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Fear and Fascination? Consumer Attitudes towards Virtual Influencer Marketing

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1. Introduction

During my first semester at Corvinus University of Budapest, enrolled as a Marketing master's student, one of my Business Communication and Strategy classes genuinely grabbed my attention. This particular class covered virtual characters created by CGI technology, used by brands to market their products and services. At first, I was in shock. Are virtual influencers already existing? Not only in utopistic movies that one would watch on Netflix? Could advancement in AI technologies replace the need for marketing experts, a field that I eagerly aspired to enter? Despite my aversion at first, soon I've got truly invested in the role virtual influencers could take in the landscape of marketing. Complementing the work and expertise of marketing experts, hopefully. My initial shock turned into fascination and amazement at the multitude of opportunities that development of technologies can bring. I found myself increasingly compelled to delve deeper into understanding the phenomenon of virtual influencers. However, as I discussed my enthrallment and engagement with those around me, I started to realize that not many people share my enthusiasm. I've got curious. Why do some people express feeling of eeriness when seeing the content shared by Lil Miquela? Why do others engage with Janky's posts as he would be their actual friend? Why do big corporations, such as Prada invest large amounts to create their own virtual influencer, Candy, to foster increased demand for their renowned perfume line, Candy?

The influencer industry's rapid growth has become a fertile ground for technological innovation, particularly with the advancements in artificial intelligence (AI) that have expanded the horizons of influencer marketing (Li et al., 2023). Social media platforms now host a multitude of voices, ranging from individual users to paid influencers endorsing brands. However, the emergence of AI-driven technologies raises the question: are all these voices human? It seems highly unlikely (Thomas & Fowler, 2021). The convergence of AI and influencer marketing has given rise to a new category of influencers: virtual influencers (Li et al., 2023; Xie-Carson, Benckendorff & Hughes, 2023). While the current surge of virtual influencers may seem novel, their history traces back to the early 1990s, with the advent of the first cartoon characters turned virtual celebrities, particularly in Japan. The subsequent introduction of virtual YouTubers, exemplified by Kizuna AI, marked the beginning of a trend that has gained momentum over the years (Gerlich, 2023). Despite their early origins, it was the intersection of advanced AI technologies and computer-generated imagery (CGI) that truly revolutionized the concept. Los Angeles-based digital company

Brud pioneered this evolution with the creation of virtual social media influencers such as Lil Miquela, Blawko, and Bermuda. Since Lil Miquela's debut in 2016, virtual influencers have surged in popularity, especially during the Covid-19 pandemic when digital solutions took precedence (Conti, Gathani, and Tricomi, 2022). Forecasts predict a significant rise in the virtual influencer market in the coming years (Appel et al., 2020). This burgeoning interest has extended to scholars, leading to studies examining virtual influencers' impact on the marketing landscape. While brands are increasingly drawn to virtual influencers, it remains unclear how consumers perceive this innovative form of endorsement. Limited research suggests mixed consumer attitudes, with some studies indicating potential differences in reactions between virtual and traditional human endorsers (De Bellis and Johar, 2020; Kim et al., 2019).

The present research aims to fill in these gaps, responding to recent requests from various researchers to explore marketing activities of and consumer attitudes towards a wider range of virtual influencers, from human-like to non-human-like (Xie-Carson, Benckendorff & Hughes, 2023; Lou et al. 2023; Li et al., 2023; Qu & Baek, 2023; Franke, Groeppel-Klein, & Katrin, 2023; Thomas & Fowler, 2021; Mouritzen, Penttinen & Pedersen, 2024), examine real virtual influencers (Liu & Lee, 2024), pay more attention to their humaneness, uncanniness, and overall look and feel (Gerlich, 2023), focus on consumer attitudes towards brands that are utilizing virtual influencer marketing (Lou et al., 2023), and examine consumer reactions across different social media platforms (Sands et al., 2022; Li et al., 2023; Jiang, Zheng & Luo, 2024), potentially focusing on video content (Xie-Carson, Benckendorff & Hughes, 2023).

2. Theoretical Background

2.1 Emergence of Artificial Intelligence in the Marketing Sector

Innovative technologies, particularly solutions applying artificial intelligence (AI), are already commonplace in a wide range of industries (Qin and Jiang 2019; Rodgers 2021). Global spending on technologies utilizing AI is forecasted to rise from \$50 billion in 2020 to over \$110 billion in 2024 (Lou et al., 2023). Recent improvements in AI, more specifically AI-based customer facing technologies, caused by accelerated advancements in natural language processing (NLP) and deep

learning, lead to an increased interest of marketing scholars and practitioners in artificial intelligence (Pentina et al., 2023). Application of AI technologies is getting increasing significance in the advertising industry (Qin and Jiang 2019; Rodgers 2021; Kronemann et al., 2022). Innovative utilization of AI is especially apparent in the retail sector, where application of artificial intelligence conversational interfaces is becoming more common, and the possible emergence of digital humans is foreseeable (Sands et al., 2022). However, developed AI systems are not only used in retail but are now deployed across numerous consumer industries, for example in e-commerce, as recommendation agent software, on customer service and hospitality frontlines, as personal voice assistants and even social companions (Kronemann et al., 2022, Pentina et al., 2023).

The integration of artificial intelligence in marketing activates redefined how brands provide their services and captivate their audiences. The new phenomenon has advanced the ability of brands to deliver improved services by applying enhanced technologies. (Sands et al., 2022) Moreover, the role of artificial intelligence's impact in marketing extends to enabling a potential transition towards a more algorithmic society, as technology evolves from being only a tool to becoming an active player in the value exchange process. This shift is already noticeable as human-less transitions are increasingly more frequent, managed by intelligent systems in a variety of consumer industries (Kronemann et al., 2022).

Emergence of Virtual Influencers

The rapid growth of the influencer industry made it an appealing space for fostering technological innovation, while the fast developments of artificial intelligence extended the boundaries of influencer marketing (Li et al., 2023). Social media platforms now facilitate the expression of more diverse voices, including that of individual users and paid influencers generating content endorsing brands. But do all these voices come from humans? Thanks to the opportunities generated by AI technologies, the answer is highly unlikely to be affirmative (Thomas & Fowler, 2021). The innovations in AI technologies and influencer marketing enabled the emergence of a new category of influencers, virtual influencers. (Li et al., 2023; Xie-Carson, Benckendorff & Hughes, 2023)

Despite the current rise of virtual influencers, the history of virtual influencers can be dated back to the early 1990s, to the introduction of the first cartoon characters. The first virtual celebrities and idols originated from Japan, creating a new market for virtual YouTubers, defined as digital

characters, generating content and building relationships with consumers on YouTube, such as Kizuna AI, a widely known V-tuber, with more than 3 million followers. (Gerlich, 2023)

Therefore, virtual entities created to engage with consumers are not a new phenomenon. However, the innovations brought by advanced AI technologies, and computer-generated images (CGI) opened new opportunities for brands to communicate with followers. Utilizing the innovative technologies and consumers need for unique experiences, Brud, a digital company based in Los Angeles, created the first virtual social media influencers, namely Lil Miquela, Blawko and Bermuda. (Arsenyan & Mirowska, 2021) Since the appearance of their most popular virtual influencer, Lil Miquela in 2016, virtual influencers gained popularity (Li et al., 2023). Moreover, as humans were subject to lockdown measures during the Covid-19 pandemic, brands started to prioritize digital solutions, as virtual influencers were still able to appear in the outside world. Therefore, the upswing of virtual entities was further accelerated in recent years (Conti, Gathani, and Tricomi 2022) and professionals forecast an outstanding rise of the virtual influencer market in the near future (Appel et al. 2020).

Interest in these innovative endorsers extended beyond brands and consumers to include scholars as well. Consequently, an extensive number and variety of studies have been conducted, examining virtual influencers' effects in the marketing landscape. In the following section, I would like to give a brief overview of the currently existing definitions, applied technologies, controlling methodologies, and taxonomies of virtual influencers.

2.2 Defintion of Virtual Influencers

Virtual influencers are non-human, living and non-living, digitized entities (Kronemann et al., 2022; Liu & Lee, 2024; Xie-Carson, Benckendorff & Hughes, 2023), associated with online popularity (Thomas & Fowler, 2021) and assigned to specific social media profiles (Kronemann et al., 2022), possessing the ability to influence their audiences (Xie-Carson, Benckendorff & Hughes, 2023; Gerlich, 2023). Virtual influencers exhibit anthropomorphous appearance, behavior, traits and emotions, and utilize advanced technologies to perform human tasks (Thomas & Fowler, 2021; Franke, Groeppel-Klein, & Katrin, 2023; Lou et al., 2023). To establish the definition of these digital entities, two terms, namely “virtual” and “influencer” were combined. Being virtual indicates that they are generated, managed or simulated by software on a computer, network or online (Qu & Baek, 2023), appear to exist, but in the real world they do not (Thomas & Fowler,

2021). The term influencer suggests that these characters highly influence the beliefs and behaviors of their fans, called followers in digital context (Qu & Baek, 2023).

Virtual influencers belong to the category of virtual humans, encompassing a wide array of technology and computer-generated entities (Burden & Savin-Baden, 2019). Virtual humans applied in marketing activities can be categorized into different subgroups depending on the specific area of tasks they are implemented to perform. As the first subgroup of virtual humans, virtual assistants have been identified. Similar to chatbots, virtual assistants are utilized to carry out service tasks, however virtual assistants exceed the capabilities of chatbots merely interacting through messaging and performing uncomplicated assignments in customer support. Virtual assistants are more advanced than chatbots and are able to perform more complicated and diverse queries across numerous fields, like providing educational tutoring or sport coaching (Franke, Groeppel-Klein, & Katrin, 2023).

Virtual influencers, however, are neither conversational agents (Luger and Sellen, 2016), nor digital avatars, defined as digital entities used by marketers in consumer communications, merely representing users (Hanus and Fox, 2015), a term historically used for in-game visual representations of players, creating personalized characters in role-playing games. (Jiang, Zheng & Luo, 2024) As defined by Franke, Groeppel-Klein, & Katrin they are the second subgroup of virtual humans, applied to promote brands and their products and services in advertisements and brand communication (Franke, Groeppel-Klein, & Katrin, 2023). Also defined as “embodied virtual agents” by Tan and Liew (Tan and Liew, 2020, pg. 1).

Additional subgroups of virtual humans have been also identified, such as virtual celebrities (Franke, Groeppel-Klein, & Katrin, 2023), however in this study we do not analyze other groups in detail.

Researchers engaged with virtual influencer marketing use different terms to describe these entities, the most common terms are computer-generated imagery (CGI) influencers and artificial intelligence (AI) influencers, that highlight specific attributes of virtual influencers. In their 2023 study Li et al. defined virtual influencers as “3D, computer-generated personalities” (Li et al., 2023, pg. 1). This term refers to virtual influencers that were created leveraging computer-generated-imagery technology. On the other hand, the term artificial intelligence influencer is associated with virtual influencers that utilize artificial intelligence technologies to create content and engage with

consumers. Therefore, CGI and AI influencers are subsets of virtual influencers with distinctive traits and skills (Jiang, Zheng & Luo, 2024).

