Hao, A., & Deng, J. (2022). How social presence influences consumer purchase intention in live video commerce: The mediating role of immersive experience and the moderating role of positive emotions. *Journal of Research in Interactive Marketing(ahead-of-print)*, 1–17.

Hudders, L., & Lou, C. (2023). The rosy world of influencer marketing? its bright and dark sides, and future research recommendations. *International Journal of Advertising, 42*(1), 151–161.

Huston, S., Huston, E., & Kozlowski, M. (2019). Learning dispositif and emotional attachment: A preliminary international analysis. *Education Sciences, 9*(4), 279.

Influencer Marketing Hub. (2022). *Discover the top 15 virtual influencers for 2022 – listed and ranked!* Retrieved from https://influencermarketinghub.com/virtual-influencers/.

Influencer Marketing Hub. (2023). *Discover the top 12 virtual influencers for 2024 – listed and ranked!* Retrieved from https://influencermarketinghub.com/virtual-influencers/.

Instagram. (2022). *Noonoouri.* Retrieved from https://www.instagram.com/noonoouri/?hl=en.

Jiménez, F. R., & Voss, K. E. (2014). An alternative approach to the measurement of emotional attachment. *Psychology & Marketing, 31*(5), 360–370.

Jin, S. V., Ryu, E., & Muqaddam, A. (2021). I trust what she's# endorsing on instagram: Moderating effects of parasocial interaction and social presence in fashion influencer marketing. *Journal of Fashion Marketing and Management, 25*(4), 665–681.

Johnson, N. (2015). *The future of marketing: Strategies from 15 leading brands on how authenticity, relevance, and transparency will help you survive the age of the customer.* FT Press.

Kahn Jr, P. H., Kanda, T., Ishiguro, H., Gill, B. T., Shen, S., Gary, H. E., & Ruckert, J. H. (2015). *Will people keep the secret of a humanoid robot? Psychological intimacy in HRI.* Paper presented at the Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction.

Kahneman, D. (2017). *Thinking, fast and slow* (First paperback. ed.). New York: Farrar, Straus and Giroux.

Kätsyri, J., Förger, K., Mäkäräinen, M., & Takala, T. (2015). A review of empirical evidence on different uncanny valley hypotheses: Support for perceptual mismatch as one road to the valley of eeriness. *Frontiers in psychology, 6*, 390.

Keil, M., & Johnson, R. D. (2002). Feedback channels: Using social presence theory to compare voice mail to. *Journal of Information Systems Education, 13*(4), 295.

Kim, D., & Wang, Z. (2023). The ethics of virtuality: Navigating the complexities of human-like virtual influencers in the social media marketing realm. *Frontiers in Communication, 8*, 1205610.

Kim, H. J., & Chan-Olmsted, S. (2022). Influencer Marketing and social Commerce: Exploring the role of influencer communities in predicting usage intent. *Journal of Interactive Advertising*, 1–20.

Kim, S. Y., Schmitt, B. H., & Thalmann, N. M. (2019). Eliza in the uncanny valley: Anthropomorphizing consumer robots increases their perceived warmth but decreases liking. *Marketing Letters, 30*(1), 1–12.

Kim, T., Sung, Y., & Moon, J. H. (2020). Effects of brand anthropomorphism on consumer-brand relationships on social networking site fan pages: The mediating role of social presence. *Telematics and Informatics, 51*, Article 101406.

Konya-Baumbach, E., Biller, M., & von Janda, S. (2023). Someone out there? a study on the social presence of anthropomorphized chatbots. *Computers in Human Behavior, 139*, Article 107513.

Koponen, J. P., & Rytsy, S. (2020). Social presence and e-commerce B2B chat functions. *European Journal of Marketing, 54*(6), 1205–1224.

Kreijns, K., Xu, K., & Weidlich, J. (2021). Social presence: Conceptualization and measurement. *Educational Psychology Review*, 1–32.

Lay, S. (2015). *The Uncanny Valley Effect:* Open University (United Kingdom).

