Making Sense? The Sensory-Specific Nature of Virtual Influencer Effectiveness

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Acknowledgments

Abstract

The current research examines consumers' responses to sensory endorsements from virtual influencers. The authors reveal that consumers perceive virtual and human influencers to have similar distal sensory (i.e., visual and auditory) capacities. Consumers, however, perceive virtual influencers as having lower proximal sensory (i.e., haptic, olfactory, and gustatory) capacities. Consequently, when endorsements focus on proximal sensory experiences, consumers have lower purchase intention toward products and services endorsed by a virtual (vs. human) influencer. The findings further reveal that imagery difficulty and perceived sensory capacity serially mediate this effect. Importantly, this effect is mitigated when endorsements focus on distal sensory experiences, when sensory information is not explicitly mentioned, and when consumers are informed of new technology that enables virtual influencers to have proximal sensory experiences. These findings offer actionable insights for marketers to effectively utilize virtual influencers in sensory-driven campaigns, providing practical strategies to improve consumer responses to sensory endorsements and enhance marketing effectiveness.

Keywords: virtual influencers, sensory capacities, influencer marketing, sensory marketing, distal and proximal sensory experiences

Virtual influencers are computer-generated characters with a social media presence (Arsenyan and Mirowska 2021; Moustakas et al. 2020). Similar to human influencers, they exert significant social media influence and interact with audiences online (Moustakas et al. 2020). And they frequently endorse products and services, as witnessed in global brand campaigns for Prada, Samsung, Porsche, Unilever, and Calvin Klein (Batista da Silva Oliveira and Chimenti 2021). Table 1 lists the top 10 most-followed virtual influencers on Instagram and their endorsement deals. However, conveying sensory information through virtual influencers presents a complex and multifaceted challenge for marketers.

Insert Table 1 Here

On the one hand, examples such as virtual influencer Lil Miquela's successful promotion of fashion brands and virtual idol Miku's captivating concerts are emblematic of visual and auditory endorsements that have yielded positive outcomes. On the other hand, some virtual influencers' efforts have been ineffective, as evidenced when virtual influencer Ling shared a photo on social media applying Gucci lipstick and endorsing it using haptic appeals. Consumers reacted negatively and had doubts about Ling's ability to genuinely feel the tactile sensation of the lipstick (Vmarketing 2021). As a result of the conflicting outcomes surrounding the use of virtual influencers as endorsers, marketers are uncertain about the capacity of virtual influencers to authentically convey sensory experiences (Wong 2018; for more examples, see Web Appendix A, Table W1).

The foregoing uncertainty motivated the current study. In particular, we examine the implications of virtual influencers' endorsements of sensory experiences and discuss the potential challenges and opportunities in conveying sensory information. Our research aims to answer the following questions: How can managers effectively use virtual influencers to

impart sensory information, and what kinds of sensory information might be ineffectively conveyed by virtual influencers?

Building on prior literature on sensory marketing, anthropomorphism and humanization, and influencer marketing (e.g., Biswas et al. 2014; Crolic et al. 2022; Hughes，Swaminathan, and Brooks 2019; Kwak, Puzakova, and Rocereto 2015; Leung et al. 2022), we propose and show that virtual influencers are generally believed to have lower capacities for proximal (i.e., haptic, olfactory, and gustatory) senses than human influencers. We refer to this belief as "perceived sensory deficiency of virtual influencers." As a result of this belief, when an endorsement involves proximal sensory experiences, consumers respond less favorably toward products and services endorsed by a virtual (vs. human) influencer.

The present undertaking makes several contributions. First, it expands the growing literature on virtual influencers (see Table 2 for a summary of the literature in this area). Research in this domain has investigated perceived overall trustworthiness of virtual influencers (Riedl et al. 2014), perceived authenticity of virtual influencers (Batista da Silva Oliveira and Chimenti 2021; Moustakas et al. 2020), perceived moral responsibility of virtual influencers (Yan, Mo, and Zhou 2023), virtual agents' power of persuasion in a story-telling context (Faddoul and Chatterjee 2020), and audience reactions to virtual influencers on social media (Arsenyan and Mirowska 2021). However, only a few studies have explored the impact of virtual (vs. human) influencers on purchase intention (e.g., Franke, Groeppel-Klein, and Müller 2023; Li et al. 2023). In the current research, we systematically analyzed when, why, and how consumers perceive different sensory capacities of virtual influencers. Additionally, we examined the consequential impact of such perceptions on the effectiveness of virtual influencers' sensory endorsements. Consequently, our undertaking provides an

empirical understanding of consumer reactions to virtual influencer endorsements of sensory experiences.

Insert Table 2 Here

Second, use of sensory marketing has been found to be beneficial in many instances (e.g., Biswas et al. 2014; Elder and Krishna 2010; Krishna 2012; Krishna and Morrin 2008; Krishna, Morrin, and Sayin 2014; Peck and Childers 2003). For example, utilization of sensory language has been shown to enhance the effectiveness of human influencers (Cascio Rizzo et al. 2023). However, the present research demonstrates an important boundary condition for this practice: highlighting proximal sensory cues may inadvertently reduce consumers' purchase intention of products and services endorsed by virtual influencers.

Third, our research contributes to prior work on mind perception and anthropomorphism (e.g., Aggarwal and McGill 2007; Crolic et al. 2022; Puzakova, Kwak, and Rocereto 2013; Zhou, Kim, and Wang 2019). The extant literature in this area has focused on distinguishing between experience and agency as two distinct dimensions, but within the experience dimension, scholars have not made distinctions between the various subjective experiences of non-human entities (e.g., Gray, Gray, and Wegner 2007). We focus on sensory experiences and reveal that people do not consider the subjective experiences of non-human entities as analogous to human experiences. Indeed, we find an asymmetric effect on consumers' perceptions of the proximal versus distal sensory capacities of virtual influencers. The findings also have important implications for marketers in the fast-growing virtual influencer and social media industries.

Theoretical Framework

Virtual Influencer Marketing

Virtual influencers, which are created using computer graphics, have become an in-vogue marketing tool (Arsenyan and Mirowska 2021). These charismatic characters assume a first-person view of the world and have a social media presence (Arsenyan and Mirowska 2021; Moustakas et al. 2020). As this promotional strategy becomes increasingly popular, virtual influencers are establishing a global foothold in the lucrative influencer market. For example, Lu do Magalu is estimated to generate over $17 million per year (Steele 2022). Given the expanding use of virtual influencers in marketing campaigns, marketers and policymakers alike should have a keen understanding of human-virtual agent interactions.

Virtual influencers are frequently used to promote products and services from a sensory perspective. For example, in SK-II's "Power of Pitera" campaign featuring virtual influencer Imma, the company has focused on the haptic experiences created by the product. Another example is the virtual influencer Angie, who endorses Chicecream ice cream by conveying gustatory experiences. However, some marketing experts have raised concerns about the effectiveness of such endorsements (see Web Appendix A, Table W1). Their concerns involve whether marketers should employ virtual influencers to endorse products that appeal to the senses, as well as how to make such campaigns effective. Although virtual influencers can take many forms (e.g., animal-like virtual influencers), we focus exclusively on virtual influencers that take on a human-like form in the current research.

Sensory Experiences in Influencer Marketing

Sensory marketing is defined as "marketing that engages the consumers' senses and affects their perception, judgment, and behavior" (Krishna 2012: 333). Consumers experience products and services through their five senses (i.e., sight, hearing, smell, taste, and touch). Therefore, engaging consumers' senses is an effective way for companies to create value and achieve a competitive advantage. Scholars have consistently found that highlighting sensory cues related to a product influences consumers' evaluations of the product and their

subsequent behavior (e.g., Elder and Krishna 2010; Krishna and Morrin 2008; Krishna, Morrin, and Sayin 2014; Peck and Childers 2008). As a result, manufacturers and retailers purposefully expose consumers to assorted sensory cues at various points of contact to generate favorable consumer responses (Lindstrom 2010). Even when consumers are unable to have first-hand sensory experiences—such as in digital environments—marketers often provide them with vicarious sensory experiences (Luangrath et al. 2022).

In the context of influencer marketing, sensory marketing practices are primarily operationalized through sensory cues and information that influencers provide to consumers (e.g., Kim and Forsythe 2008; Petit, Velasco, and Spence 2019). The lack of direct sensory experiences in online shopping can be compensated by indirect sensory experiences (Abdallah 2015), in which influencers convey sensory evaluations to consumers. Given that influencers depict their own sensory experiences with the focal product or service, consumers' beliefs about the sensory capacities of influencers is critical. Thus, if influencers are perceived as lacking in related senses, their endorsements of products based on sensory experiences may not be convincing.

Human influencers obviously possess sufficient sensory capacities to convey vicarious sensory experiences to consumers. However, the picture is somewhat different when the influencers are not human. How, then, do consumers perceive the sensory capacities of virtual influencers? Of course, consumers know that virtual influencers are only digital constructs, not having literal physical and mental capacities with which to actually "see," "hear," "touch," "smell," and "taste"—at least not according to the traditional meaning ascribed to these sensory perceptions. Yet, virtual influencers sometimes act as if they have such capacities. Thus, in such instances, will consumers believe that virtual influencers have all five sensory capacities? In this research, we examine consumers' beliefs about virtual

influencers' sensory capacities (i.e., proximal vs. distal) and the related downstream consequences of consumer behavior.