2.2.1 Applied technologies

These characters are extremely complex, therefore utilize numerous technologies in their generation, improvement and management, (Liu & Lee, 2024), however companies do not openly share the software's and technologies applied in generating virtual influencers (Gerlich, 2023). Brands, usually create a 3D character or avatar resembling to an influencer or celebrity and utilize software and programming to animate this digital entity and enable it to interact with its surroundings and real individuals (Gerlich, 2023). Kietzmann, Paschen and Treen have identified five fundamental components of artificial intelligence that, when combined, generate a virtual influencer. These components include natural language processing, image identification, speech recognition, problem solving, and machine learning (Kietzmann, Paschen, & Treen, 2018). The purpose of the first three is to collect information. First, natural language process modeling is applied to analyze meaning carried within texts shared on social media content or in direct messages by consumers. Additionally, image recognition enables advertisers to understand consumer behavior represented in pictures and videos shared (Kietzmann, Paschen, & Treen, 2018). Consumers attitudes towards brands can be therefore subtracted from contents including brand related information, even if it is not explicitly mentioned. Hutson found that this technology might be even more efficient in analyzing facial expressions than humans (Hutson 2018). Ultimately, speech recognition could also be implemented to further analyze consumer content on social media. Applying these advanced technologies, virtual influencers gain the ability to disclose consumers personalities, values and needs and subsequently interact with consumers more effectively (Kietzmann, Paschen, & Treen, 2018).

2.2.2 Controlling virtual influencers

Consumers often lack awareness of the exact controlling methodology of virtual influencers (Franke, Groeppel-Klein, & Katrin, 2023). Although it is commonly assumed that virtual influencers are operated by artificial intelligence, up until now, a level of human supervision has been always involved in the management of these entities. Some virtual influencers heavily rely on artificial intelligence, but others are still operating with human input (Sands et al., 2022; Qu & Baek, 2023; Gerlich, 2023). Virtual influencers are usually established and managed by individuals,

digital agencies, or brands (Kronemann et al., 2022; Sands et al., 2022; Qu & Baek, 2023). There are instances where the virtual nature of the influencer is uncertain or misinterpreted, for example creators of Lil Miquela foster ambiguity among consumers (Klein, 2020). On the other hand, in the case of some virtual characters their digital origin is not hidden, as an example, on her Instagram page Noonnoouri, the animated character, developed by Munich-based graphics expert Jörg Zuber (TextilWirtschaft, 2019), openly shares that she is human generated, utilizing motion capture technologies of Manus technology company (Noonnoouri, 2023).

Although, completely autonomous virtual influencers are not yet commonplace, Appel and colleagues forecast that fully autonomous virtual influencers would soon gain greater prominence on social media, since they hold the ability to explicitly embody and execute brand values and engage with consumers at any given time (Appel et al., 2020).

2.4 Taxonomy of Virtual Influencers

Virtual influencers can take on various forms and shapes, ranging from imaginary, unrealistic characters who resemble simple drawings, such as the Good Advice Cupcake, a delightful Instagram influencer sharing entertaining stories and offering insightful advices to followers (Virtual Humans, n.d.-a) to hyper-realistic characters that are practically impossible to differentiate from real human influencers (Aggarwal & McGill, 2007; Delbaere et al., 2011), like Code Miko, popular Twitch live streamer (Virtual Humans, n.d.-b). Furthermore, while some of these entities appear to live in a virtual environment, others create the illusion of existing in the physical world, merging the boundaries between reality and virtuality (Arsenyan & Mirowska, 2021).

Further developing the definition of virtual influencers, previous studies categorized virtual influencers according to their specific taxonomy. Nonetheless, the overview of existing literature review shows that scholars predominantly focused on human-like and anime-like virtual influencers.

According to their understanding, virtual influencers can be defined as a type of digital human avatar that exhibits strong behavioral and form realism (Miao et al., 2022), rendering realistic and appealing human bodies (Byun and Ahn, 2023) and faces (Arsenyan & Mirowska, 2021; Khan & Sutcliffe, 2014). In studies focusing on human-like virtual influencers, realistic human characters were examined, such as Imma, one of Japan's first virtual models with iconic pink hair, created by

Tokyo-based company ModelingCafe (Virtual Humans, n.d.)-c or Prada's virtual influencer Candy, promoting the brands fragrance collection (Virtual Humans, 2021).

Building on the three distinguished groups of influencers, human, human-like and anime-like by Arsenyan & Mirowska, several research investigated anime-like virtual influencers. Anime-like influencers have low realism; however, they are humanized to fit into human social networks, and exhibit distinct anime features, like large eyes and small mouths (Mirowska & Arsenyan, 2023). An example of anime-like characters is Polar, the young singer and dancer created by The Soul Publishing (Virtual Humans, 2022)

These taxonomies mainly considered andromorphic virtual influencers but further researching existing literature reviews Mouritzen, Penttinen & Pedersen presented a new 2x2 taxonomy categorizing virtual influencers into four distinct groups, "hyper- realistic non-humans, hyper-realistic humans, unrealistic non-humans, and unrealistic humans" (Mouritzen, Penttinen & Pedersen, 2024 pg. 24).

Categories were created based on the level of anthropomorphism and position on the reality-virtuality continuum, providing a more nuanced differentiation of the virtual influencer marketing landscape. This grouping allows scholars, marketing and AI professionals to develop deeper

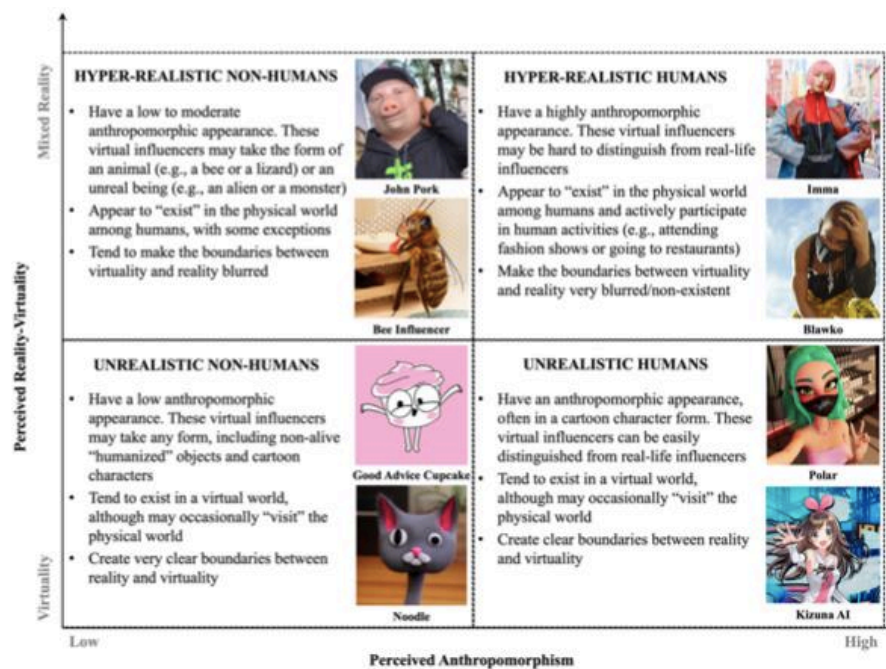


Figure 1. Taxonomy of Virtual Influencers (Mouritzen, Penttinen & Pedersen, 2024)

understanding of how brands leverage virtual influencers in their marketing activities to engage with consumers (Mouritzen, Penttinen & Pedersen, 2024).

In their taxonomy hyper-realistic human virtual influencers correspond to the ones previously described. Therefore, these entities closely resemble real humans and on their social media platforms share human-like experiences, such as attending events and socializing, blurring the line between the virtual and real world. Like Imma, sharing her involvement in the fashion world and in commercial activities (Mouritzen, Penttinen & Pedersen, 2024).

Unrealistic human virtual influencers also extinguish anthropomorphic characteristics, however they are designed as 3D or 2D cartoon characters. They mainly appear in virtual realms but can also engage with the physical world by attending places or events. Their cartoonish look creates a clear distinction between virtual and physical domains (Mouritzen, Penttinen & Pedersen, 2024). This category highly resembles the previously defined group of anime-like virtual influencers, examples are therefore Polar or Kizuna AI, Japanese VTuber, currently managed by Kizuna AI Inc (Virtual Humans, n.d.-d).

The research integrated two, previously not explicitly defined groups of virtual influencers, hyper-realistic and unrealistic non-human virtual influencers. Hyper-realistic virtual influencers take various forms, with low level of anthropomorphism, occasionally bearing human-like attributes. These characters frequently appear in the real world, demonstrated by the Bee Influencer, whose appearance and behavior are consistent with its bee-like form. Blurring the line between reality and virtuality, these entities redefine the digital connection and influence on consumers (Mouritzen, Penttinen & Pedersen, 2024).

Finally, unrealistic non-human virtual influencers, including animals, mythical creatures and humanized objects, exhibit little resemblance to humans. They usually exist in a well-constructed virtual universe, occasionally appearing in the physical world (Mouritzen, Penttinen & Pedersen, 2024). The previously mentioned Good Advice Cupcake or Nobody Sausage, originating from Lisbon, Portugal sharing adventures and commercials with its sausage friends (Nobody Sausage, n.d.)

2.5 The Persona behind the Virtual Influencers

In the past researchers have considered emotions as key features differentiating humans from non-human entities (Petersen et al., 2019). However, advancements in technology and the increasing skills of engineers and designers significantly improved virtual influencer's ability to possess personalities and identities of their own (Arsenyan & Mirowska, 2021; Choudhry et al., 2022) and simulate human emotions (Calvo et al., 2014). Additionally, they became capable of expressing highly sophisticated social cues, like autonomy, agency, and started to show empathy (Pentina et al., 2023). Thanks to these advancements, the distinction between human and machine-like conduct is becoming less apparent, allowing virtual influencers to have enormous influence on their audience (Sands et al., 2022). This distinguishes virtual influencers from widely applied digital human agents, such as online sales and recommendation agents or chatbots. (Qu & Baek, 2023)

2.6 Virtual Influencers as Social Media Influencers

Social media influencers emerged on social media platforms over the past decade utilizing advanced communication technologies. These social artists are individuals that share self-generated content about their life, experiences on social media platforms in return for monetary or barter compensations (Campbell and Grimm, 2019). They are usually recognized for being experts in specific subjects, like traveling, lifestyle, or fashion. They share content that holds various benefits for consumers, including educational tutorials, entertaining videos, or inspiring ideas for cooking (Audrezet et al., 2020; Majid et al., 2019). Influencers usually possess sizeable networks of engaged followers that are accessible to promote brands, products or services (de Veirman et al., 2017). Although, these social artists share certain similarities with celebrities in terms of their status and success factors (Breves et al., 2019; Weinswig, 2016), they are perceived as being more relatable and authentic sharing more similarities with their audience. Influencers are defined by unique attributes, by effectively branding themselves they gain fame amongst consumers, while becoming experts in social media management (Khamis et al., 2017), most successful influencers focus on one group of niche audiences (García-Rapp, 2016), they foster interactive communication with their followers (Khamis et al., 2017), their perceived agreeability becomes high, as they share their personal life and stories (Schau & Gilly, 2003).

Typically, marketers collaborate with traditional human influencers, who have the autonomy to make their own decisions about brand partnerships and develop their own opinions on the products and services they endorse (Schouten et al., 2020).