Lazarus, R. S., & Smith, C. A. (1988). Knowledge and appraisal in the cognition—emotion relationship. *Cognition & Emotion, 2*(4), 281–300.

Lee, J. A., Sudarshan, S., Sussman, K. L., Bright, L. F., & Eastin, M. S. (2022). Why are consumers following social media influencers on instagram? exploration of consumers' motives for following influencers and the role of materialism. *International Journal of Advertising, 41*(1), 78–100.

Lee, K. M., Peng, W., Jin, S. A., & Yan, C. (2006). Can robots manifest personality?: An empirical test of personality recognition, social responses, and social presence in human–robot interaction. *Journal of Communication, 56*(4), 754–772.

Lee, S., Park, G., & Chung, J. (2023). Artificial emotions for Charity collection: A serial mediation through perceived anthropomorphism and social presence. *Telematics and Informatics, 102009.*

Li, Y., Xiong, Y., Mariuzzo, F., & Xia, S. (2021). The underexplored impacts of online consumer reviews: Pricing and new product design strategies in the O2O supply chain. *International Journal of Production Economics, 237*, 108148.

Lou, C., Kiew, S. T. J., Chen, T., Lee, T. Y. M., Ong, J. E. C., & Phua, Z. (2023). Authentically fake? how consumers respond to the influence of virtual influencers. *Journal of Advertising, 52*(4), 540–557.

Luo, X., Tong, S., Fang, Z., & Qu, Z. (2019). Frontiers: Machines vs. humans: The impact of artificial intelligence chatbot disclosure on customer purchases. *Marketing Science, 38*(6), 937–947.

MacDorman, K. F. (2019). In the uncanny valley, transportation predicts narrative enjoyment more than empathy, but only for the tragic hero. *Computers in Human Behavior, 94*, 140–153.

MacInnis, D. J., & Folkes, V. S. (2017). Humanizing brands: When brands seem to be like me, part of me, and in a relationship with me. *Journal of Consumer Psychology, 27*(3), 355–374.

MacKinnon, D. P. (2012). *Introduction to statistical mediation analysis.* Routledge.

Mei, J. (2021). Virtual influencers: Walking around the boundary of real and virtual. *Lecture Notes in Education Psychology and Public Media*, 104–113.

Mirowska, A., & Arsenyan, J. (2023). Sweet escape: The role of empathy in social media engagement with human versus virtual influencers. *International Journal of Human-Computer Studies, 174*, Article 103008.

Mohanty, S. (2021). *Role of the appearance of the virtual influencers on social presence and brand attitude* [Doctoral dissertation, State University of New York at Binghamton]. ProQuest Dissertations Publishing. https://www.proquest.com/docview/2597859750?pq-origsite=gscholar&fromopenview=true.

Molin, V., & Nordgren, S. (2019). Robot or human? The marketing phenomenon of virtual influencers: a case study about virtual influencers' parasocial interaction on Instagram [Master's thesis, Uppsala University]. Digitala Vetenskapliga Arkivet. https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1334486&dswid=-883.

Morgan, E. J., Carroll, D. J., Chow, C. K., & Freeth, M. (2022). The effect of social presence on mentalizing behavior. *Cognitive Science, 46*(4), e13126.

Mouritzen, S. L. T., Penttinen, V., & Pedersen, S. (2023). Virtual influencer marketing: the good, the bad and the unreal. *European Journal of Marketing, Vol. ahead-of-print* (No. ahead-of-print).

Moustakas, E., Lamba, N., Mahmoud, D., & Ranganathan, C. (2020). *Blurring lines between fiction and reality: Perspectives of experts on marketing effectiveness of virtual influencers.* Paper presented at the 2020 International Conference on Cyber Security and Protection of Digital Services (Cyber Security).

Mozafari, N., Weiger, W. H., & Hammerschmidt, M. (2021). Trust me, i'm a bot–repercussions of chatbot disclosure in different service frontline settings. *Journal of Service Management, 33*(2), 221–245.