Perceived Sensory Capacities of Virtual Influencers

Although all five senses can detect stimuli at close range, only certain senses can detect stimuli from afar (Elder et al. 2017). Even if sound or light waves are miles away, as long as they can travel through the atmosphere, people can see or hear them. In contrast, the stimuli for touch, smell, and taste must be at close range in order to be experienced (Elder et al. 2017). For this reason, touch, smell, and taste are referred to as proximal senses, while sight and hearing are labeled distal senses (Marks 2008).

A major distinction between proximal and distal senses is the salience of bodily sensation. Specifically, minimal bodily sensations accompany sight and hearing, but the proximal senses of touch, smell, and taste almost always induce salient bodily sensations (Korsmeyer 2019), such as the taste of hot chilies or the scratchy feeling of wool. Although sight and hearing can sometimes be experienced through bodily sensation—notably, when the stimuli are extreme, as with piercing light or penetrating sound frequencies—the embodied nature of the proximal senses of touch, smell, and taste is more prominent (Marks 2008). For this reason, proximal senses are also referred to as "bodily senses" or "sensuous" senses, according to the sensory hierarchy in Western philosophy (e.g., Prall 1929; Santayana 1896).

In the current research, we propose that consumers ascribe the distal sensory experiences of seeing and hearing to virtual influencers, but such a belief is to a lesser extent ascribed to influencers' proximal sensory experiences of touching, smelling, and tasting. In other words, consumers likely find virtual influencers capable of distal sensory experiences but relatively incapable of proximal sensory experiences. Why is this? We propose that imagery difficulty induces consumers' reluctance to believe that virtual influencers can experience touch, smell, and taste.

People make inferences about others' subjective experiences and behavior through simulation and imagination (Decety and Grèzes 2006). To understand others' subjective experiences, people usually imagine what they would feel if they were in the same situation and then project the simulated results onto the targets (Harris 1992). In the current context, we argue that it is difficult for consumers to imagine that a virtual influencer is capable of experiencing touch, smell, and taste. For instance, as previously mentioned, salient bodily sensations accompany these proximal sensory experiences. However, it can be difficult for consumers to project their own bodily experiences onto virtual influencers, because they know that the "bodies" of these influencers are markedly different from their own. Accordingly, they will be reluctant to use their own bodily sensations to simulate the virtual influencers' bodily sensations. Another factor that contributes to the difficulty of imagining virtual influencers' proximal sensory experiences is the absence of technology that enables them to touch, smell, and taste. Thus, this lack of exposure to certain sensory technologies may hinder consumers' ability to envision virtual influencers in possession of proximal sensory experiences.

Conversely, the ability of consumers to imagine that a virtual influencer is capable of seeing and hearing should be relatively easy. Because distal sensory experiences engender minimal bodily sensation, consumers can use their own past experiences to simulate others' visual and auditory experiences and effortlessly project the simulation results onto the target. Moreover, consumers are familiar with technologies that can "see" or "hear" (e.g., Siri can "hear" people speak; a Roomba vacuum can "see" to navigate around a home).

The Current Research

Collectively, the foregoing arguments suggest that consumers will have difficulty imagining virtual influencers' proximal sensory experiences. As such, this will lead them to believe that virtual influencers are incapable of processing proximal sensory input. This

perceived sensory-capacity deficiency will in turn induce consumers to be less likely to purchase their endorsed products and services with proximal sensory experiences. Therefore, we posit the following hypotheses:

> H_1: Consumers have lower purchase intention toward products and services endorsed by a virtual (vs. human) influencer when the endorsement focuses on proximal (vs. distal) sensory experiences.
>
> H_2: Imagery difficulty and perceived sensory capacity of the endorser sequentially mediate the effect of influencer type on consumers' purchase intention toward sensory-endorsed products and services.

According to our theoretical framework, the anticipated impact of influencer type on consumers' purchase intention stems from consumers' imagery difficulty and perceptions of sensory deficiencies toward virtual influencers. If consumers learn about innovative technology that equips virtual influencers with the capacity to perceive and process proximal sensory information, they may react favorably to advertisements from these virtual influencers that endorse products using proximal sensory experiences. Accordingly, we posit that making consumers aware of advanced technology—which indeed allows a virtual influencer to engage in proximal sensory experiences—might alleviate the aforementioned negative impact. Therefore, we propose the following hypothesis:

> H_3: The effect of influencer type on consumers' purchase intention toward sensory-endorsed products and services is mitigated when information about technology that enables virtual influencers to have proximal sensory experiences is provided.

Overview of Studies

Six studies (four of which were preregistered) were conducted to explore the proposed proximal sensory deficiency of virtual influencers and its consequences vis-à-vis consumer

behavior. Study 1 demonstrated this effect in a controlled online experiment, which revealed that participants perceived virtual influencers as having lower capacities for proximal (i.e., haptic, olfactory, and gustatory) senses than human influencers. To demonstrate the marketing implications of our findings, Study 2 found that when the endorsement focused on proximal sensory experiences, participants had lower purchase intention toward products and services that were endorsed by a virtual (vs. human) influencer. This finding was replicated in an online field experiment through A/B split advertisement testing on an actual shopping website (Study 3). To confirm the proposed underlying mechanism, Study 4 demonstrated that imagery difficulty and perceived sensory capacity of the endorser serially mediated the proposed effect. Study 5 showed that shifting away from conveying proximal sensory attributes toward conveying distal sensory attributes led to participants' acceptance of the endorsement. In addition, it indicated that participants' purchase intention did not decline with virtual (vs. human) influencers when the endorsement did not explicitly mention any sensory information. Study 6 demonstrated that the effect of virtual influencer endorsements was mitigated when participants received information about an advanced technology, thus affording virtual influencers to be perceived as able to experience proximal senses.

Insert Table 3 Here

We used various types of virtual influencers across the studies (see Table 3). Target sample sizes for all of the experiments were determined based on participant availability, study design, and collection method before the data were collected (Simmons, Nelson, and Simonsohn 2011). We report all manipulations and all hypothesis-related measures. We added an attention check in Studies 2, 4, 5, and 6. Excluding the participants who failed the attention check from our analyses did not significantly change the pattern of the main results (see Web Appendix B). Basic demographic measures (i.e., gender and age) were collected at

the end of each experiment (except for Study 3). Because they did not have a systematic

impact on our findings, we do not discuss them further in the paper (additional details about

manipulations, measures, and analyses can be found in the Web Appendix).

Study 1

Study 1 examined consumers' perceptions of the sensory capacities of virtual and

human influencers in an experimental setting. We predicted that consumers would perceive

virtual (vs. human) influencers as having distal sensory (i.e., visual and auditory) capacities

to some extent but lacking proximal sensory (i.e., haptic, olfactory, and gustatory) capacities.

Method

Two hundred participants (66.0% female; $M_{age} = 25.5$ years) completed this study in

exchange for nominal monetary compensation on Credamo, an online data-collection

platform similar to the Qualtrics Panel. They were randomly assigned to a 2 (influencer type:

virtual vs. human; between-subjects) × 5 (sensory type: visual vs. auditory vs. haptic vs.

olfactory vs. gustatory; within-subject measures) mixed-subjects design.

Participants were presented with an online profile of a fictitious female influencer,

Rico, based on a famous virtual influencer, Kizuna AI. All content in the profile was

controlled and equivalent, except that Rico was described as a virtual (vs. human) influencer

in the virtual (vs. human) influencer condition (see Table 3). In the virtual condition of this

study and the following studies (except for Study 3), participants were also informed that "a

virtual influencer is a digital character created in computer graphics software who takes a

first-person view of the world and has a social media presence." To capture participants'

perceptions of Rico's sensory capacities, we asked them to indicate their perceptions of Rico

on five three-item, seven-point scales in a randomized order (i.e., "Rico has the capability to

see/hear/touch/smell/taste"; "Rico is sensitive to visual/auditory/haptic/olfactory/gustatory

stimuli"; "Rico has visual/auditory/haptic/olfactory/gustatory experiences"; 1 = totally agree,

7 = totally disagree; all αs > .85).