However, in recent years, virtual influencers have entered the marketing field, creating competition for traditional human influencers (Mediakix, 2019). Similar to traditional influencers, virtual influencers are active on social media platforms, presenting themselves as unique public personas, sharing engaging social media content. Their anthropomorphic and appealing appearance, unique persona and captivating storylines enable them to impersonate the role of social media influencers (El Hedhli et al., 2023; Deng & Jiang, 2023). Their activities shared online increases user engagement in the virtual environment (Arsenyan & Mirowska, 2021; Leighton, 2019; Sands et al., 2022; Thomas & Fowler, 2021) and they can become trusted, authentic and credible brand ambassadors in the opinion of consumers, despite their virtual nature (de Veirman et al., 2017, Moustakas et al. 2020). Consequently, virtual influencers hold the power to build relationships with a wide audience (Hugh et al., 2022; Leung et al., 2022a), effectively influencing their followers (Gerlich, 2023), without the potential of brand image degradation, as caused by the unpredictability of human influencer, engaging in scandals as an example (Moustakas et al., 2020; Thomas and Fowler, 2021).

2.7 Brands Collaborating with Virtual Influencers

Endorsement with virtual influencers has become particularly desirable for brands, as if applied appropriately their activities can be more effective than traditional marketing strategies. Numerous global brands, like KFC, LVMH, Mini, Netflix, Nike and Samsung started to work with virtual influencers in the past few years (Baklanov, 2019). In 2019 KFC introduced their own virtual influencer, an attractive gray-haired human-like entity showcasing its glamorous lifestyle and his stories from the everyday at KFC (Weiden & Kennedy, 2019) LVMH welcomed its virtual ambassador Livi in 2021, the new, feminine face representing their innovative aspirations, modeled by technological startup, Alava (Fashion Network, 2022). In 2021 Mini launched its new electric car with Lil Miquela driving it (Mini, 2021). Netflix teamed up with Nobody Sausage to create collaborated animations (nxuniq, 2024). Rae, a virtual influencer from Singapore, passionate about street culture could incorporate some fashionable pieces from Nike into her

wardrobe (Virtual Humans, 2021). While Samsung promotes its products with SamsungSam, created by Brazilian design firm Lightfarm and Cheil (Sam Mobile, 2022).

With a wide range of examples of global brands collaborating with virtual influencers, or even creating their own, one might question, why marketers are becoming more drawn to virtual influencers? In the following section, I would like to give a brief introduction to the potential advantages of working with virtual influencers, considering control, customization, flexibility, automation and lower cost.

One of the most outstanding advantages of working with virtual influencers is the high level of control brands or agencies can assert on their behavior, which is extremely important to maintain the desired reputation of the entities and the associated brands (de Silva Oliveria and Chimenti, 2021; Thomas and Fowler, 2021) and to keep the brands voice consistent (Del Rowe, 2019). Unlike traditional human influencers, virtual ones enable brands to mitigate the risk of “human error” by giving them complete authority over their actions and communications with consumers (Sands et al., 2022). Additionally, virtual influencers are not influenced by personal biases or motivations (Kádeková & Holienčinová, 2018), and have less potential to engage in scandals or unethical behaviors (Guthrie, 2020).

Another main benefit of working with virtual influencers is the high level of possible customization, enabling to reach a perfect alignment with the endorsed brands image (Moustakas et al. 2020). Customization of virtual influencers allows marketers to freely determine and alter all aspects of their digital existence. For instance, virtual influencers can be designed to possess distinct physical attributes, such as skin color, height, and weight (Mustak et al., 2022; Sands et al., 2022). Virtual influencers can also be associated with distinct background stories, such as their origin and geolocation, as well as distinctive behaviors, including preferences, attitudes and beliefs (Conti et al., 2022). Creators and managers of virtual influencers can also specify the content of their shared posts, allowing them to position the influencer as experts or opinion leaders in specific areas, such as fashion or tourism (Guthrie, 2020). Furthermore, virtual influencers attributes can also be adapted to the values and needs of the endorsed brands target audience (Conti et al., 2022; Thomas and Fowler, 2021). At the extreme, virtual influencers would be able to rapidly create unlimited amount of micro-targeted, and even completely personalized influences for companies. As an example, these endorsers can be specifically tailored to appeal to young women interested

in beauty products or to promote the sustainable consumption advocated by the endorsed brand. Hyper-personalized AI influencers can offer practical advantages, such as minimizing return rates through providing more precise product recommendations to consumers (Parisi, 2021). Customization also gives the possibility to adjust virtual influencers attributes to changing market trends and evolving customer preferences (Mouritzen, Penttinen & Pedersen, 2024).

Furthermore, not only are virtual influencers highly controllable and customizable, but brands can also utilize the flexibility of the digital entities. Due to their digital nature, virtual influencers are not subject to the same needs and limitations as traditional human influencers. For example, virtual influencers do not experience fatigue, hunger or illness (Appel et al., 2020; Yesiglou & Costello, 2020). Since they do not age, the risk of ageing out of the specific demographic segment is eliminated (Sands et al., 2022; Yesiglou & Costello, 2020). Unlike human influencers, virtual influencers do not need cosmetic preparations before shoots or collaborations (Yesiglou & Costello, 2020), neither is their work influenced by external conditions, such as the weather (Yesiglou & Costello, 2020). Moreover, these entities can anywhere, anytime and execute any task (Conti et al., 2022). They are not tied to a certain geographic area, instead they can even appear on a different planet or imaginary universe (Appel et al., 2020) and are available all the time, ready to prepare any advertising for brands (Yesiglou & Costello, 2020). Besides, the virtual nature of the influencers enables them transmedia storytelling, simultaneously appearing on numerous platforms, even beyond social media, such as on the metaverse (Barrera and Shah 2023; Sands et al., 2022) and sharing different formats utilizing digital technologies (Rasmussen, 2021). Therefore, the same virtual influencer can interact with its audience across different online platforms and spaces at the same time. Working with human influencers requires time, scheduling must be agreed on to create, edit and release content, but virtual influencers can enhance the efficiency of the entire creative process of content development (Yesiglou & Costello, 2020) and allows brands to quickly respond to and capitalize social media trends (Sands et al., 2022).

Although, management of virtual influencers still requires a level of human involvement, they are progressively transitioning to be more autonomous (Appel et al., 2020). As a result, virtual influencers are serving as effective brand ambassadors, offering consumer assistance (Conti et al., 2022) and providing effective problem solving, identifying multiple potential solutions and selecting the most beneficial ones (Paschen, Pitt, and Kietzmann 2020). Machine learning supports

virtual influencers in continuous self-optimization, they collect data and learn from every interaction with consumers (Kietzmann et al., 2018). Therefore, enable brands to build valuable relationships with each consumer or target group (Campbell et al., 2020). Most of the interactions are still text-based, however, technological developments enable them to gradually move towards voice- and video-based communication (Guthrie, 2020).

As virtual influencers are highly controllable, customizable, flexible and soon they could be fully automated, their management is associated with significantly less financial resources required in the long term. Therefore, perceived lower cost is also an outstanding reason for companies to work with virtual influencers instead of traditional human endorsers (Thomas and Fowler, 2021, Arsenyan & Mirowska, 2021; Sands et al., 2022)

Numerous advantages are brought by the advanced technologies virtual influencers utilize, this can be the reason behind global brands turning to these virtual entities to promote their brand and products in the past few years (Block & Lovegrove, 2021; Spangler, 2020). However, as previous studies show, a wide range of disadvantages is also associated with innovative technology.

While virtual influencers allow for high level of control and therefore security, it also poses challenges for collaborating brands. Although, virtual influencers themselves lack the ability to participate in unethical conduct or scandals, individual responsible for their operation can (Mrad et al., 2022; Thomas and Fowler, 2021). The firms or individuals behind the virtual characters might mismanage these entities, for example utilize them to spread misinformation amongst followers, that can degrade the virtual influencers and the connected brands image (Sands et al., 2022a). Further exacerbating the potential risks of virtual influencers, their designers might decide to remain anonymous (Ciuchita et al., 2022), which might motivate them even more to engage in unethical behavior, while remaining anonymous and not facing consequences. As the virtual nature of the digital characters does not allow them to experience any product or service firsthand, they are not able to develop their own subjective opinions, to this end they mainly represent impressions of others and might expressed biased viewpoints which might be offensive or misleading (Conti et al., 2022; Mrad et al., 2022). As an example, virtual influencers might be programmed to engage with unethical causes, like violence and racism on their social media (Ciuchita et al., 2022; Mustak et al., 2022), potentially fostering immoral behavior in society.

As described earlier, customization brings numerous advantages to brands, however, it also entails negative implications. Influencers visual appearance plays a crucial role in shaping society's beauty standards, often showcasing idealized image of flawless skin or figure (Guthrie, 2020; Sands et al., 2022b). Consequently, these unrealistic standards can induce feelings of anxiety amongst consumers regarding their own appearance (Deng & Jiang, 2023). The potential of disturbing consumers is even higher when customers struggle to differentiate virtual influencers from real humans (Franke et al., 2023), because consumers might not even be aware that they are comparing themselves to a virtually created creature. Moreover, the fabricated background of the virtual influencer and their shared content have the potential to generate misleading perceptions about society (Conti et al., 2022).

Whilst the high level of flexibility may initially seem attractive for brands, it also raises some concerns. Similarly, to their appearance, virtual influencers unrestricted ability to be present in any location at any time, might create false image of human lives and capabilities (Conti et al., 2022; Mustak et al., 2022). Similar to human influencers, virtual influencers might showcase luxurious lifestyle that is out of reach for the majority of consumers (Conti et al., 2022). To this ends consumer may also experience intimidation and fear of losing out (Dinh & Lee, 2022). Simultaneously, as virtual influencers display excessively adaptable behaviors that is unrealistic for a human being, they might appear more robotic than influential figures (Miao et al., 2022). Consequently, these virtual beings might appear as less genuine and relevant (Sands et al., 2022a), which can be disadvantageous in their marketing activities (Hugh et al., 2022; Schouten et al., 2020).

Despite the clear advantages, automation of the virtual endorsers is also linked to negative issues. Therefore, a high number of consumers might experience unease when interacting with AI technology powered characters (Kamoonpuri and Sengar, 2023; Rajaobelina et al., 2021). Consequently, brands might face challenges in capitalizing in engaging and establishing connections with potential consumers when working with virtual influencers. Moreover, there is a risk that characteristics of AI-driven virtual influencers may deliberately suppress facts, resulting in consumers mistakenly believing that they are interacting with a real human. Furthermore, the ability to collect consumer data from social media automatically raises concerns about the privacy of their private information and utilizing it to influence consumers into purchasing goods and

services, without the consumers being aware of this process. AI-driven virtual endorsers also represent a potential risk of intentionally disseminating misinformation or unethical messaging, either through deliberate design or by being deluded by inaccurate or unreliable online data (Mustak et al., 2022; Kraft, 2016). This can even result in harming consumers or the image of the endorsed brands.

2.8 Overview of Existing Literature

In the previous section we discussed why brands tend to be drawn to working with virtual influencers. Nonetheless, it invites inquiry about what consumers attitude towards this innovative endorsement is? Although there is growing study about virtual influencers (Thomas & Fowler, 2021), understanding of consumers reactions to the digital entities and brands utilizing them remains limited and mixed consumer attitudes have been found. It is uncertain whether consumers would respond less favorably to virtual humans compared to traditional human endorsers or they would view virtual influencers in the same way as other human influencers, as observed in previous studies (De Bellis and Johar, 2020; Kim et al., 2019). Even less studies examined consumers reactions to the different types of virtual influencers, such as human and non-human like, realistic and unrealistic influencers.