Munnukka, J., Talvitie-Lamberg, K., & Maity, D. (2022). Anthropomorphism and social presence in human-virtual service assistant interactions: The role of dialog length and attitudes. *Computers in Human Behavior, 135*, Article 107343.

NAKS Digital Consulting. (2023). *The Rise of Virtual Influencers: Redefining the Social Media Landscape.* Retrieved from https://www.linkedin.com/pulse/rise-virtual-influencers-redefining-social-media/.

Neeley, S. M., & Schumann, D. W. (2004). Using animated spokes-characters in advertising to young children: Does increasing attention to advertising necessarily lead to product preference? *Journal of Advertising, 33*(3), 7–23.

Nowak, K. L., & Biocca, F. (2003). The effect of the agency and anthropomorphism on users' sense of telepresence, copresence, and social presence in virtual environments. *Presence: Teleoperators & Virtual Environments, 12*(5), 481–494.

Nowak, K. L., & Rauh, C. (2008). Choose your "buddy icon" carefully: The influence of avatar androgyny, anthropomorphism and credibility in online interactions. *Computers in Human Behavior, 24*(4), 1473–1493.

Oh, C. S., Bailenson, J. N., & Welch, G. F. (2018). A systematic review of social presence: Definition, antecedents, and implications. *Frontiers in Robotics and A, I,* 114.

Ong, T. (2020). Virtual influencers make real money while covid locks down human stars. *Bloomberg UK.* Retrieved from https://www.bloomberg.com/news/features/2020-10-29/lil-miquela-lol-s-seraphine-virtual-influencers-make-more-real-money-than-ever.

P2P. (2022). *A virtual influencer: What are they and why you need them for your brand.* Retrieved from https://peertopeermarketing.co/virtual-influencer/#:~:text=%205%20Brands%20Who%20Are%20Using%20Virtual%20Influencers.,virtual%20influencer%20action%20and%20created%20Daisy.%20More%20.

Pan, X., & Hamilton, A. F. D. C. (2018). Why and how to use virtual reality to study human social interaction: The challenges of exploring a new research landscape. *British Journal of Psychology, 109*(3), 395–417.

Prasad, A., & Holzinger, I. (2013). Seeing through smoke and mirrors: A critical analysis of marketing CSR. *Journal of Business Research, 66*(10), 1915–1921.

Purington, A., Taft, J. G., Sannon, S., Bazarova, N. N., & Taylor, S. H. (2017). *"Alexa is my new BFF" social roles, user satisfaction, and personification of the amazon echo.* Paper presented at the Proceedings of the 2017 CHI conference extended abstracts on human factors in computing systems.

Qaiser, S., Bashir, M. A., Yasir, M., & Fahim, S. M. (2021). The mediating role of customer engagement on brand involvement and emotional brand attachment. *The Lahore Journal of Business, 9*(2), 19–40.

Qu, T., & Deng, I. (2022). Move over mickey mouse: Disney's hottest hit in China is a pink fox called linabell. *South China Morning Post.* Retrieved from https://www.scmp.com/tech/big-tech/article/3162715/move-over-mickey-mouse-disneys-hottest-hit-china-pink-fox-called.

Rosário, J. F. D., & Loureiro, S. M. C. (2021). The effectiveness of e-word-of-mouth communication about smartphones purchase intention: Digital influencer. *International Journal of Internet Marketing and Advertising, 15*(4), 429–449.

Rottenstreich, Y., Sood, S., & Brenner, L. (2007). Feeling and thinking in memory-based versus stimulus-based choices. *Journal of Consumer Research, 33*(4), 461–469.

Sambo, C. F., Howard, M., Kopelman, M., Williams, S., & Fotopoulou, A. (2010). Knowing you care: Effects of perceived empathy and attachment style on pain perception. *PAIN®, 151*(3), 687–693.

Sands, S., Campbell, C. L., Plangger, K., & Ferraro, C. (2022). Unreal influence: Leveraging AI in influencer marketing. *European Journal of Marketing, 56*(6), 1721–1747.