Results

      A 2 (influencer type) × 5 (sensory type) mixed ANOVA on perceived sensory capacity revealed significant main effects of influencer type ($M_{virtual}$ = 5.26, SD = 1.11 vs. M_{human} = 5.79, SD = 1.00; $F(1, 198)$ = 12.53, p = .001; η_p^2 = .059) and sensory type (M_{visual} = 5.86, SD = 1.03 vs. $M_{auditory}$ = 5.93, SD = 1.03 vs. M_{haptic} = 5.15, SD = 1.41 vs. $M_{olfactory}$ = 5.22, SD = 1.54 vs. $M_{gustatory}$ = 5.44, SD = 1.55; $F(4, 195)$ = 22.35, p < .001; η_p^2 = .314), qualified by a significant interaction effect ($F(4, 195)$ = 5.43, p < .001; η_p^2 = .100; see Figure 1). Specifically, the virtual influencer's perceived capacities were rated lower than those of the human influencer on all three proximal senses: haptic ($M_{virtual}$ = 4.74, SD = 1.53 vs. M_{human} = 5.57, SD = 1.13; $F(1, 198)$ = 19.01, p < .001; η_p^2 = .088), olfactory ($M_{virtual}$ = 4.83, SD = 1.73 vs. M_{human} = 5.63, SD = 1.18; $F(1, 198)$ = 14.36, p < .001; η_p^2 = .068), and gustatory ($M_{virtual}$ = 5.05, SD = 1.74 vs. M_{human} = 5.86, SD = 1.19; $F(1, 198)$ = 14.56, p < .001; η_p^2 = .069). However, participants rated the distal senses—both visual ($M_{virtual}$ = 5.79, SD = .98 vs. M_{human} = 5.93, SD = 1.08; $F(1, 198)$ = 1.04, p = .309) and auditory ($M_{virtual}$ = 5.90, SD = 1.06 vs. M_{human} = 5.97, SD = 1.00; $F(1, 198)$ = .23, p = .635)—similarly with respect to the perceived capacities of the virtual influencer and the human influencer.

Figure 1: Mean Perceived Sensory Capacities as a Function of Influencer Type and Sensory Type (Study 1)
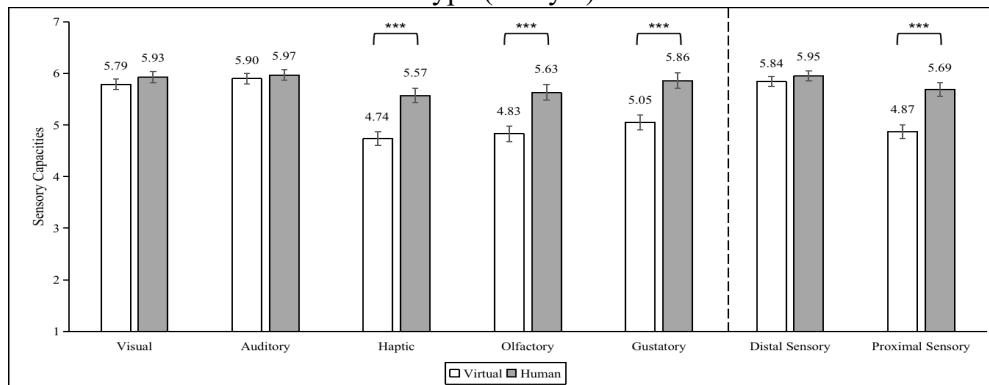
Notes: Error bars represent ±1 SEs; ***p* < .001.

To compare perceived distal and proximal sensory capacities, we averaged the ratings of perceived visual and auditory sensory capacities to form a composite score for the perceived distal sensory capacities (α = .90). Similarly, we indexed the perceived proximal sensory capacities by averaging the ratings on the nine items for haptic, gustatory, and olfactory sensory capacities (α = .95). A mixed ANOVA was then conducted, with influencer type (virtual vs. human) as the between-subjects factor and sensory distance (distal vs. proximal) as the within-subject factor. Significant main effects were revealed for both influencer type ($M_{virtual}$ = 5.36, SD = 1.04 vs. M_{human} = 5.82, SD = .99; $F(1, 198)$ = 10.26, *p* = .002; η_p^2 = .049) and sensory type ($M_{proximal}$ = 5.27, SD = 1.37 vs. M_{distal} = 5.89, SD = .96; $F(1, 198)$ = 65.52, *p* < .001; η_p^2 = .249), qualified by a significant interaction effect ($F(1, 198)$ = 21.38, *p* < .001; η_p^2 = .097; see Figure 1). Specifically, simple contrasts showed that the virtual influencer's proximal sensory capacities were rated lower than those of the human influencer ($M_{virtual}$ = 4.87, SD = 1.50 vs. M_{human} = 5.69, SD = 1.07; $F(1, 198)$ = 19.17, *p* < .001; η_p^2 = .088). However, the distal sensory capacities of the virtual and human influencers were similarly rated ($M_{virtual}$ = 5.84, SD = .93 vs. M_{human} = 5.95, SD = 1.00; $F(1, 198)$ = .64, *p* = .425).

Discussion

Study 1 provided evidence concerning consumers' perceptions of virtual influencers' sensory deficiencies. Specifically, we found that consumers perceived virtual and human influencers as having similar capacities in terms of their distal senses (i.e., visual and auditory). Virtual influencers, however, were perceived as having lower capacities in terms of proximal senses (i.e., haptic, olfactory, and gustatory) than human influencers.

Study 2

Based on the finding that virtual influencers were perceived as deficient in proximal

sensory capacities when compared to human influencers, we next examined the effectiveness of virtual influencer endorsements using sensory experiences. Study 2 assessed participants' purchase intention after they were presented with information about a fictitious hotel endorsed by either a human influencer or a virtual influencer. The information pertained to one of the five sensory experiences. When the endorsement centered on distal (i.e., visual or auditory) sensory experiences, we did not expect any difference in purchase intention toward the hotel endorsed by the virtual (vs. human) influencer. However, when the endorsement focused on proximal sensory (i.e., haptic, olfactory, or gustatory) experiences, participants were anticipated to have lower purchase intention toward the hotel endorsed by the virtual (vs. human) influencer.

Method

One thousand respondents (50.5% female; $M_{age} = 42.7$ years) from Prolific Academic participated in this preregistered study (https://aspredicted.org/3XT_SNL) for nominal monetary compensation. They were randomly assigned to a 2 (influencer type: virtual vs. human) × 5 (sensory type: visual vs. auditory vs. haptic vs. olfactory vs. gustatory) between-subjects design. Eighteen participants failed the attention check, leaving a final sample of 982 participants (50.8% female; $M_{age} = 42.8$ years).

We used a profile similar to the fictitious virtual versus human influencer Rico from Study 1 and inserted a photo in the profile (see Table 3). The photo of the virtual influencer Rico was constructed based on the photo of the human Rico, which was downloaded from a website with a collection of realistic faces (https://generated.photos). To control for other variables that may influence endorsement effectiveness, a pretest (N = 195) confirmed that there was no significant difference in people's perceptions of attractiveness, trustworthiness, expertise, or familiarity between the virtual and human influencers, or in their attitudes toward them (see Web Appendix C1 for details).

After reading the influencer's profile, participants imagined that they were searching for a hotel for their next trip and encountered a tweet from Rico recommending a hotel near their destination. In the tweet endorsing the hotel, Rico focused on one of the five sensory experiences. For instance, in the visual condition, the tweet read as follows: "10/10 definitely recommend the Selty Hotel. Everything at this hotel LOOKS great!" (see Web Appendix C2 for details). Participants then indicated their intention to book the hotel using a three-item scale (1 = very unlikely/unwilling/not inclined, 7 = very likely/willing/inclined; Yan, Keh, and Chen 2021; α = .96).

Results

A 2 (influencer type) × 5 (sensory type) ANOVA on hotel purchase intention revealed only a significant main effect of influencer type ($M_{virtual}$ = 3.18, SD = 1.55 vs. M_{human} = 3.59, SD = 1.56; $F(1, 972)$ = 17.89, $p < .001$; η_p^2 = .018), qualified by a significant interaction effect ($F(4, 972)$ = 2.63, p = .033; η_p^2 = .011; see Figure 2). The main effect of sensory type was not significant (M_{visual} = 3.47, SD = 1.56 vs. $M_{auditory}$ = 3.38, SD = 1.39 vs. M_{haptic} = 3.40, SD = 1.64 vs. $M_{olfactory}$ = 3.25, SD = 1.64 vs. $M_{gustatory}$ = 3.41, SD = 1.59; $F(4, 972)$ = .58, p = .677). Consistent with our expectation, when the endorsement focused on distal sensory experiences, simple contrasts showed that participants' purchase intention did not differ across the virtual and human influencer conditions: visual ($M_{virtual}$ = 3.44, SD = 1.46 vs. M_{human} = 3.51, SD = 1.66; $F(1, 972)$ = .11, p = .746) and auditory ($M_{virtual}$ = 3.37, SD = 1.39 vs. M_{human} = 3.39, SD = 1.40; $F(1, 972)$ < .01, p = .956). However, when focusing on proximal sensory experiences, participants had lower intention to book the hotel that was endorsed by the virtual (vs. human) influencer: haptic ($M_{virtual}$ = 3.06, SD = 1.57 vs. M_{human} = 3.75, SD = 1.65; $F(1, 972)$ = 9.45, p = .002; η_p^2 = .010), olfactory ($M_{virtual}$ = 2.86, SD = 1.68 vs. M_{human} = 3.64, SD = 1.50; $F(1, 972)$ = 12.73, $p < .001$; η_p^2 = .013), and gustatory ($M_{virtual}$ = 3.15, SD = 1.58 vs. M_{human} = 3.68, SD = 1.57; $F(1, 972)$ = 5.61, p = .018; η_p^2 = .006).