Driven by the diversity of approaches and inconsistent findings concerning the role of virtual influencers in the landscape of digital marketing, this study aims to present a systematic literature review, analyzing 17 key and recent peer-reviewed studies published between 2020 and 2024. The study identifies two major theoretical domains; consumer attitudes towards virtual influencers, examined through uncanniness, attractiveness and consumer attitudes towards the endorsed brands, as well as detailed theories used in the reviewed papers, as foundations of further empirical research, presented in this paper.

The data collection was started by searching for peer-reviewed English-language articles, on EBSCO Business Source Complete, Google Scholar, Science Direct and JSTOR, that had the following terms in their title, abstract, or keywords:

“Virtual influencer” OR “AI influencer” OR “digital influencer” OR “CGI influencer” OR “non-human influencer” AND “consumer perception” OR “consumer behavior” OR “consumer engagement” OR “consumer attitude” OR “social media marketing” OR “influencer marketing”

OR “endorsement” OR “brand awareness” “brand image” OR “anthropomorphism” OR “Uncanny Valley”.

The date range of publications was limited to 2020-2024. Although the first known virtual influencer, LilMiquela was created by the Los Angeles based startup, Brud in 2016, marketing activities utilizing virtual influencers started to become more prevalent during this period. For example World Health Organization called in Knox Frost, an AI influencer to educate people during the COVID-19 pandemic. While, Bailmain, French luxury brand introduced their new AI influencers, Shudu, Margot and Xhi. (Sands et al., 2022)

The selected articles were published in the following major journals European Journal of Marketing, Journal of Advertising, Psychology & Marketing, Journal of Retailing and Consumer Services, Journal of AI, Robotics & Workplace Automation, Spanish Journal of Marketing, Journal of Retailing and Consumer Services, Computers in Human Behavior, Journal of Research in Interactive Marketing, Journal of Product & Brand Management, Journal of Business Research, Administrative Sciences.

All papers were reviewed to identify and analyze the primary theories employed, methodology utilized, models examined and key findings, and summarized in Figure 2.

Consumer Attitudes Towards Virtual Influencers

Key studies concerning the application of virtual influencers in the realm of marketing analyzed the attitudes and responses of consumers after being exposed to virtual influencers.

3.8.1 Uncanniness and level of anthropomorphism

The most researched theme across literature of virtual influencers was the correlation between anthropomorphism and level reality in their appearance and behavior and consumer attitudes.

Anthropomorphism is a crucial concept that helps us gain a deeper understanding of how humans engage with technology (van Doorn et al., 2017). As designers can assign andromorphic features and even establish an identity for virtual influencers (Ene et al., 2019), analyzing consumers attitudes towards the anthropomorphism of virtual influencers is crucial to understand their effect in the realm of marketing.

Figure 2. Ovevview of Existing Literature

Article	Virtual Influencer Type	Applied Theories, Models, Aspects	Methodology	Primary Findings
Sands et al. (2022)	HI vs. HVI	Social-Psychological Distance, Influencer Agency The Moderating Role Of Need For Uniqueness AND: Intention To Follow, Personalization, Trust, WOM	Online Survey	There is no significant difference in intention to follow and personalization, consumers tend to trust AI VI less than HI, however AI VI generates more WOM. AI VI is seen as more socially distant compared to HI and that consumers need for uniqueness has a positive relationship with consumers' willingness to engage with AI VI. Additionally, they showed that AI VIs lack of agency is a disadvantage compared to HI.
Lou et al. 2023	HVI & AVI	Uses And Gratification (U&G) Approach Uncanny Valley Theory AND Brand Image, Brand Awareness, Purchase Intentions	Focus Groups, Snowball sampling	They determined six primary motivations – namely, novelty, information, entertainment, surveillance, esthetics, and integration and social interaction that drive followers to consumer the content of VIs. They found that consumers characterize VIs as uncanny and authentically fake, however curated flaws and self-justification can moderate these attitudes. Virtual influencers can be effectively utilized in enhancing brand image and increasing brand awareness, however, they do not seem to have significant effect on purchase intentions.
Franke, Groeppel-Klein, & Katrin (2023)	HI vs. HVI	The Uncanny-Valley Effect ALSO: Novelty, General Attitude, Identification, Product Fit	Online Survey	Identifying human and virtual influencers caused hardships for consumer. Consumers still find human influencers more appealing in marketing activities. HVIs can provide more novelty in the eyes of consumers. Finding fitting products to endorse with virtual influencers is determinant in advertising effectiveness.
Böhdnel & Rudeloff (2023)	HI vs. HVI	Credibility Competence Likability Purchase intentions	Online Survey	Consumer perceptions about virtual influencers are somewhat more negative than about human influencers, there were no significant differences in credibility, expertise and purchase intentions, however virtual influencers proved to be less likeable than traditional influencers.
Kronemann et al. (2022)	VI (HVI)	Personalisation-Privacy Paradox (PPP) Privacy Calculus Theory (PCT) AND Anthropomorphism, Personalisation	Literature Review	This study developed a conceptual model with seven research propositions, concerning personalisation-privacy paradox (PPP), privacy calculus theory (PCT) to provide a system to analyze AIs effect on consumer information disclosure. According to their proposal, anthropomorphism and personalisation positively, while privacy concerns negatively influence consumers impressions and readiness to share personal information.
Lim & Lee (2023)	HVI	Social Identity Theory Uncanny Valley Theory Parasocial Interaction Theory AND Credibility, Origin Disclosure, Emotional Narratives, Humanness	Between-subjects design	No origin disclosure and share of negative emotions increased PSI, indicating intimacy and connection, however sharing VI origin, especially combined with negative emotions decreased PSI, further demonstrating the uncanny valley effect. On the other hand, sharing positive emotions, while also disclosing origin, boosted PSI, suggesting that positive emotions favors human-machine connections. Altogether, they found that the connection between these parameters and the perceived credibility was mediated by PSI.
Pentina et al. (2023)	VI (HVI & AVI)	Social Exchange And Social Penetration Theories Social support, Attachment, And Love Theories Social Attraction, Social Anxiety, And Uncertainty Reduction Uses And Gratifications (U&G) Paradigm Human–Machine And Computer-Mediated Communication Theories CASA Approach Theory Of Mind Uncanny Valley Theory	Systematic literature review	Due to the novelty of the social AI innovations, they found that a new theoretical approach is necessary to effectively employ literature from various fields, factors and processes describing human-machine relationships should be reconceptualized. Their analysis resulted in proposing an integrative conceptual framework and recommended areas for future research.
Li et al. (2023)	HI vs. HVI	Endorsement Effectiveness Mind Perception Theory Perceived Credibility Sensory AND Brand Attitude, Purchase Intention, Perceived Sensory Capability And Credibility	Secondary Data Analysis Scenario-based experiments	Virtual influencers tend to be less effective in endorsement, caused by the perceived credibility and sensory capability. Salience of sensory cues, physical product characteristics, represented in advertisements are highly influential moderators, extenuating negative attitudes towards virtual influencers.
Jiang, Zheng & Luo (2024)	HVI vs. AVI	VI Image Emotional Appeal Product Involvement	Experimental study	HVI proved to be more credible, fostered higher purchase intention and positive brand attitude. Considering pride appeals HVI proved to be a better match, while AVI endorsement was more suitable for gratitude appeals.
Thomas & Fowler (2021)	HI vs. HVI	Associative Network Model Of Memory Technology Acceptance Model Transgression	Online Survey	Emotional appeals are only relevant when endorsing low-involvement products, but HVI proved to be more effective in case of high-involvement product.
Mouritzen, Penttinen & Pedersen (2024)	HVI, AVI, NHVI, NVI	Customization Flexibility Ownership Automation	Conceptual Literature Review	Positive brand benefits and brand degradation via transgression can be both caused by AI influencers. If AI influencers engage in transgression consumers will expect similar behavior from other AI influencers. In case of brand image degradation, replacing VI with human celebrity endorsers can support rebuilding brand image.
Qu & Baek (2023)	HI vs. VI (HVI & AVI)	Cue utilization Theory Consistency Theory Source Credibility Theory Uncanny Valley (UV) Theory AND Contextual Factors, Trustworthiness	Online Panel	Customization and flexibility of virtual influencers can bring numerous advantages, however it might cause anxiety in consumers by representing unrealistic beauty and lifestyle standards. Additional concerns, regarding their ownership and automation of VIs, is that they can automatically engage in or can be programmed to represent unethical causes by their creators, further increasing the risks in VI marketing.
Liu & Lee (2024)	HI vs. HVI	Match-Up Hypothesis	Between-subjects design	HVIs lack consumer trust compared to AVI and HI, however perceived trustworthiness and overall attitude can be enhanced when the VI was presented in a virtual environment or with virtual companions.
Xie-Carson, Benckendorff & Hughes (2023)	NHVI	Actor-Network Theory	Netnography	Considering authenticity HVIs got more negative evaluations in all examined product types, functional, symbolic, experiential. However, the effect on brand attitudes and purchase intentions varied based on the endorser fit and product type.
Gerlich, 2023	HI vs. VI (HVI & NHVI)	Source Credibility Theory The Concept of Parasocial Relationships The Concept of Opinion Leadership The Uncanny Valley Theory AND Brand Trust, Expertise, Purchase Intention	Online Survey	Consumers engage with non-human influencers for entertaining, emotional or educational content, and they evaluate similar factors to human influencers, like expertise, trustworthiness, attractiveness or product-endorser fit.
Arsenyan & Mirowska, 2021	HI vs. HVI vs. AVI	Uncanny Valley Hypothesis, And Computers Are Social Actors (CASA) Paradigm AND Human-Computer Interactions	Scraping	Consumers are becoming more drawn to virtual influencers, they find them more relevant, trustworthy, credible and therefore VIs have a positive effect on purchase intention.
				VIs virtual nature can be even accepted by consumers, as they are perceived as “authentically” fake. However, HVIs received remarkably lower positive consumer feedback, compared to AVIs, further affirming the Uncanny Valley Theory. Therefore, it is advised to keep some elements of “virtualness” in the virtual influencers marketing activities.

Several studies analyzed whether consumers could differentiate virtual influencers from traditional human endorsers and how the level of anthropomorphism changes consumer attitudes. In some cases, the virtual influencer proved to be anthropomorphized to such an extent that identifying human and virtual influencers caused hardships for consumers (Franke, Groeppel-Klein, & Katrin, 2023)

The Uncanny Valley theory, first defined by Masahiro Mori in 1970, hypothesizing that consumers' response to anthropomorphized would rapidly change from empathy to the feeling of eeriness, as humanness is closely approached, however can't be fully reached (Mori & Macdorman, 2017) was discussed by various scholars in the past years. In their study Kronemann et al. found that anthropomorphism and personalization can positively influence consumers' impressions (Kronemann et al., 2022).