Sands, S., Ferraro, C., Demsar, V., & Chandler, G. (2022). False idols: Unpacking the opportunities and challenges of falsity in the context of virtual influencers. *Business Horizons, 65*(6), 777–788.

Sannygangwar. (2023). *The Evolution of Natural Language Processing in Virtual Assistant AI.* Retrieved from https://medium.com/@sannygangwar21/the-evolution-of-natural-language-processing-in-virtual-assistant-ai-6312f5d9e98f#:~:text=Advanced%20NLP%20models%20can%20now,and%20considering%20the%20broader%20conversation.

Schroeder, J., & Epley, N. (2016). Mistaking minds and machines: How speech affects dehumanization and anthropomorphism. *Journal of Experimental Psychology: General, 145*(11), 1427.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications.* London: John Wiley & Sons.

Singh, R. (2021). "Hey Alexa–order groceries for me"–the effect of consumer–VAI emotional attachment on satisfaction and repurchase intention. *European Journal of Marketing, 56*(6), 1684–1720.

Skalski, P., & Whitbred, R. (2010). Image versus sound: A comparison of formal feature effects on presence and video game enjoyment. *PsychNology Journal, 8*(1).

Sokolov, M. (2019). Virtual influencer trends: an overview of the industry. Retrieved from https://www.thedrum.com/opinion/2019/12/05/virtual-influencer-trends-overview-the-industry.

Statista. (2022). *Virtual influencers - statistics & facts.* Retrieved from https://www.statista.com/topics/9805/virtual-influencers/#dossierKeyfigures.

Statista. (2023). *Digital humans in China - statistics & facts.* Retrieved from: https://www.statista.com/topics/11043/virtual-humans-in-china/#editorsPicks.

Stein, J. P., Linda Breves, P., & Anders, N. (2022). Parasocial interactions with real and virtual influencers: The role of perceived similarity and human-likeness. *New Media & Society,* 14614448221102900.

Stock, R. M. & Merkle, M., (2018), "Can humanoid service robots perform better than service employees? A comparison of innovative behavior cues", *Proceedings of the 51st Hawaii International Conference on System Sciences*, Waikoloa Village, HI, January 3-6, pp. 1056-1065.

Thomas, V. L., & Fowler, K. (2021). Close encounters of the AI kind: Use of AI influencers as brand endorsers. *Journal of Advertising, 50*(1), 11–25.

Thomson, M., MacInnis, D. J., & Whan Park, C. (2005). The ties that bind: Measuring the strength of consumers' emotional attachments to brands. *Journal of Consumer Psychology, 15*(1), 77–91.

Tinwell, A., Grimshaw, M., Nabi, D. A., & Williams, A. (2011). Facial expression of emotion and perception of the Uncanny Valley in virtual characters. *Computers in Human Behavior, 27*(2), 741–749.

Tsai, W.-H.-S., Liu, Y., & Chuan, C.-H. (2021). How chatbots' social presence communication enhances consumer engagement: The mediating role of parasocial interaction and dialogue. *Journal of Research in Interactive Marketing, 15*(3), 460–482.

Tseng, F.-C., Cheng, T., Yu, P.-L., Huang, T.-L., & Teng, C.-I. (2019). Media richness, social presence and loyalty to mobile instant messaging. *Industrial Management & Data Systems, 119*(6), 1357–1373.

Tu, C. H. (2000). On-line learning migration: From social learning theory to social presence theory in a CMC environment. *Journal of Network and Computer Applications, 23*(1), 27–37.

Tu, C. H. (2001). How chinese perceive social presence: An examination of interaction in online learning environment. *Educational Media International, 38*(1), 45–60.

Twitter. (2019). *Hatsune Miku.* Retrieved from https://twitter.com/cfm_miku_en/status/1166894560959578114?lang=en.

Tyagi, C., & Kumar, A. (2004). *Consumer behaviour.* Atlantic Publishers & Dist.