Figure 2: Purchase Intention as a Function of Influencer Type and Sensory Type (Study 2)
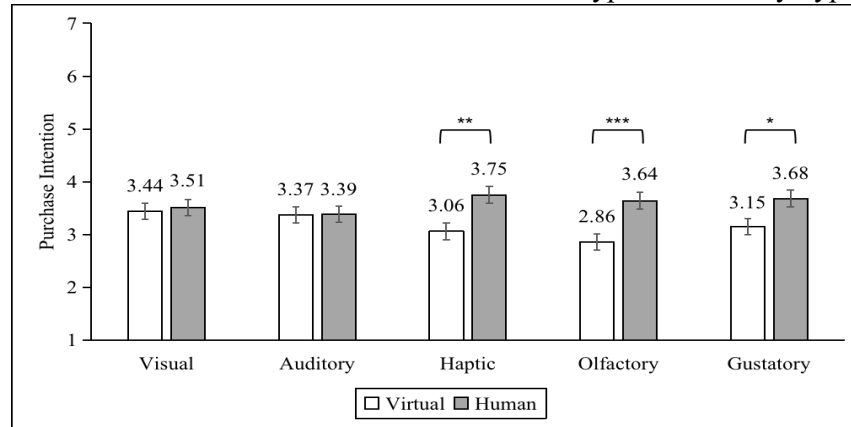
Notes: Error bars represent ±1 SEs; *p* < .05; **p* < .01; ***p* < .001.

Discussion

Study 2 confirmed the hypothesis that the perceived sensory deficiency of virtual influencers would have downstream impacts on consumers' reaction to the products and services endorsed. Specifically, we found that consumers had lower purchase intention toward a hotel endorsed by a virtual (vs. human) influencer when the endorsement focused on proximal sensory (i.e., haptic, olfactory, and gustatory) experiences. However, the effect disappeared when the endorsement centered on distal sensory (i.e., visual and auditory) experiences.

Study 3

To replicate our key findings (i.e., the perceived proximal sensory deficiency of virtual influencers) in a field setting, we conducted an online field experiment through the A/B split advertisement test on a shopping website. This shopping website has developed a function to allow merchants to test alternative versions of advertisements with an A/B split (similar to the A/B split advertisement test function on Facebook; cf. Orazi and Johnston 2020).

We expected that an advertisement focusing on the proximal sensory (e.g., haptic)

experiences of a product would be less effective when a virtual influencer rather than a human influencer endorsed it. We did not anticipate such an effect for an advertisement centered on the distal sensory (e.g., auditory) experiences of the product.

Method

We created four versions of an advertisement for a pair of sleep headphones. Either a virtual influencer or a human influencer endorsed the product, and the advertisement focused on either the haptic or auditory experiences of the headphones (see Web Appendix D1). We conducted three pretests. The first pretest (N = 180) confirmed that there was no significant difference in consumers' perceptions of attractiveness, trustworthiness, expertise, or familiarity between the virtual influencer and the human influencer, or in their attitudes toward them (see Web Appendix D2 for details). A second pretest (N = 200) suggested that consumers considered auditory and haptic experiences as equally important when using this product (see Web Appendix D3 for details). A third pretest (N =199) showed that the endorsement used in the haptic condition pertained to haptic rather than other sensory experiences, and that the endorsement used in the auditory condition dealt with auditory rather than other sensory experiences (see Web Appendix D4 for details).

The advertisement ran for 48 hours using the A/B split advertisement test function of an online shopping website on random audience groups (final N = 6,522). Once viewers clicked on the advertisement, they were redirected to the shopping webpage of the product. We obtained the click-through rates (CTRs) of the advertisements, a commonly used performance metric (Orazi and Johnston 2020), which were indexed as the percentage of clicks an advertisement received out of all unique impressions.

Results

We conducted logistic regression analysis with influencer type (1 = virtual, 0 = human), sensory type (1 = haptic, 0 = auditory), and their interaction as the independent

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variables, and whether or not the advertisement stimulated a click (1 = click, 0 = no click) as the dependent variable. The results showed a significant interaction effect (B = −1.44, SE = .47, Wald χ^2 = 9.43, p = .002; Exp(B) = .24). Specifically, the CTRs of the haptic advertisement were significantly lower when the virtual influencer endorsed the product (.70%, 11 out of 1,578) than when the human influencer endorsed it (2.00%, 37 out of 1,850; effect = −1.07, SE = .35, Wald χ^2 = 9.56, p = .002; Exp(B) = .34). However, the CTRs of the auditory advertisement were similar when either the virtual influencer (1.58%, 23 out of 1,453) or the human influencer (1.10%, 18 out of 1,641; effect = .37, SE = .32, Wald χ^2 = 1.38, p = .241; Exp(B) = 1.45) endorsed the headphones.

Discussion

Consistent with the hypothesis, the results of this field study confirmed that when an endorsement focused on proximal sensory experiences, consumers had a lower interest in the product (as measured by CTRs) endorsed by a virtual (vs. human) influencer. However, no significant difference was observed when the endorsement centered on distal sensory experiences. Specifically, a consumer exposed to an advertisement featuring a human influencer mentioning her haptic experiences with the product was 2.91 times more likely to click through the advertisement than when a virtual influencer described its haptic experiences in the advertisement.

Study 4

Study 4 examined the underlying mechanism of the endorsement effectiveness of virtual influencers. Why are virtual influencers effective in endorsing distal sensory experiences but ineffective in endorsing proximal experiences? We proposed that imagery difficulty and perceived sensory capacity serially mediated the effect on consumers' purchase intention toward virtual influencer endorsements conveying proximal sensory experiences. In other words, consumers will have difficulty imagining the proximal sensory experiences of

virtual influencers. As such, they will perceive virtual (vs. human) influencers as less capable of having these experiences. Consequently, consumers will have lower purchase intention when virtual influencers endorse proximal sensory (i.e., haptic) experiences of the product.

This study also explored alternative explanations for the asymmetric attribution of distal and proximal sensory capacities to virtual influencers. The first set of alternative explanations involved physical distance and psychological distance. Proximal and distal senses differ in terms of not only the typical physical distance required for their functioning, but also the psychological distance the sensory imageries generate (Elder et al. 2017). The second set of alternative explanations was related to perceptions of an "unsettling" sense, autonomy, and the master-servant relationship, as consumers might view virtual influencers as "creepy," lacking autonomy, or functioning as servants (e.g., Kim and Kramer 2015; Kim et al. 2021). The third set of explanations pertained to the primacy of online audiovisual stimuli. We tested perceived fluency to examine the possibility that visual and auditory stimuli can easily be conveyed through online mediums, while the other senses cannot; therefore, when audiovisual stimuli are paired with a virtual influencer, consumers will conceivably process information more fluently (Kostyk, Leonhardt, and Niculescu 2021). Additionally, we examined the perceived salience of the individual managing the account, as this behind-the-scenes person could be more prominent in the case of virtual influencers than in that of human influencers.

Finally, we investigated whether egocentric bias moderated the effect. We did so to examine the possibility that consumers project the capacity for vision and hearing onto virtual influencers via an egocentric bias, given that audiovisual experiences constitute a significant portion of human experiences (Ross and Sicoly 1979).

Method

Four hundred respondents (49.5% female; M_{age} = 38.6 years) from Prolific Academic

participated in this preregistered study (https://aspredicted.org/XPT_W4H) for nominal monetary compensation. They were randomly assigned to conditions of a 2 (influencer type: virtual vs. human) × 2 (sensory type: visual vs. gustatory) between-subjects design. Thirteen participants failed the attention check, leaving a final sample of 387 participants (49.6% female; M_{age} = 38.8 years).

Participants were first presented with an online profile of either a male virtual influencer or a male human influencer named Rico (see Table 3); photos of Rico were generated in the same way as in Study 2. A pretest (N = 200) on the two versions of the profiles confirmed that there was no significant difference in people's perceptions of human identity threat, attractiveness, trustworthiness, expertise, or familiarity between the virtual influencer and the human influencer, or in their attitudes toward them (see Web Appendix E1).

Participants then imagined that they were searching for a restaurant and saw a tweet from Rico recommending a fictitious restaurant nearby. The tweet began as follows: "Highly recommend the Koila restaurant! Everything at Koila LOOKS/TASTES great!" (see Web Appendix E2). After reading the tweet, participants reported their intention to have a meal at the Koila restaurant on the same three-item scale as in Study 2 (α = .96). They also completed a measure of perceived sensory (visual/gustatory) capacity (α = .91) of the influencer, using the same items as in Study 1, as well as a two-item measurement of imagery difficulty ("How difficult/easy is it for you to imagine that Rico is experiencing the restaurant?" 1 = not difficult/easy at all, 7 = very difficult/easy; adapted from Zhao, Hoeffler, and Dahl 2012; r = .68, p < .001). Participants then responded to a series of measurements for the alternative explanations (see Web Appendix E3).