However, supporting the widely applied Uncanny Valley theory, Mouritzen, Penttinen & Pedersen highlighted that, although customization and anthropomorphism of virtual influencers can bring several advantages, it might raise concerns about causing anxiety in consumers by representing unrealistic beauty and lifestyle standards. This issue is especially exaggerated when the virtual influencer is hardly distinguishable from real humans (Mouritzen, Penttinen & Pedersen, 2024). Franke, Groeppel-Klein, & Katrin described that consumers still find human influencers more appealing in marketing activities (Franke, Groeppel-Klein, 2023), and Böhndel & Rudeloff also found that consumer perceptions about virtual influencers are somewhat more negative compared to traditional human influencers (Böhndel & Rudeloff, 2023), while comparing anime-like influencers and human-like influencers Arsenyan & Mirowska also summarized that HVIs received remarkably lower positive consumer feedback compared to AVIs (Arsenyan & Mirowska, 2021). On the other hand, studies have shown that the virtual nature of the digital avatars can be even accepted by consumers, as they are perceived as “authentically” fake (Arsenyan & Mirowska, 2021; Lou et al., 2023), and curated flaws, like the gap between LilMiquela's front teeth and self-justification of consumers about the virtuality of the entities can moderate these attitudes (Lou et al., 2023). Therefore, it is advised to keep some elements of “virtualness” in the virtual influencers' marketing activities (Arsenyan & Mirowska, 2021), as an example overall attitude can be enhanced when the VI is presented in a virtual environment or with virtual companion. (Qu & Baek, 2023)

2.8.2 Attractiveness of Virtual Influencer

Despite the prevalent negative effects of uncanniness, virtual influencers present a unique opportunity in endorsement, as consumers are becoming more drawn to their content (Gerlich, 2023). According to former studies this phenomenon is probably caused by the fact that complementing the feeling of eeriness a mixed “fear and fascination” experience can be observed amongst consumers. In several cases, non-human influencers effectively grab users' attention by imitating the characteristics and behaviors associated with being human (Xie-Carson, Benckendorff & Hughes, 2023). Oliveria and Chimenti found that attractiveness is an inherent quality in exerting virtual influencers effectiveness, necessitating the possession of true or perceived attributes such as ability, beauty, style, humour, sensuality, or authority to capture attention. Qualities such as value creation, creativity, and exclusivity are likely to add to the attractiveness of endorsers. (Oliveira and Chimenti, 2021)

Transparency about uncanniness and humanness can also lead to an appealing impression in consumers, as find virtual influencers novelty and innovativeness fascinating (Block and Lovegrove 2021; Franke, Groeppel-Klein, & Katrin) they Sands et al. also concluded that need for uniqueness positively affects consumers' willingness to engage with artificial intelligence generated VIs. (Sands et al., 2022) Researching the motivation of consumers to follow virtual influencers, Lou and colleagues determined six primary motivations – namely, novelty, information, entertainment, surveillance, esthetics, and integration and social interaction - that drive followers to consume the content of VIs. (Lou et al., 2023). Whether consciously or unconsciously, consumers chose to follow virtual influencers, as with their life experiences and cultivated identities they effectively represent a broader population, drawing followers to engage with their content. Despite being under the control of a business, avatar influencers possess significant impact and have great potential for establishing connections with their audience. The absence of a clear distinction between avatar influencers and real individuals may restrict the ability of the latter to change the attitudes of their followers and exert influence over them. Nevertheless, according to their research, the absence of avatars in the real world adds to their fascination and allure (De Brito Silva et al., 2022).

2.8.3 Additional Factors Researched to Understand Consumers Attitudes towards Virtual Influencers

To explore consumer attitudes towards virtual influencers a wide range of additional aspects have been researched by scholars, such as trustworthiness, source credibility, expertise, likeability and their effect on consumer attitudes.

Xie-Carson, Benckendorff & Hughes found that consumers evaluate similar factors when consuming virtual influencers content as when traditional human influencers (Xie-Carson, Benckendorff & Hughes, 2023), such as trustworthiness, source credibility, expertise, likeability, therefore these factors are also reliable indicators, when measuring consumer attitudes. Sands et al. and Qu & Baek in both their studies stated that virtual influencers lack consumer trust compared to human influencers and human-like virtual influencers perform even worse than anime-like virtual influencers (Sands et al., 2022; Qu & Baek, 2023). The perceived low credibility was the reason behind lower effectiveness in virtual influencer endorsement according to Li et al. (Li et al., 2023) while Böhndel & Rudeloff found that virtual influencers are less likeable according to consumer responses. However, their study found no significant differences in perceived credibility and expertise (Böhndel & Rudeloff, 2023). Opposingly, the investigation of Gerlich in 2023 found that customers find them more relevant, trustworthy, credible and therefore VIs have a positive effect on consumer attitudes (Gerlich, 2023). Examples of positive perceptions can be the fashion sense of Barbie, humor of Sophia the Robot, or the LGBTQ issues represented by Lil Miquela (Xie-Carson, Benckendorff & Hughes, 2023).

Lim & Lee conducted two experiments in 2023, exploring virtual influencers perceived credibility and humanness corresponding to the entity's origin disclosure, and used emotional narratives, through parasocial interactions. The study found that no origin disclosure and share of negative emotions increased PSI, indicating intimacy and connection, however sharing VI origin, especially combined with negative emotions decreased PSI, further demonstrating the uncanny valley effect. On the other hand, sharing positive emotions, while also disclosing origin, boosted PSI, suggesting that positive emotions favor human-machine connections. Altogether, they found that the connection between these parameters and the perceived credibility was mediated by PSI (Lim & Lee, 2023).

2.8.4 Consumer Reactions to Brands Endorsed by Virtual Influencers

An additional important aspect of virtual influencer marketing is the effect of the digital entities on brand endorsement. Related to brand endorsement, the following aspects have been researched by previous studies, brand image, brand awareness, brand perception product endorsement, product and endorser fit and purchase intentions.

As Lou et al. found in 2023, virtual influencers can be effectively utilized in enhancing brand image and increasing brand awareness, however, they do not seem to have significant effect on purchase intentions, caused by low authenticity, little similarity to followers and lack of parasocial interactions. (Lou et al., 2023)

In their study, consumers commonly communicated that applying virtual influencers in marketing activities can boost brand image (Lou et al., 2023), supporting the findings of Jang and Yoh that virtual influencers qualities, such as innovation and professionalism will be also associated with the endorsed brand, fostering positive brand perceptions (Jang & Yoh, 2020) and the results of Moustakas and colleagues and Robinson, that working with virtual influencers can project a futuristic and trendy image on the endorsed brands, as a result of the novelty of this phenomena (Moustakas et al. 2020; Robinson, 2020).

According to the findings of Lou and colleagues, utilizing virtual influencer marketing can also effectively boost brand awareness, as consumers tend to recognize and recall brands that engaged in marketing activities collaborating or working with virtual influencers (Lou et al., 2023). These results are also supported by the associative network model of memory. Several scholars found that in the case of brand endorsers, there will be a linked path in consumers memory, connecting the endorsed brand to the virtual influencer, over time (Keller, 1993; Thomas & Fowler, 2016; Till & Shimp, 1998; Till, 1998).

Furthermore, these digital entities foster higher engagement level and evoke stronger word-of-mouth amongst consumers according to the findings (Arsenyan & Mirowska, 2021; Sands et al., 2022) and thanks to the novelty and shock factor and their high follower base can increase the visibility of endorsed brands (Robinson 2020; Lou et al., 2023).

The results are mostly consistent with the arguments made by Thomas and Fowler in 2021 on the favorable impact of visual images on brand attitudes. In their two studies Thomes and Fowler

demonstrated that positive brand benefits and brand degradation via transgression can be both caused by AI influencers, like by human celebrity influencers. However, if AI influencers engage in transgression consumers will expect similar behavior from other AI influencers. In the case of human celebrity endorsers, however behaviors are perceived as less interchangeable. Therefore, in case of brand image degradation caused by an AI influencer, replacing them with human celebrity endorsers can support rebuilding brand image. (Thomas & Fowler, 2021)

Several researchers examined the role of virtual influencers in product endorsement.

In 2023 Li and colleagues determined that the salience of sensory cues, physical product characteristics, such as taste or smell, represented in advertisements are highly influential moderators, extenuating negative attitudes towards virtual influencers (Li et al., 2023). While according to the study of Liu & Lee in 2024, the effect on brand attitudes and purchase intentions varied based on the endorser fit and product type. For example, the collaboration of Pacsun with Lil Miquela in the fashion industry faced backlash, while consumers found her and Imma ideal for promoting technological innovations of Samsung and Lenovo (Liu & Lee in 2024). Jiang, Zheng & Luo compared HVI and AVI in endorsing different eco-friendly products, such as natural laundry detergent. According to their results, HVI proved to be more credible, fostered higher purchase intention and positive brand attitude. Considering pride appeals HVI proved to be a better match, while AVI endorsement was more suitable for gratitude appeals. They also looked at product involvement and found that emotional appeal is only relevant when endorsing low-involvement products, like eco-tissues, but HVI proved to be more effective than AVI in case of high-involvement product, such as energy vehicles, irrespective of the applied emotional appeal (Jiang, Zheng & Luo, 2024).

3. Research Questions and Methods

Due to the novelty of using virtual influencers in marketing, there is a scarcity of research on consumer attitudes towards virtual influencers and brand endorsement by virtual influencers, as well as guidance for managers in dealing with virtual influencer marketing. The present research aims to fill in these gaps, responding to recent requests from various researchers to explore marketing activities of and consumer attitudes towards a wider range of virtual influencers, from human-like to non-human-like (Xie-Carson, Benckendorff & Hughes, 2023; Lou et al. 2023; Li et

al., 2023; Qu & Baek, 2023; Franke, Groeppel-Klein, & Katrin, 2023; Thomas & Fowler, 2021; Mouritzen, Penttinen & Pedersen, 2024), examine real virtual influencers (Liu & Lee, 2024), pay more attention to their humaneness, uncanniness, and overall look and feel (Gerlich, 2023), focus on consumer attitudes towards brands that are utilizing virtual influencer marketing (Lou et al., 2023), and examine consumer reactions across different social media platforms (Sands et al., 2022; Li et al., 2023; Jiang, Zheng & Luo, 2024), potentially focusing on video content (Xie-Carson, Benckendorff & Hughes, 2023).

Examining consumer attitudes towards virtual influencers and brands utilizing virtual influencer marketing, the research consisted of one experimental study and a complementary netnographic study, where the consumer attitudes towards virtual influencers and endorsed brands were measured. Utilizing an online survey, Study 1 establishes the baseline effect of the level of anthropomorphism on consumer attitudes towards the endorser and the endorsed brand. Study 2 complements Study 1 by measuring consumer attitudes expressed by engaging with posts representing virtual influencer endorsement.

3.1 Identifying Key Measures for the Study

Building on the presented literature review and the identified gaps in existing studies, the following key measures have been identified for this study:

Level of anthropomorphism and reality of virtual influencers; considering consumer attitudes towards the four different groups of virtual influencers identified by Mouritzen, Penttinen & Pedersen “hyper- realistic non-humans, hyper-realistic humans, unrealistic non-humans, and unrealistic humans” (Mouritzen, Penttinen & Pedersen, 2024)

Attractiveness of virtual influences; the variable of perceived beauty is measuring physical attractiveness in consumers opinion suggested by Gerlich (Gerlich, 2023), consumers fascination measures changing attitudes evoked by the perceived novelty of virtual influencers (Block and Lovegrove 2021; Franke, Groeppel-Klein, & Katrin), finally, sympathy indicates consumers attitude towards the virtual influencers as a result of their showcased emotional capabilities (Lim & Lee, 2023).

Uncanniness of virtual influencers; measuring the variables of perceived scariness, evoked anxiety and shock in consumers, as first described by Masahiro Mori in 1970 (Mori & Macdorman, 2017).