Van Doorn, J., Mende, M., Noble, S. M., Hulland, J., Ostrom, A. L., Grewal, D., & Petersen, J. A. (2017). Domo arigato mr. roboto: Emergence of automated social presence in organizational frontlines and customers' service experiences. *Journal of Service Research, 20*(1), 43–58.

Virtual Humans. (2022a). *The case for non-human digital characters.* Retrieved from https://www.virtualhumans.org/article/the-case-for-non-human-digital-characters.

Virtual Humans. (2022b). *Who is virtual influencer and famous tiktoker nobody sausage?* Retrieved from https://www.virtualhumans.org/article/who-is-virtual-influencer-and-famous-tiktoker-nobody-sausage.

Virtual Humans. (2022c). *About good advice cupcake.* Retrieved from https://www.virtualhumans.org/human/good-advice-cupcake.

Virtual Humans. (2022d). The most-followed virtual influencers of 2022. Retrieved from https://www.virtualhumans.org/article/the-most-followed-virtual-influencers-of-2022.

Vlachos, P. A., Theotokis, A., Pramatari, K., & Vrechopoulos, A. (2010). Consumer-retailer emotional attachment: Some antecedents and the moderating role of attachment anxiety. *European Journal of Marketing, 44*(9/10), 1478–1499.

Wandoko, W., & Panggati, I. E. (2022). The influence of digital influencer, e-WOM and information quality on customer repurchase intention toward online shop in e-marketplace during pandemic COVID-19: The mediation effect of customer trust. *Journal of Relationship Marketing, 21*(2), 148–167.

Wang, T., Yeh, R. K. J., Yen, D. C., & Sandoya, M. G. (2016). Antecedents of emotional attachment of social media users. *The Service Industries Journal, 36*(9–10), 438–451.

Wei, M., Vogel, D. L., Ku, T.-Y., & Zakalik, R. A. (2005). Adult attachment, affect regulation, negative mood, and interpersonal problems: The mediating roles of emotional reactivity and emotional cutoff. *Journal of Counseling Psychology, 52*(1), 14.

Wiener, M., & Mehrabian, A. (1968). *Language within language: Immediacy, a channel in verbal communication.* Ardent Media.

Wolff, W. E. M. (2022) *A trend or is the future of influencer marketing virtual? The effect of virtual influencers and sponsorship disclosure on purchase intention, brand trust, and consumer engagement* [Master's thesis, University of Twente]. Student Theses. https://purl.utwente.nl/essays/89515.

Wu, G. M. (2000). *The role of perceived interactivity in interactive ad processing.* The University of Texas at Austin.

Yang, J., Chuenterawong, P., Lee, H., & Chock, T. M. (2022). Anthropomorphism in CSR endorsement: A comparative study on human-vs. cartoon-like virtual influencers' climate change messaging. *Cartoon-Like Virtual Influencers' Climate Change Messaging.* Available at SSRN: https://ssrn.com/abstract=4145550 or https://doi.org/10.2139/ssrn.4145550.

Xia, S., Ling, Y., De Main, L., Lim, M. K., Li, G., Zhang, P., & Cao, M. (2022). Creating a low carbon economy through green supply chain management: Investigation of willingness-to-pay for green products from a consumer's perspective. *International Journal of Logistics Research and Applications,* 1–31.

Yoo, Y., & Alavi, M. (2001). Media and group cohesion: Relative influences on social presence, task participation, and group consensus. *MIS quarterly,* 371–390.

Zhang, L., & Liu, X. (2023). Interactivity and live-streaming commerce purchase intention: Social presence as a mediator. *Social Behavior and Personality: An international journal, 51*(2), 1–7.

Zhang, L., & Wei, W. (2021). Influencer marketing: A comparison of traditional celebrity, social media influencer, and AI influencer. *Boston Hospitality Review.* Available at: https://www.bu.edu/bhr/2021/10/04/influencer-marketing-a-comparison-of-traditional-celebrity-social-media-influencer-and-ai-influencer/.

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