Results

A two-way ANOVA on purchase intention revealed a significant main effect of

influencer type ($M_{virtual}$ = 3.49, SD = 1.71 vs. M_{human} = 4.06, SD = 1.54; $F(1, 383)$ = 12.36, p < .001; η_p^2 = .031), qualified by a significant interaction effect ($F(1, 383)$ = 20.21, p < .001; η_p^2 = .050). The main effect of sensory type was not significant (M_{visual} = 3.85, SD = 1.64 vs. $M_{gustatory}$ = 3.71, SD = 1.67; $F(1, 383)$ = .89, p = .346). Replicating our previous results, when the endorsement focused on gustatory experiences, participants had lower purchase intention toward the restaurant that was endorsed by the virtual (vs. human) influencer ($M_{virtual}$ = 3.05, SD = 1.69 vs. M_{human} = 4.34, SD = 1.38; $F(1, 383)$ = 32.51, p < .001; η_p^2 = .078). When the endorsement focused on visual experiences, however, a similar level of purchase intention was revealed ($M_{virtual}$ = 3.92, SD = 1.62 vs. M_{human} = 3.77, SD = 1.66; $F(1, 383)$ = .47, p = .491).

We then tested our proposed serial mediation mechanism (i.e., influencer type → imagery difficulty → perceived sensory capacity → purchase intention). Serial moderated-mediation analyses using bootstrapping techniques (5,000 resamples; Hayes 2015, PROCESS Model 85) with influencer type (1 = virtual, 0 = human) as the independent variable, sensory type (1 = gustatory, 0 = visual) as the moderator, purchase intention as the dependent variable, and imagery difficulty and perceived sensory capacity as the two serial mediators confirmed our proposed moderated-mediation model of purchase intention (indirect effect = –.16, SE = .05, 95% CI = [–.26, –.08]). The serial mediation was significant in the proximal sensory (i.e., gustatory) condition (indirect effect = –.18, SE = .05, 95% CI = [–.28, –.10]) but not in the distal sensory (visual) condition (indirect effect = –.03, SE = .02, 95% CI = [–.07, .02]). In addition, the alternative explanations were ruled out through mediation and moderation analyses (see Appendix E1 for details).

Discussion

Through serial moderated-mediation tests, Study 4 confirmed that imagery difficulty and perceived deficiency of proximal sensory capacities serially mediated the effect of virtual

(vs. human) influencer endorsements on purchase intention. In addition, we examined and ruled out a series of alternative explanations, including social and physical distances, processing fluency, an unsettling appearance, familiarity with and general attitude toward virtual versus human influencers, master-servant relationships, autonomy, persuasion knowledge, salience of the person behind the scenes, and egocentric bias.

<div align="center">

Study 5

</div>

Thus far, our studies have shown that when the focus was on proximal sensory experiences, a virtual influencer's endorsement was less effective than a human influencer's endorsement. In Study 5, we added a control condition where the virtual (vs. human) influencer promoted a product with no specific reference to sensory experiences. We predicted that when proximal sensory experiences were not presented, the previously observed difference between the endorsement effectiveness of the human and the virtual influencer would be mitigated.

Method

Six hundred participants (49.5% female; M_{age} = 39.9 years) from Prolific Academic participated in this preregistered study (https://aspredicted.org/LBM_Y84) in exchange for nominal monetary compensation. They were randomly assigned to conditions in a 2 (influencer type: virtual vs. human) × 3 (sensory type: visual vs. haptic vs. control) between-subjects design. Eleven participants failed the attention check, leaving a final sample of 589 participants (48.7% female; M_{age} = 40.0 years).

Participants were presented with the same online profile of the virtual (or human) influencer Rico as used in Study 4. Participants then imagined that they were shopping for a T-shirt and saw Rico's Twitter endorsement of a T-shirt from a fictitious brand (see Web Appendix F for details). In the visual condition, the endorsement detailed visual experiences. In the haptic condition, the endorsement described haptic experiences. In the control

condition, the endorsement did not explicitly refer to any sensory experience. After reading the endorsement, participants reported their intention to purchase the T-shirt ($\alpha = .96$) on the same scale used in Studies 2 and 4.

Results

A 2 × 3 ANOVA on purchase intention revealed only a significant two-way interaction ($F(2, 583) = 5.36$, $p = .005$; $\eta_p^2 = .018$). Neither the main effect of influencer type ($M_{virtual} = 2.24$, $SD = 1.35$ vs. $M_{human} = 2.31$, $SD = 1.44$; $F(1, 583) = .31$, $p = .578$) nor that of sensory type ($M_{visual} = 2.34$, $SD = 1.42$ vs. $M_{haptic} = 2.27$, $SD = 1.43$ vs. $M_{control} = 2.20$, $SD = 1.35$; $F(2, 583) = .51$, $p = .603$) was significant. Specifically, purchase intention did not differ across virtual and human conditions when the endorsement focused on visual experiences ($M_{virtual} = 2.44$, $SD = 1.49$ vs. $M_{human} = 2.25$, $SD = 1.34$; $F(1, 583) = .89$, $p = .345$) or when the endorsement did not mention sensory experiences ($M_{virtual} = 2.31$, $SD = 1.32$ vs. $M_{human} = 2.09$, $SD = 1.37$; $F(1, 583) = 1.12$, $p = .291$). However, when the endorsement centered on haptic experiences, participants had a lower purchase intention toward the T-shirt that was endorsed by the virtual (vs. human) influencer ($M_{virtual} = 1.97$, $SD = 1.21$ vs. $M_{human} = 2.56$, $SD = 1.57$; $F(1, 583) = 9.08$, $p = .003$; $\eta_p^2 = .015$).

Discussion

The results in Study 5 again demonstrated that highlighting proximal information reduced the effectiveness of virtual influencers' endorsements. Two potential ways were considered to mitigate this effect. First, as shown in the distal-sensory condition of this study, shifting away from conveying proximal sensory experiences toward conveying distal sensory attributes augmented consumers' purchase intention. Second, as shown in the control condition of this study, refraining from explicitly mentioning sensory experiences also alleviated the negative effect of the virtual influencer's endorsement.

Study 6

Consumers' limited exposure to and knowledge about existing technologies may hinder their ability to envision virtual influencers having proximal sensory experiences. As a result, informing consumers about advanced technology that enables virtual influencers to have proximal sensory experiences may well decrease imagery difficulty of virtual influencers' proximal sensory experiences. This, in turn, could lead to an increased purchase intention among consumers when virtual influencers endorse proximal sensory experiences. Study 6 examined this possibility.

Method

Four hundred and four participants (47.3% female; M_{age} = 41.4 years) from Prolific Academic completed this preregistered study (https://aspredicted.org/931_X29) in exchange for nominal monetary compensation. They were randomly assigned to conditions of a 2 (influencer type: virtual vs. human) × 2 (information type: control vs. sensory technology) between-subjects design. Twenty-five participants failed the attention check, leaving a final sample of 379 participants (48.5% female; M_{age} = 41.6 years).

Participants were asked to complete two independent tasks. The first task was a reading comprehension task. In the sensory technology condition, participants read a news article about an advanced electronic skin technology that would allow virtual influencers to experience physical sensations and interact with products through touch. In the control condition, however, they read a news article about an advanced technology that would enable virtual influencers to recognize people's emotions (see Web Appendix G1 for details). A pretest (N = 200) confirmed that the article in the sensory technology (vs. control) condition indeed led readers to attribute greater proximal sensory capacities to the virtual influencer (see Web Appendix G2 for details).

After participants read the news article and summarized its main content—used as a purportedly different task (i.e., the second task) than the comprehension task—they were

presented with the same online profile of the virtual (or human) influencer Rico, as used in

Studies 4 and 5. They then read the same product endorsement from Rico that focused on

haptic experiences, as employed in Study 5. Participants next reported their intention to

purchase the T-shirt ($\alpha = .97$) on the same scale employed in previous studies.

Results

A 2 × 2 ANOVA on purchase intention revealed a significant main effect of influencer

type ($M_{virtual} = 3.25$, SD = 1.88 vs. $M_{human} = 3.65$, SD = 1.76; $F(1, 375) = 4.64$, $p = .032$; η_p^2

= .012), qualified by a significant two-way interaction effect ($F(1, 375) = 10.03$, $p = .002$; η_p^2

= .026; see Figure 3). The main effect of information type was not significant ($M_{sensory\ technology}$

= 3.50, SD = 1.83 vs. $M_{control} = 3.39$, SD = 1.84; $F(1, 375) = .31$, $p = .581$). Simple contrasts

showed that in the control condition, participants had a lower purchase intention when the

virtual (vs. human) influencer endorsed the product ($M_{virtual} = 2.91$, SD = 1.84 vs. $M_{human} =$

3.89, SD = 1.71; $F(1, 375) = 13.98$, $p < .001$; $\eta_p^2 = .036$). However, when information about

advanced technology that enables virtual influencers to have haptic experiences was provided,

this effect was mitigated ($M_{virtual} = 3.59$, SD = 1.87 vs. $M_{human} = 3.41$, SD = 1.79; $F(1, 375)$

= .519, $p = .472$). Interestingly, when comparing virtual influencer endorsements between the

control condition and the sensory technology condition, participants had a significant

increased purchase intention toward the product that was endorsed by the virtual influencer

after they had learned about the technology that allows virtual influencers to obtain a haptic

capacity ($F(1, 375) = 7.01$, $p = .008$; $\eta_p^2 = .018$).