Brand attitude; indicating consumers attitudes towards brands utilizing virtual influencers in marketing on three scales. The variable likeability/unlikability of the endorsed brands indicating overall impression of consumers after being exposed to virtual influencer endorsement (Mitchell & Olson, 1981; Shimp, 1981). The variable of perceived innovativeness/boredom reflects the perceived novelty of brands after applying virtual influencers (Block and Lovegrove, 2021). Finally, the perceived rationality of brands working with virtual influencers was measured by the scale of wisdom and foolishness as applied by MacKenzie, Lutz and Belch (MacKenzie, Lutz and Belch, 1986).

From the described key measures and variables, the following research model has been constructed, presented in Figure 2.

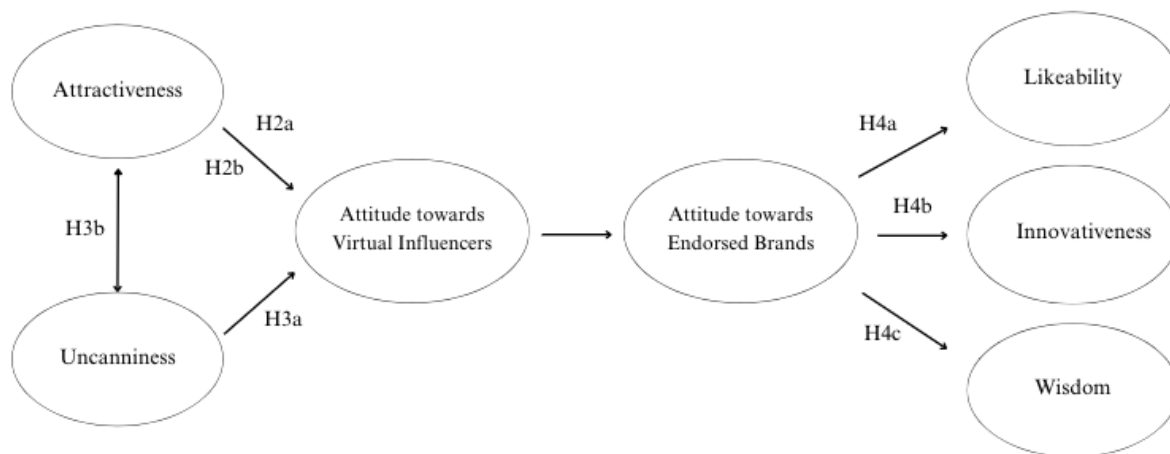


Figure 3. Research Model and Hypotheses

3.2 Hypotheses to Analyze Key Measures

Initially, hypotheses were formulated to analyze the attitudes of various demographic groups:

H1a: There will be a significant difference in attitude towards the attractiveness of the virtual influencers between different genders.

$$H_0: \mu_1 = \mu_2$$

$$H_{1a}: \mu_m \neq \mu_f$$

H1b: There will be a significant difference in attitude towards the uncanniness of the virtual influencers between different genders.

H0: $\mu_1 = \mu_2$

H1b: $\mu_m \neq \mu_f$

Pertaining to the construct of attractiveness as attributed to virtual influencers, the following hypotheses have been formulated:

H2a: There will be a significant difference in the perceived attractiveness of the different influencers.

H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

H1: Not all means are equal, at least one mean is significantly different from the others.

H2b: The hyper-realistic human influencer receives significantly lower positive consumer feedback compared to the unrealistic human influencer.

H0: $\mu_1 = \mu_2$

H1: $\mu_1 \leq \mu_2$

Regarding the concept of uncanniness in relation to virtual influences, the following assumptions have been outlined:

H3a: There will be a significant difference in the perceived uncanniness of the different influencers.

H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

H3a: Not all means are equal, at least one mean is significantly different from the others.

H3b: There will be a negative correlation between perceived uncanniness and perceived attractiveness.

$$H_0 = \rho = 0$$

$$H_1 = \rho < 0$$

Considering consumers attitudes towards brands utilizing virtual influencer marketing, the subsequent hypotheses have been delineated:

H4b: The endorsed brand will be considered as innovative after collaborating with virtual influencers.

$$H_0: \mu \leq 3$$

$$H_1: \mu > 3$$

H4a: There will be a significant difference in the likeability of the endorsed brands.

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$$

H1: At least one mean is significantly different from the others.

H4c: There will be a significant difference in the perceived wisdom of the endorsed brands.

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$$

H1: At least one mean is significantly different from the others.

3.3 Selection of the Virtual Influencers and Endorsed Brands

Applying the taxonomy introduced by Mouritzen, Penttinen & Pedersen, 4 different virtual influencers were selected, each representing one type from the 2x2 taxonomy, namely “hyper-

realistic humans, unrealistic humans, hyper-realistic non-humans, and unrealistic non-humans"(Mouritzen, Penttinen & Pedersenm 2024).

Since the phenomenon of endorsement with virtual influencers, especially non-human virtual influencers, is not yet common practice in numerous sectors, first the sectors had to be defined, that already applied virtual influencer endorsement. According to previous research, virtual endorser and product fit seems to be the most advantageous, when the sensory capabilities and appearance does not play an important role in the use of the product or service (Li et al., 2023). Therefore, the car industry seems to be fitting. Especially in the case of the introduction of new technologies and electronic cars, car companies tend to collaborate with virtual influencers.

In the selection process, the Virtual Humans database was reviewed to find a suitable example for each virtual influencer type active in the car industry (Influencers, Virtual Humans, n. d.).

In the category of hyper-realistic human virtual influencer, Lil Miquela was selected. Lil Miquela is a 19-year-old female popstar, created by Los Angeles based tech company, Brud in 2016 (Virtual Humans, 2021). She is known to engage in the music and fashion industry and even advocates social causes. Her influential role is further proven by the fact that TIME Magazine recognized her as one of their ‘25 Most Influential People on the Internet’ (TIME Magazine, 2018). Her characteristics style enabled her to collaborate with luxury fashion brands such as Calvin Klein and Prada (Buyukaslan, Maher & Baytar, 2023). Additionally, tech companies such as Lenovo and Samsung also collaborated with the virtual pop star. (Okolia, 2020). Sharing her everyday life on her main platforms, Instagram and TikTok, Lil Miquela acquired 2,6 and 3,5 million followers, also called “Miqaliens” (Virtual Humans, n.d.) as of April 2024. (Lil Miquela, 2024; Lil Miquela, 2024)

The selected campaign to be analyzed in this research is the “Make it Real” campaign of BMW collaborating with Lil Miquela to endorse the innovative iX2, in 2023 (Marketing-Interactive, 2023).

As unrealistic human virtual influencer, Hatsune Miku, the anthropomorphized mascot was identified (Franke, Groeppel-Klein, & Katrin, 2023). Hatsune Miku, is a 16-year-old virtual sensation,p created by Crypton Future Media, based in Sapporo, Japan in 2007 (Virtual Humans, n.d.). With her distinctive long, turquoise twintails and eternal voice, the cyber celebrity gained an

enormous fan community across the world. Hatsune released over 100,000 songs and continues to perform on sold-out 3D concerts in Los Angeles, Taipei, Hong Kong, Singapore and Tokyo. Her unique fame allowed her to perform with international stars, like Lady Gaga or Pharrell Williams (Mary, 2022) and she teamed up with several global brands, such as SEGA, Toyota USA, Google and more (Crypton Future Media, n. d.). Fans mainly engage with the virtual star on YouTube and Facebook, where the virtual celebrity gained fan communities of 3 million and 2.4 million until 2024 April (HatsuneMiku, 2024; Hatsune Miku, 2024).

In 2011, Toyota USA created a campaign to promote Toyota Corolla and invited Hatsune Miku as the promotion's face. The collaboration was so popular that Toyota continued with the collaboration and announced a fan event, named MikuSpace and introduced the Corolla and Hatsune Miku Augmented Reality Experience in 2011 (Toyota Newsroom, 2011).

In this study Janky will represent the category of unrealistic non-human virtual influencers. Janky is one of the top synthetic celebrities of Superplastic, creator and owner of the world's first massively popular animated character universe, launching animated characters, designer toys and apparel (About, Superplastic, 2024). Originating from Los Angeles, California, Janky is known for his prominent influence in the streetwear scene, sourcing his unique fashion collection from movie sets and of celebrity homes in Beverly Hills. Additionally, he became a cartoon stuntman, after proving his toughness in Travis Scott's "ASTROWORLD" trailer (Universe, Superplastic, n.d.). Along with his animated friend Guggimon, Janky was hired by Amazon, to create the world's first animated comedy series (PR Newswire, 2023), luxury powerhouse, Gucci launched its SUPERGUCCI collection featuring Janky NFTs (Gucci, 2022), additionally in 2021 Fortnite introduced its new Epic skin of Janky (Fortnite, 2021). During the past years Instagram followers of Janky reached 1 million (Janky, 2024).

In this study we analyze the collaboration of Janky with Mercedes-Benz in 2023 launching a limited-edition capsule collection and a distinguished VIP event in New York (PR Newswire, 2023).

Application of unrealistic non-human virtual influencers in advertisements is an infrequent practice in marketing therefore selecting the character and brand for this category was challenging. However, GEICO, the insurance company for cars and other valuable assets (GEICO, n.d.), introduced its realistic lizard's figure, the GEICO Gecko in 2000 and resulting from his active

social media presence became a virtual influencer. The spokes-reptile of GEICO represents the brand's commitment to providing high value and excellent service to its customers (AdAge, 2020). To achieve his mission of helping people save money, Gecko travels to the US and educates and entertains his audiences and became one of the most popular figures in the world of advertising (Virtual Humans, n.d.). Although the Gecko is mainly appearing in the advertisements of GEICO, the lizard already collaborated with Guardians of the Galaxy's Baby Groot to more efficiently promote conscious financial decisions (Framestore, n.d.), has his Midweek Matinee for children at the Prince George's County Publick Playhouse (Business Wire, 2015) and became the on-set consultant of Netflix's film "Leo" (Marketing Dive, 2023).

As a social artist Gecko acquired 240 thousand followers on Facebook and 40 thousand fans on Instagram as to 2024 April. (The GEICO Gecko, 2024)

4. Study 1

4.1 Methodology

The most influential variables have been selected after the literature review: consumer attitude, brand attitude after being exposed to virtual influencer endorsement. Considering these factors, an online survey was prepared in Qualtrics and shared on LinkedIn, Facebook, Instagram, WhatsApp and promoted on leaflets amongst students of Corvinus University Budapest from March to April 2024. Therefore, the samples collected from the online platforms are self-selection, volunteer samples.

The questionnaire consisted of nominal (multiple-choice) question, Likert-scale questions, matrix questions, with a clear distinction between parameters related to different types of influencers, aiming for user-friendliness and simplicity in decision making. To reduce the potential for confusion, the selection of questions was formulated straightforwardly. Additionally, in the aim of reaching a wider audience, the questionnaire was shared in English and Hungarian.

The survey began with a short introduction of the questionnaire including the necessary disclaimers for participants concerning the terms of participation.

In the first section of the questionnaire, pictures and a short description were presented about the selected four virtual influencers, namely Lil Miquela, Hatsune Miku, Janky and GEICO Gecko.

Following the introductions participants were asked whether they have known the virtual influencer and to evaluate the presented endorser on Likert scales, in terms of attractiveness and uncanniness, by rating the following aspects, perceived beauty, fascination, sympathism, scariness, evoked anxiety and shock.