Figure 3: Purchase Intention as a Function of Influencer Type and Information Type (Study 6)
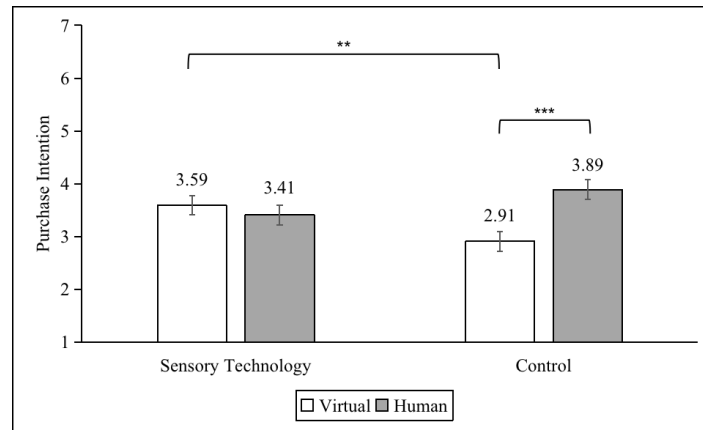
Notes: Error bars represent ±1 SEs; **$p < .01$; ***$p < .001$.

Discussion

Study 6 manipulated participants' capacity to imagine virtual influencers' sensory experiences. This was achieved using a news article that informed participants about the adoption of new sensory technology by virtual influencers. The findings corroborated our proposed hypothesis that participants tended to have lower purchase intention toward a product that a virtual influencer endorsed through proximal sensory experiences. This was because participants perceived the sensory deficiency of the virtual influencer. Notably, when participants were informed about advanced technology that enabled virtual influencers to have proximal sensory experiences, they had higher purchase intention toward products endorsed by virtual influencers with haptic experiences.

It should be noted that the new sensory technology mentioned in our stimuli is hypothetical, and to the best of our knowledge, currently virtual influencers are not able to "truly" possess proximal sensory experiences. However, we believe that with the development of super computing, artificial intelligence, and new materials, it may not always be impossible for virtual influencers to possess such sensory experiences. When that day comes, the effect we observed is likely to be weakened given consumers' updated knowledge in this domain.

General Discussion

Should managers leverage virtual influencers to endorse products and services with sensory experiences? Our research answers this question. Using a series of online and field studies, we found that individuals believe that virtual influencers are capable of sight and hearing but incapable of touch, smell, and taste. As a result, when the endorsement focuses on proximal sensory experiences, consumers have lower purchase intention toward products and services endorsed by a virtual (vs. human) influencer. This effect is sequentially mediated through imagery difficulty and perceived sensory capacity.

Theoretical Contributions

The current work makes several contributions. It contributes to the emerging field of virtual influencer marketing. Previous research has primarily focused on overall perceptions of virtual influencers (e.g., trustworthiness: Riedl et al. 2014; authenticity: Batista da Silva Oliveira and Chimenti 2021; Moustakas et al. 2020; moral responsibility: Yan, Mo, and Zhou 2023; persuasiveness: Faddoul and Chatterjee 2020) and audience reactions to virtual influencers on social media (Arsenyan and Mirowska 2021). Recently, scholars have begun exploring the impact of virtual (vs. human) influencers on purchase intention (e.g., Franke, Groeppel-Klein, and Müller 2023). However, relatively scant research has explored the efficacy of endorsements across different product categories (Li, Huang, and Li 2023). To the best of our knowledge, how consumers respond to virtual influencer endorsements related to sensory experiences has not yet been comprehensively explored. Accordingly, we address this gap, systematically analyzing this issue and providing in-depth knowledge of consumers' responses to sensory-endorsed products and services by virtual influencers.

In a comparable, yet distinct study, Li et al. (2023) found that virtual (vs. human) influencers were perceived to possess lower sensory capability and credibility as endorsers, consequently resulting in lower brand attitude and purchase intention. Although their work

provided valuable insights into this emerging area of research, the current research transcends their findings in several key aspects. First, we delve more deeply into consumers' perceptions of virtual influencers, differentiating between two types of sensory capacity: distal and proximal. This distinction allowed for the uncovering of nuanced variations in consumers' beliefs associated with each type of sensory experience, thus providing a more comprehensive understanding of consumers' attitudes toward virtual influencer endorsements. Second, we empirically examine the underlying psychological processes that drive consumers' perceptions of sensory capacities in virtual influencers. Offering evidence to explain why consumers might perceive virtual influencers as having sensory deficiencies, we proffer a richer theoretical framework by which to interpret this phenomenon. Third, our investigation extends beyond the scope of Li et al., exploring several moderating variables to validate our proposed process and enhance the practical relevance of our findings. Revealing the underlying psychological mechanisms and exploring their effects on consumer behavior, the current research yields valuable insights in the field of virtual influencer marketing.

Our research also add to the literature on sensory marketing. Previous research in sensory marketing has emphasized the benefit of highlighting proximal sensory cues, such as touch (e.g., Krishna and Morrin 2008; Peck and Childers 2003) or smell, in marketing contexts (e.g., Biswas et al. 2014; Krishna, Morrin, and Sayin 2014). Sensory marketing is likely to be beneficial in many circumstances. For example, Cascio Rizzo et al. (2023) found that the use of sensory language (e.g., words such as "crumble" and "juicy," which stimulate the senses) increases human influencer effectiveness; this is because it elicits the inference that the influencer actually uses the product being endorsed, which in turn enhances perceived authenticity. This argument aligns well with our proposal, but we further illustrate a crucial boundary condition that suggests caution when employing this practice with virtual influencers. Specifically, highlighting proximal sensory cues may inadvertently induce

negative effects on consumers' purchase intention toward products and services endorsed by virtual influencers.

Moreover, this research broadly contributes to research on mind perception and anthropomorphism. The growing pervasiveness of perceiving mental capacities in non-human agents has led to an abundant stream of literature examining how humans ascribe their unique mental capacities to other (i.e., non-human) entities (e.g., Gray, Gray, and Wegner 2007). However, this research does not distinguish between the various subjective experiences of non-human entities. We focus on sensory experiences and reveal that people do not consider the subjective experiences of non-human entities to be comparable to other experiences of the same entity, or to human experiences. This is because there is an asymmetric effect on consumers' perceptions of the proximal versus distal sensory capacities of virtual influencers.

Managerial Implications

From a managerial perspective, the study results are also novel, as practitioners have just begun to employ virtual influencers as an in-vogue marketing tool. Virtual influencers have numerous advantages. They are ageless, tireless, and scandal-free, thus affording companies marked control; they do not incur travel expenses, hence eliminating such costs; and they can be easily customized, consequently offering extensive possibilities for adaptation (Hoang and Su 2019). Despite the foregoing benefits, scant research exploring whether consumers will embrace endorsements made by virtual influencers has been undertaken. Our findings are useful for companies that are debating whether and how to effectively leverage virtual influencers' endorsements.

Although contemporary companies are considering the use of virtual influencers to endorse products, we offer a cautionary tale: virtual influencers are deficient in conveying the proximal sensory properties of products and services. Relatedly, the absence of sensory experiences, such as touch, is considered a major impediment to online shopping (e.g., Alba

et al. 1997; Citrin et al. 2003). One compensatory strategy that scholars have proposed involves providing sensory information through influencers in web communities (Bickart and Schindler 2001). Specifically, companies often rely on influencers to describe their sensory experiences with products to engender favorable consumer attitudes toward these products. However, our empirical results reveal that virtual influencers may be unable to effectively achieve this objective, as consumers are not convinced by these influencers' perceived capacities of touch, smell, and taste. Based on our findings, marketers can highlight product attributes related to visual or auditory experiences when using virtual influencers, as these sensory experiences are more believable. However, they should eschew references to tactile, olfactory, and gustatory experiences.

Several real-world business examples are reflective of our findings. For instance, Miku—a virtual singer who has become popular through her successful world tours of "live" concerts—has impassioned fans who have become fully immersed in her visual spectacle and her singing voice, even though they were aware that Miku was being holographically projected on stage. Fans even shout at her holographic image, with expressions such as "Look here" and "I love you," as if Miku can see and hear them. Nonetheless, Miku's fans have kept their physical distance from the hologram. Indeed, they do not attempt to shake hands or make physical contact with her, as fans typically do with a human idol (Lam 2016). Moreover, many Instagram users expressed doubt in their comments concerning Lil Miquela's post about eating kale. Thus, consumers tend to challenge the authenticity of many virtual influencers' endorsements related to proximal sensory experiences. This is because, for example, Lil Miquela cannot eat kale with her non-existent body. Moreover, the virtual colonel used in Kentucky Fried Chicken advertisements would not have his physique if he actually ate that much fried chicken (Cowan 2022).

Directions for Future Research

Several avenues for future research have merit. For instance, many different forms of virtual influencers employ a variety of methods for endorsing products. Callcott and Lee (1995) created a spokes-character typology termed the AMOP (Appearance, Medium, Origin, and Promotion) Framework. It categorizes spokes-characters' appearance (i.e., fictitious humans vs. non-human), medium (i.e., print vs. film vs. radio vs. merchandise), origin (i.e., non-celebrity vs. celebrity), and type of promotion (i.e., active vs. passive). Phillips and Gyoerick (1999) added four variables to the classification: product type (i.e., high vs. low involvement), number and size of character advertisements, character gender, and character ethnicity. In our studies, most of the virtual influencers were easily differentiated from the human influencers by appearance. However, in the real world, many virtual influencers are designed in such a way that they closely resemble human beings (e.g., Lil Miquela, Imma). Will virtual influencers with such a high degree of realism change consumers' perceptions of their sensory capacities? We conducted a study that examined this issue. It showed that even when virtual influencers look exactly like humans, they are still perceived as being deficient in terms of proximal sensory endorsements (see Web Appendix H for details). However, additional research is needed to more fully examine other forms of virtual influencers.

Future research should also examine whether consumers from different cultures prefer different types of virtual influencers. For example, a study found that, compared to North Americans, East Asians preferred cartoon-like avatars to human-like avatars when playing games (Yoon and Vargas 2016). Conceivably, East Asians favor virtual influencers that are two-dimensional and less human-like but more aesthetically exaggerated; however, people in Western cultures opt for virtual humans that are more realistic but have certain flaws (Hoang and Su 2019). Moreover, the virtual idols preferred in East Asian cultures are likely to be younger, more childish, and easier to control; in contrast, Westerners favor virtual humans with strong personalities and opinions (Hoang and Su 2019). Accordingly, scholars could

examine the effect of cultural differences with virtual influencers and explore the underlying mechanisms.

Study 4 investigated our proposed mechanism and ruled out potential alternative explanations: processing fluency, an unsettling appearance, salience of the person behind the scenes, persuasion motives, and egocentric bias. However, possible congruency effects between what virtual influencers are ostensibly capable of (i.e., sight and hearing) and what digitally mediated environments can accommodate (i.e., visual and audio stimuli) could also play a role in the observed effect. Therefore, future research could examine this possibility.

In Studies 3, 4, 5, and 6, we found that endorsements by the virtual influencer led to higher purchase intention than that by the human influencer toward distal sensory products, although the differences were not significant. However, there may be other mechanisms that enhance purchase intention toward products endorsed by virtual influencers. One possible explanation is that virtual (vs. human) influencers are perceived as having less salient ulterior persuasion motives (Campbell and Kirmani 2000). Moreover, it is possible that when a first-person virtual personality is paired with a storyline, some consumers may willingly suspend disbelief (Ferri 2007), which in turn may motivate purchase intention. A third possibility is that products endorsed by virtual influencers signal desirable attributes, such as trendiness, innovativeness, and open-mindedness (Sands, Campbell et al. 2022). Additionally, virtual influencers can act as a form of diversion, bridging real and imaginary worlds and thereby offering consumers a form of escape and a sense of freedom (Arsenyan and Mirowska 2021). Subsequent studies are needed to examine whether virtual influencers can more effectively encourage purchases in certain product categories.

We used fictitious brands in the study stimuli. However, brand attitude, awareness, and trust may influence consumers' purchase intention (e.g., Herbst et al. 2012). Future research should thus explore whether these effects differ when consumers have existing brand

relationships and knowledge. Finally, virtual influencers are currently used mainly to endorse

fashion and luxury brands (Moustakas et al. 2020). Scholars could explore the possibility of

leveraging virtual influencers in a range of product categories, and for a variety of causes. For

instance, can virtual influencers help with charitable giving? Can virtual idols effectively

promote digital products or innovative products? Can virtual influencers raise awareness of

environmental issues? Answers to these questions will likely prove invaluable to both

scholars and marketers alike.

Table 1: The Top 10 Most-Followed Virtual Influencers on Instagram

Name	Country	Birth	Occupation	Followers	Estimated earnings per post	Brand_Cooperation (Product_Endorsement)
Lu do Magalu (@magazineluiza)	Brazil	2009	Digital marketing specialist	6.5M	$55.2k – $74.7k	Adidas (clothes, shoes), McDonald's, Red Bull (food and drink), MAC (makeup), Samsung (smartphones), and Bic (stationery)...
CB (@casasbahia)	Brazil	2017	Brand mascot	3.6M	$31.1k – $42.0k	Casas Bahia (E-commerce retail goods), Xbox (games)...
Barbie (@barbie)	USA	1959	Movie and doll characters	3.6M	$32.3k– $43.6k	Barbie (toys, movies), Balmain, Moschino, Kith, Karl Lagerfeld, Juicy Couture (clothes, bags, luxuries), and BossBeauties (makeup)...
Lil Miquela (@lilmiquela)	USA	2016	Musician and style visionary	2.8M	$23.6k – $31.9k	Prada, Supreme, UGG, PacSun, Calvin Klein, Gucci (clothes, bags, shoes, luxuries), Dior (makeup), and Samsung (smartphones)...
Janky & Guggimon (@jankyandguggimon)	Canada	2019	Fashion horror artist	1.1M	$9.2k – $12.5k	Superplastic (toys), Gucci, Nike (clothes, shoes), Sandbox and Bored Ape Yacht Club (games)...
Any Malu (@anymalu_real)	Brazil	2015	Artist and YouTuber	599.4K	$5.2k – $7.0k	Cartoon Network and Wizkids (cartoon shows)...
Thalasya Pov (@thalasya_)	Indonesia	2018	Digital creator	463.4K	$4.0k – $5.4k	Yipiiiii (clothes and bags), Chocolatos ID (drink)...
Noonoouri (@noonoouri)	Germany	2018	Artist and fashionista	403.1K	$3.5k – $4.7k	Supreme, Louis Vuitton, Dior, Skims, Thierry Mugler, Tmall Luxury (clothes, bags, shoes, luxuries, makeup), and Honor (smartphones)...
Imma (@imma.gram)	Japan	2018	Digital creator	398.2K	$3.4k – $4.6k	IKEA (furniture), Puma, Nike, Valentino (clothes, bags, shoes), Magnum (ice cream), and Lenovo (computers)...
Bermuda (@bermudaisbae)	USA	2016	Musician	241.8K	$2.3k – $3.1k	Chanel, Balenciaga, Adam Selman (clothes, bags), Tesla (car), and Starbucks (drink)...

Lu Magalu   CB   Barbie   Lil Miquela   Janky & Guggimon   Any Malu   Thalasya   Noonoouri   Imma   Bermuda

Note: The data on estimated earnings per post were derived from Instagram and inBeat (https://www.inbeat.co/collaboration-cost-calculator-instagram/) on August 31, 2023.

Table 2: Summary of Findings from the Literature on Virtual Influencers in the Extant Research

Reference	Virtual Influencer	Methods	Main IV(s)	Main DV(s)	Product Type	Key Findings	Size of Sample
Darner and Arvidsson (2019)	A fictitious virtual influencer	Field study	Influencer characters	Social media Engagement	Not studied	Character realism, Instagram's algorithm, and visually appealing content are important factors that drive consumer engagement with virtual influencer accounts on Instagram.	Real engagement on Instagram
Hoang and Su (2019)	Virtual influencers in general	Survey	Culture	Opinion, misbehavior	Not studied	Misbehavior is less accepted by Eastern consumers than by Western consumers; Eastern consumers want to influence virtual celebrities, but Western consumers want to be influenced by them.	117 Eastern and 89 Western respondents
Molin and Nordgren (2019)	Lil Miquela and Noonoouri	Interview	――――	Parasocial interaction	Not studied	Perceived humanness of the virtual influencers affects the level of their perceived attractiveness, similarity, and trustworthiness.	8 participants
Andersson and Sobek (2020)	Lil Miquela, Noonoouri, Bebiselis, and Bee_nfluencer	Focus group, interview	――――	Authenticity	Not studied	A synthesis of four factors (Purpose, Personality, Continuity, and Transparency) forms the Authenticity Model for virtual influencers.	23 participants
Moustakas et al. (2020)	Virtual influencers in general	Interview	――――	Influencer characters	Not studied	A Lack of authenticity, need for a major investment, challenges with legality, and risk of unpopularity from poor execution are potential pitfalls when collaborating with fictional characters on social media.	6 experts in digital firms
Arsenyan and Mirowska (2021)	Noonoouri, Lil Miquela, and Marta Cygan	Secondary data	Influencer: anime-like virtual vs. human-like virtual vs. human	Reactions	Not studied	The human-like virtual influencer receives lower positive reactions than the animated virtual influencer or the human influencer.	48,827 comments from three influencers' Instagram posts
Batista da Silva Oliveira and Chimenti (2021)	Lil Miquela, Imma, Shudu, and Bermuda	Interview	――――	Influencer characters	Not studied	Virtual influencers affect marketing communication through five aspects: attractiveness, authenticity, controllability, scalability, and anthropomorphism/humanization.	8 specialists in Brazil
Cheung and Leung (2021)	Lil Miquela, and Hatsune Miku	Survey	Influencer: anime-like virtual vs. human-like virtual	Influencer characters	Not studied	A cartoon character celebrity is more preferred (i.e., considered more attractive and credible) than a human-like influencer.	105 university students

Author	Virtual Influencer	Method	Independent Variable	Dependent Variable	Product	Key Findings	Sample
Farrera Saldaña (2021)	Barbie, Mar.ia, Catalina, Spongebob, Any Malu, Villainous	Interview	——	Influencer characters	Not studied	There are concerns and potential risks attributed to virtual influencers with realistic human behavior, and the need to separate reality from fiction was emphasized.	6 specialists from different companies
Park et al. (2021)	11 virtual influencers (e.g., Lil Miquela)	Secondary data	Number and types of social actors	Sentimental dimensions	Not studied	Users employ more positive and anxious words when responding to content with both a virtual influencer and a real human(s) than to content without real humans.	2,036 contents with 364,053 comments on Instagram
Rönnhed and Wiksborg (2021)	Virtual influencers in general	Interview	——	Parasocial relationships and opinion leadership.	Not studied	It is difficult for virtual influencers to be perceived as credible sources and to develop parasocial relationships and opinion leadership.	12 participants
Ahn, Cho, and Tsai (2022)	Lil Miquela	Survey	Anthropomorphism	Post and brand attitudes	Not studied	Perceived anthropomorphism effectively enhances social presence, which in turn boosts perceived physical and social attractiveness to drive consumer evaluation outcomes.	303 university students
Hofeditz et al. (2022)	8 virtual influencers (e.g., Rozy)	Experiment	Influencer: virtual vs. human	Influencer characters	Not studied	Human influencers are consistently rated higher for perceived trust, social presence, and humanness than virtual influencers.	112 online participants
Huang, Qu, and Li (2022)	6 virtual idols (e.g., Hatsune Miku)	Survey	Influencer characters	Purchase intention	Clothing	The popularity, homogeneity, relevance, and anthropomorphism of virtual idols enhance customers' willingness to buy.	479 participants
Liu and Lee (2022)	Lil Miquela, Imma, and Shudu	Experiment	Influencer: virtual vs. human influencer; Outcome: success vs. failure	Responsibility attribution	Not studied	Virtual influencers are attributed less culpability for endorsement failure caused by an influencer's misbehavior than human influencers, but virtual influencers' companies and endorsed brands are attributed as having significantly more responsibility than their human counterparts.	483 participants
Sands, Campbell et al. (2022)	Lil Miquela and a fictitious virtual influencer	Experiment	Influencer: AI vs. human	Source trust, intention to follow, word-of-mouth	Not studied	Compared to human influencers, consumers perceive no difference in intention to follow AI influencers. However, AI influencers are perceived as having lower source trust and greater word-of-mouth intention.	325 (Study 1) and 347 (Study 2) participants
Sands, Ferraro et al. (2022)	Virtual influencers in general	Survey	——	Attitude toward virtual influencers	Not studied	This article discusses the rise of virtual influencers and the opportunities and challenges thereof.	2,160 participants

Stein, Breves, and Anders (2022)	A fictitious virtual influencer	Experiment	Influencer: digital vs. human	Parasocial interactions	Not studied	Viewers' parasocial response does not differ between virtual and human influencers. However, they perceive virtual influencers as having less mental human-likeness and similarity to themselves.	179 university students
Deng and Jiang (2023)	Ayayi	Experiment	Virtual human vs. real human	State appearance anxiety	Not studied	Both human influencers (HI) and virtual influencers (VIs) induce higher appearance anxiety, but participants exposed to VIs report lower appearance anxiety than those exposed to HI.	178 women
El Hedhli et al. (2023)	Shudu Gram and Lil Miquela	Survey	Anthropomorphism of the virtual influencer	Purchase Intention	Not studied	Anthropomorphism is positively associated with warmth and competence judgments of virtual influencers, as well as willingness to follow the VI's recommendations and purchase intention.	393 respondents
Franke, Groeppel-Klein, and Müller (2023)	Lil Miquela	Experiment	Influencer: virtual vs. human	Purchase intention, ad attitude	Cosmetic vs. technical	Human influencers are preferred over virtual influencers in the advertising of cosmetic brands in terms of endorser and advertisement evaluation. However, using virtual influencers could help these advertisements and brands, especially those for technical products, achieve a higher perceived novelty.	338 female (Study 1) and 142 female (Study 2) participants
Ham et al. (2023)	Lil Miquela	Experiment	Social cues: alone vs. with a real human	Brand attitude	Not studied	While some elements of realism and product engagement levels do increase anthropomorphic and authenticity perceptions, the effects are significantly attenuated when the virtual influencer is engaging with too much reality in a single social media post, such as consuming a real-world branded product with a real human.	242 participants
Kim et al. (2023)	A fictitious virtual influencer, Jessica	Experiment	Human-like vs. anime-like virtual influencers	Message credibility and attitudes	Not studied	Human-like virtual influencer (HVI) endorsements are more effective than anime-like virtual influencer (AVI) endorsements in producing perceptions of message credibility and message attitudes.	233 participants
Kim and Park (2023)	A female virtual influencer on Instagram	Survey	Attractiveness	Purchase intention	Not studied	A virtual influencer's attractiveness has a positive effect on purchase intention through mimetic desire and brand attachment.	364 participants
Li et al. (2023)	Lil Miquela and fictitious virtual influencers	Secondary data, experiment	Influencer: virtual vs. human	Brand Attitude Purchase Intention	sensory cue salience:	Virtual influencers are less effective as endorsers than human influencers as endorsers in terms of brand attitude and purchase intention. This effect is	107,218 Instagram comments and a

						serially mediated by perceived sensory capability and credibility and is attenuated when the salience of sensory cues is low.	total of 1152 participants
Li, Huang, and Li (2023)	Liu Yexi and Ling	Experiment	Hedonic vs. utilitarian	Product attitude	Hedonic vs. utilitarian	For hedonic products, authenticity fit has a greater impact on attitudes; for utilitarian products, however, association fit is a more influential factor in digital human avatar endorsements.	619 (Test 1) and 617 (Test 2) participants
Mirowska and Arsenyan (2023)	Lil Miquela	Experiment	Influencer: virtual vs. human	Social media engagement	Not studied	Individuals with elevated levels of empathy tend to demonstrate a greater inclination to follow a virtual influencer and perceive him or her as more socially appealing than a human influencer with similar characteristics.	214 participants
Tan (2023)	Virtual Youtubers in general	Survey	Parasocial attachment	Parasocial attachment	Not studied	Parasocial attachment to VTubers helps reduce people's discomfort and pain during stressful times.	665 participants
Xie-Carson et al. (2023)	Fictitious virtual influencers	Focus group Survey	Source realness Image composition Caption discourse	Engagement preference	Not studied	Respondents exhibit a stronger affinity toward humanlike virtual influencers (VIs) when compared to both 3D and 2D animated VIs, yet real human influencers tend to be most favored.	309 adult Instagram users
Wang and Qiu (2023)	A fictitious virtual endorser	Experiment	Image realism	Purchase Intention	Gift products for the elderly	Cartoon digital endorsers (vs. realistic digital endorsers) generate higher purchase intention toward a product for elderly individuals.	205 (Study 1), 174 (Study 2) and 127 (Study 3) participants
Yan, Mo, and Zhou (2023)	Fictitious virtual humans	Experiment	Cultural Differences	Moral Responsibility Judgment	Not studied	After being informed of the immoral behavior of virtual humans, people in Chinese (vs. Western) culture attribute more moral responsibility to them. However, they assign equal moral responsibility to real humans engaged in the same immoral behavior.	A total of 2398 participants

Table 3: Stimuli Used in Studies

Study	Influencer	Profile
Study 1	Virtual vs. Human	Rico is a [virtual] influencer who debuted this year. Rico, also known as Coco, was born on March 21, 2001, in a major coastal city. She joined Maxi Entertainment Company in 2019 and debuted as a [virtual] singing and dancing idol in May 2020. Her representative music works include Youth Waltz, Dream Ferris Wheel, and Ready, among others. Rico has attracted a lot of fans since her debut. She has her own dressing style and always follows the latest fashion. Rico also shares her daily life on social media. Rico is curious about everything. She likes all objects in cat shapes. Her favorite amusement is the roller coaster.
Study 2	Virtual Human	Rico is a [virtual] influencer who debuted last year. Rico, also known as Coco, was born on March 21, 2001, in Los Angeles, USA. Rico signed with Maxi Entertainment (an international company) in 2019. She is also active on Twitter, Instagram, YouTube, and Facebook. She shares various events that occur in her life on these social media.
Study 4 Study 5 Study 6	Virtual Human	Rico is a 21-year-old [virtual] influencer living in Atlanta, Georgia. As a [virtual] social media influencer, Rico grew his following organically, to over one hundred thousand followers in just one year. He shares various events that occur in his life on social media. His content drives strong conversations within comments on his posts, and he receives thousands of direct messages where he engages with his followers around the world.
Web Appendix Study	Low-realism virtual High-realism virtual Human	Rico is a [virtual] influencer who debuted this year. Rico, also known as Coco, was born on March 21, 2001, in a major coastal city. She joined Maxi Entertainment Company in 2019 and debuted as a [virtual] singing and dancing idol in May 2020. Her representative music works include Youth Waltz, Dream Ferris Wheel, and Ready, among others. Rico has attracted a lot of fans since her debut. She has her own dressing style and always follows the latest fashion. Rico also shares her daily life on social media. Rico is curious about everything. She likes all objects in cat shapes. Her favorite amusement is the roller coaster.

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