Additionally, participants were shown videos of the collaborations with the evaluated endorser, a BMW campaign with Lil Miquela, Toyotas collaboration with Hatsune Miku, the joined project of Mercedes-Benz and Janky and finally, an advertisement of GEICO featuring Gecko. This time participants had to express their attitude towards the endorsed brands, by indicating whether they find the brand likeable versus unlikeable, innovative versus boring and wise versus foolish.

The virtual influencer evaluation was followed by a short explanation of the phenomenon of virtual influencers. Participants were asked to rank the presented influencers representing which one they preferred, and they also had to declare whether they were able to recognize the virtual nature of the characters. Additionally, simple questions were asked about their social media consumption and attitude towards technological advancements.

Finally, the last section of the survey was devoted to collecting relevant demographic information from respondents, including age, gender and level of education.

4.2 Analyzis

The comprehensive survey conducted for our study yielded a rich dataset that was meticulously curated and analyzed using SPSS, a sophisticated statistical software package. Initially, the raw data were imported into SPSS where a rigorous review process ensured the accuracy and completeness of the dataset. To maintain the integrity of our analysis, we excluded responses from participants who did not fully complete the survey. Additionally, to address the issue of underrepresentation, responses from individuals identifying with a third gender or who chose not to disclose their educational background were removed from the final dataset.

The dataset underwent a transformation to consolidate educational levels into two distinct groups, due to the underrepresentation of respondents with elementary and higher educational backgrounds. Post-cleaning, our final sample size consisted of 201 participants, distilled from the original 374. With this refined dataset, we embarked on a detailed examination within SPSS, starting with

demographic variables, subsequently moving to hypothesis testing to evaluate perceived attractiveness and uncanniness of virtual influencers, and ultimately, their impact on brand attitude.

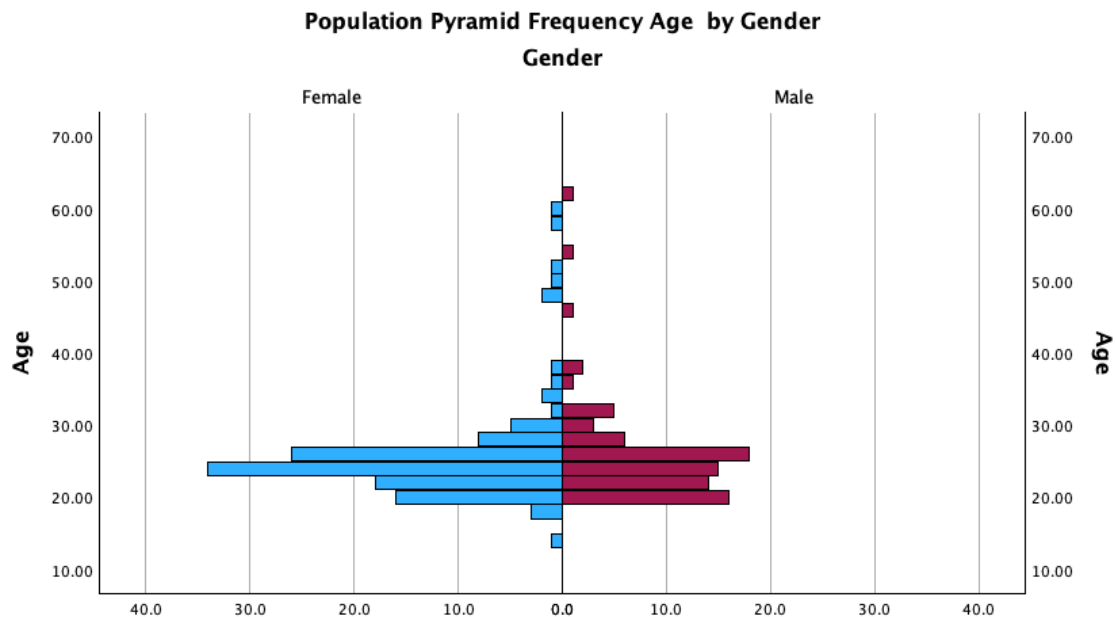


Figure 4. Population Pyramid Frequency

The demographic distribution of our survey respondents, as illustrated by the Population Pyramid Frequency chart, suggests a relatively balanced gender representation, with age groups concentrated around the 20-40 years range. This age distribution indicates that our survey targets a young to middle-aged audience, which is typically active online and potentially receptive to digital marketing.

Educational groups		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Pre-tertiary Education Group	71	35.3	35.3	35.3
	Tertiary and Higher Education Group	130	64.7	64.7	100.0
	Total	201	100.0	100.0	

Figure 5. Educational Groups

In terms of education, the majority of our respondents (64.7%) belong to the Tertiary and Higher Education Group, which demonstrates a highly educated demographic, while the remaining 35.3% are part of the Pre-tertiary Education Group. This educational split is significant for understanding the level of sophistication and critical thinking skills that the respondents might apply when interacting with marketing content.

Hours spent on social media daily		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 hour	16	8.0	8.0	8.0
	1 hour	37	18.4	18.4	26.4
	2-3 hours	95	47.3	47.3	73.6
	3-5 hours	50	24.9	24.9	98.5
	More than 5 hours	3	1.5	1.5	100.0
	Total	201	100.0	100.0	

Figure 6. Hours spent on social media daily

Regarding social media usage, the largest group of respondents reports spending 2-3 hours daily on social media (47.3%), followed by those who spend 3-5 hours (24.9%). This indicates that our respondent base is highly engaged in social media platforms, which are crucial channels for modern marketing strategies.

Connection to advancements in technology					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very connected	30	14.9	14.9	14.9
	Somewhat connected	93	46.3	46.3	61.2
	Minimally connected	67	33.3	33.3	94.5
	Not connected	11	5.5	5.5	100.0
	Total	201	100.0	100.0	

Figure 7. Connection to technological advancements

When assessing the connection to advancements in technology, a substantial portion of the respondents feels 'Somewhat connected' (46.3%), with a further 33.3% feeling 'Minimally connected'. This could imply a varied level of openness and adaptability towards new technological offerings within our sample.

First, the hypotheses related to demographic differences have been examined.

H1a: There will be a significant difference in attitude towards the attractiveness of the virtual influencers between different genders.

H0: $\mu_1 = \mu_2$

H1: $\mu_m \neq \mu_f$

First an Independent Samples T-test was conducted to examine the differences in attitudes toward the attractiveness of virtual influencers between male and female participants, thereby testing for potential gender-based disparities in perception. For this analysis, a composite attractiveness score for all virtual influencers was created in SPSS using the Compute Variable function.

Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
attractiveness_ALL	Male	82	34.9390	9.40757	1.03889
	Female	119	37.8319	10.04677	.92099

Figure 8. Descriptive Statistics for Attractiveness of Virtual Influencer's by Gender

In the study, males (N=82) recorded a mean attractiveness score for virtual influencers of 34.9390 (M = 34.9390, SD = 9.40757), while females (N=119) reported a higher mean score of 37.8319 (M = 37.8319, SD = 10.04677).

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Significance One-Sided p	Significance Two-Sided p	Mean Difference	Std. Error Difference	90% Confidence Interval of the Difference Lower Upper
attractiveness_ALL	Equal variances assumed	.813	.368	-2.059	199	.020	.041	-2.89291	1.40531	-5.21525 -.57056
	Equal variances not assumed			-2.084	181.425	.019	.039	-2.89291	1.38835	-5.18826 -.59756

Figure 9. Independent Samples Test for Attractiveness of Virtual Influencer's by Gender

Levene's Test for Equality of Variances is not significant ($p = .368$), indicating equal variances can be assumed. The t-test for Equality of Means gives a t-statistic of -2.059 with 199 degrees of freedom. The one-sided p-value is .020, and the two-sided p-value is .041, which are both less than the alpha level of 0.1, indicating a statistically significant difference between genders. The mean difference is -2.89291, showing females score higher in attractiveness than males. The 90% Confidence Interval for the mean difference does not include zero (-5.21826, -0.56756), supporting the significance of the difference.

Considering an alpha level of 0.1, there is a significant difference in the way males and females perceive the attractiveness of virtual influencers, with females rating them as more attractive than males. This finding substantiates the hypothesis that gender differences exist in the perception of virtual influencers' attractiveness.

H1b: There will be a significant difference in attitude towards the uncanniness of the virtual influencers between different genders.

H0: $\mu_1 = \mu_2$

H1: $\mu_m \neq \mu_f$

To assesses the difference in attitudes towards the uncanniness of virtual influencers between genders, an Independent Samples T-test was performed.

Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
uncanniness_ALL	Male	82	29.8293	11.29712	1.24756
	Female	119	35.2437	10.35060	.94884

Figure 10. . Descriptive Statistics for Uncanniness of Virtual Influencer's by Gender

Males (N=82) had a mean uncanniness score of 29.8293 (M = 29.8293, SD = 11.29712), while females (N=119) reported a higher mean score of 35.2437 (M = 35.2437, SD = 10.35060).

Independent Samples Test										
Levene's Test for Equality of Variances				t-test for Equality of Means						
		F	Sig.	t	df	Significance One-Sided p	Significance Two-Sided p	Mean Difference	Std. Error Difference	90% Confidence Interval of the Difference Lower Upper
uncanniness_ALL	Equal variances assumed	.003	.953	-3.511	199	<.001	<.001	-5.41443	1.54227	-7.96311 -2.86575
	Equal variances not assumed			-3.454	164.116	<.001	<.001	-5.41443	1.56738	-8.00718 -2.82168

Figure 11. Independent Samples Test for Uncanniness of Virtual Influencer's by Gender

The t-test for Equality of Means provided a t-statistic of -3.511 and a significant two-sided p-value of less than .001, indicating a significant difference in perceptions of uncanniness between male and female participants, with females perceiving a higher level of uncanniness. The mean difference was -5.41443, and the 90% confidence interval of this difference ranged from -7.96311 to -2.86575, which does not include zero, further confirming the observed significance.

This substantial difference corroborates the proposed hypothesis, demonstrating that gender significantly affects the perception of virtual influencers' uncanniness, with females perceiving these influencers as more uncanny than males do at the specified alpha level of 0.1.

In the next section, hypothesis related to the perceived attractiveness of the presented virtual influencers was analyzed.

H2a: There will be a significant difference in the perceived attractiveness of the different influencers.

H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

H1: Not all means are equal, at least one mean is significantly different from the others.

The Repeated Measures ANOVA was conducted to evaluate whether there were significant differences in the perceived attractiveness across the four different types of influencers. To conduct the analysis on perceived attractiveness, I combined the values of perceived beauty, fascination, and sympathy for each of the four influencers. This was achieved by using the Compute Variable function in SPSS to create a new variable that represents the average score of these three attributes. This composite score was then used as the dependent variable in subsequent analyses.

Descriptive Statistics			
	Mean	Std. Deviation	N
LM_attractiveness	9.7363	3.14724	201
HM_attractiveness	8.2537	3.47567	201
J_attractiveness	7.6667	3.17070	201
G_attractiveness	10.9950	3.48496	201

Figure 13. Descriptive Statistics of Virtual Influencers' Attractiveness

The Descriptive Statistics table indicates the means and standard deviations for perceived attractiveness of each influencer type, with the virtual influencer, Gecko coded as "G_attractiveness" having the highest mean score ($M = 10.9950$, $SD = 3.48496$), suggesting that participants rated this influencer as most attractive on average.

Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi^2(5) = 19.246$, $p = .002$, which suggests that the variances of the differences between all combinations of related groups are not equal. Consequently, corrections for violations of sphericity were applied

using Greenhouse-Geisser estimates of sphericity ($\epsilon = .941$), which adjust the degrees of freedom for the averaged tests of significance.

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^b		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
attractiveness	.908	19.246	5	.002	.941	.956	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: attractiveness

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Figure 14. Mauchly's Test of Sphericity of Virtual Influencers' Attractiveness

The Tests of Within-Subjects Effects table presented the results after the sphericity assumption was adjusted. The F-tests using Greenhouse-Geisser corrections revealed a significant effect of influencer type on perceived attractiveness, $F(2.823, 566.600) = 68.438$, $p < .001$, with a partial eta squared of .255, indicating a large effect size. This result suggests that the type of influencer has a strong impact on how attractive they are perceived to be by the participants.

To further investigate these differences, a Paired Samples T-test was conducted between the two influencers with the closest means in attractiveness, specifically Hatsune Miku and Janky, coded as HM_attractiveness and J_attractiveness.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
attractiveness	Sphericity Assumed	1356.909	3	452.303	68.438	<.001	.255
	Greenhouse-Geisser	1356.909	2.823	480.585	68.438	<.001	.255
	Huynh-Feldt	1356.909	2.868	473.111	68.438	<.001	.255
	Lower-bound	1356.909	1.000	1356.909	68.438	<.001	.255
Error(attractiveness)	Sphericity Assumed	3965.341	600	6.609			
	Greenhouse-Geisser	3965.341	564.690	7.022			
	Huynh-Feldt	3965.341	573.612	6.913			
	Lower-bound	3965.341	200.000	19.827			

Figure 15. Tests of Within-Subjects of Effects of Virtual Influencers' Attractiveness

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	HM_attractiveness	8.2537	201	3.47567	.24516
	J_attractiveness	7.6667	201	3.17070	.22364

Figure 16. Paired Samples Statistics of Hatsune Miku's and Janky's Attractiveness

The Paired Samples Statistics table shows that the mean score for perceived attractiveness was higher for HM_attractiveness ($M = 8.2537$, $SD = 3.47567$) than for _attractiveness ($M = 7.6667$, $SD = 3.17070$).

Paired Samples Test									
		Paired Differences				Significance			
		Mean	Std. Deviation	Std. Error Mean	90% Confidence Interval of the Difference				
					Lower	Upper	t	df	
Pair 1	HM_attractiveness - J_attractiveness	.58706	3.34569	.23599	.19709	.97703	2.488	200	
									One-Sided p Two-Sided p
									.007 .014

Figure 17. Paired Samples Test of Virtual Influencers' Attractiveness

The T-test yielded a t-value of 2.488 with 200 degrees of freedom. The one-sided p-value was .007, and the two-sided p-value was .014, both of which are below the conventional .1 threshold for statistical significance.

These results indicate that there is a statistically significant difference between the perceived attractiveness scores for Hatsune Miku's attractiveness (HM_attractiveness) and Janky's attractiveness (J_attractiveness), with Hatsune Miku being rated as more attractive than Janky.

The reason for performing a Paired Samples T-test after observing a significant main effect in the Repeated Measures ANOVA was to identify specific pairs of influencers that differed in attractiveness. This post hoc comparison was necessary to understand the nature of the differences detected by the broader ANOVA test, allowing for a more nuanced analysis of the data.

H2b: The hyper-realistic human influencer receives significantly lower positive consumer feedback compared to the unrealistic human influencer.

H0: $\mu_1 = \mu_2$

H1: $\mu_1 \leq \mu_2$

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	LM_attractiveness	9.7363	201	3.14724	.22199
	HM_attractiveness	8.2537	201	3.47567	.24516

Figure 18. Paired Samples Statistics of Lil Miquela's and Hatsune Miku's Attractiveness

The Paired Samples Statistics reveal a disparity in the average ratings of perceived attractiveness between Lil Miquela ($M = 9.7363$, $SD = 3.14724$) and Hatsune Miku ($M = 8.2537$, $SD = 3.47567$). Lil Miquela is considered more attractive than Hatsune Miku.

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	90% Confidence Interval of the Difference				Significance
					Lower	Upper	t	df	
Pair 1	LM_attractiveness - HM_attractiveness	1.48259	3.64567	.25715	1.05765	1.90752	5.766	200	One-Sided p <.001 Two-Sided p <.001

Figure 19. Paired Samples Test of Lil Miquela's and Hatsune Miku's Attractiveness

The calculated t-value is 5.766 with 200 degrees of freedom. The significance levels for one-sided and two-sided tests are both reported as less than .001, significantly below the alpha level of .1, confirming that the difference in attractiveness between Lil Miquela and Hatsune Miku is statistically significant.

In conclusion, these results substantiate the hypothesis of a significant difference in perceived attractiveness between Lil Miquela and Hatsune Miku, with Lil Miquela receiving a higher attractiveness rating than Hatsune Miku. The statistical significance indicated by the t-test and the confidence interval that does not cross zero allow us to assert that this observed difference is unlikely to have occurred by chance.

After the examination of perceived attractiveness, the uncanniness of the presented virtual influencers has been analyzed.

H3a: There will be a significant difference in the perceived uncanniness of the different influencers.

H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

H1: Not all means are equal, at least one mean is significantly different from the others.

To conduct the analysis on perceived uncanniness, I combined the values of perceived scariness, evoked anxiety, and shock for each of the four influencers. This was achieved by using the Compute Variable function in SPSS to create a new variable that represents the average score of these three attributes. This composite score was then used as the dependent variable in subsequent analyses. A Repeated Measures ANOVA was performed to assess the level of uncanniness in the perception of different virtual influencers: Lil Miquela, Hatsune Miku, Janky, and Gecko.

Descriptive Statistics			
	Mean	Std. Deviation	N
Lil Miquela – Uncanniness	8.2388	3.76599	201
Hatsune Miku – Uncanniness	9.6070	4.08164	201
Janky – Uncanniness	9.0746	3.96981	201
Gecko – Uncanniness	6.1144	3.03839	201

Figure 20. Descriptive Statistics of Virtual Influencers' Uncanniness

The descriptive statistics for uncanniness yielded the following mean scores (M) and standard deviations (SD): Lil Miquela exhibited a mean score of 8.2388 with a standard deviation of 3.76599, Hatsune Miku had a mean score of 9.6070 with a standard deviation of 4.08164, Janky showed a mean score of 9.0746 with a standard deviation of 3.96981, and Gecko had a mean score of 6.1144 with a standard deviation of 3.03839. These scores indicate that Hatsune Miku was perceived as the most uncanny on average, followed closely by Janky, then Lil Miquela, and finally, Gecko was perceived as the least uncanny.

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^b		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
uncanniness	.910	18.743	5	.002	.939	.954	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept

Within Subjects Design: uncanniness

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Figure 21. Mauchly's Test of sphericity of Virtual Influencers' Uncanniness

The test of sphericity, which checks if the variances of the differences between all combinations of related groups (the influencers) are equal, was significant ($p = .002$), indicating that the assumption of sphericity was violated. Therefore, the degrees of freedom were adjusted using Greenhouse-Geisser estimates ($\epsilon = .939$) to correct for this violation.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
uncanniness	Sphericity Assumed	1423.453	3	474.484	56.196	<.001	.219
	Greenhouse-Geisser	1423.453	2.816	505.419	56.196	<.001	.219
	Huynh-Feldt	1423.453	2.861	497.581	56.196	<.001	.219
	Lower-bound	1423.453	1.000	1423.453	56.196	<.001	.219
Error(uncanniness)	Sphericity Assumed	5066.047	600	8.443			
	Greenhouse-Geisser	5066.047	563.276	8.994			
	Huynh-Feldt	5066.047	572.150	8.854			
	Lower-bound	5066.047	200.000	25.330			

Figure 22. Tests of Within-Subjects Effects of Virtual Influencers' Uncanniness

The results showed a significant effect of the influencer type on the perception of uncanniness, $F(2.816, 563.276) = 56.196$, $p < .001$, with a partial eta squared of .219. This large effect size suggests a substantial variation in uncanniness scores across the different virtual influencers.

The statistically significant main effect in the Repeated Measures ANOVA indicates that participants' perceptions of uncanniness significantly differ among the virtual influencers examined in this study. The partial eta squared value of .219 denotes that approximately 21.9% of the variance in uncanniness scores can be explained by the type of influencer. Given that the Greenhouse-Geisser correction was used, these results are reliable despite the violation of the sphericity assumption.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Hatsune Miku – Uncanniness	9.6070	201	4.08164	.28790
	Janky – Uncanniness	9.0746	201	3.96981	.28001

Figure 23. Paired Samples Statistics of Hatsune Miku's and Janky's Uncanniness

Following the significant main effect observed in the Repeated Measures ANOVA, a Paired Samples T-test was conducted to further investigate the two influencers with the closest mean scores, Hatsune Miku and Janky. This targeted analysis aimed to determine if the slight difference in their uncanniness ratings was statistically significant. The Paired Samples Test revealed a mean difference of 0.53234, with Hatsune Miku rated slightly higher in uncanniness than Janky.

Paired Samples Test										
		Paired Differences					Significance			
		Mean	Std. Deviation	Std. Error Mean	90% Confidence Interval of the Difference		t	df	One-Sided p	Two-Sided p
					Lower	Upper				
Pair 1	Hatsune Miku – Uncanniness – Janky – Uncanniness	.53234	3.93830	.27779	.07329	.99138	1.916	200	.028	.057

Figure 24. Paired Samples Test of Hatsune Miku's and Janky's Uncanniness

The two-sided p-value of 0.057 is below the alpha level of 0.1, which indicates that this difference is statistically significant at your stated alpha level. The 90% confidence interval for the mean difference, ranging from -0.07329 to 0.99138, further supports this finding, pointing to a significant difference in perceived uncanniness between Hatsune Miku and Janky at the 10% significance level.

The analyses performed, consisting of a Repeated Measures ANOVA followed by a Paired Samples T-test, collectively support Hypothesis H2a, which anticipated significant differences in perceived uncanniness among different virtual influencers. The significant results of these tests

confirm that there is indeed variability in how uncanny each influencer is perceived, validating the hypothesis.

H3b: There will be a negative correlation between perceived uncanniness and perceived attractiveness.

H0: $\rho=0$

H1: $\rho<0$

First the correlation between the attractiveness of Lil Miquela and her perceived uncanniness was examined and a Correlation analysis was conducted.

Correlations			
		LM_attractiveness	LM_uncanniness
LM_attractiveness	Pearson Correlation	1	-.316**
	Sig. (2-tailed)		<.001
	N	201	201
LM_uncanniness	Pearson Correlation	-.316**	1
	Sig. (2-tailed)	<.001	
	N	201	201

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 25. Correlations for Lil Miquela's Attractiveness and Uncanniness

The Correlation coefficient (r) is -0.316, which indicates a negative relationship between the two variables: as the perceived attractiveness of Lil Miquela increases, the perceived uncanniness decreases, or vice versa. The negative correlation is statistically significant with a p-value of less than .001, which is well below the conventional threshold of 0.01 for strong significance.

Correlations		HM_attractive ness	HM_uncannine ss
HM_attractiveness	Pearson Correlation	1	-.468**
	Sig. (2-tailed)		<.001
	N	201	201
HM_uncanniness	Pearson Correlation	-.468**	1
	Sig. (2-tailed)	<.001	
	N	201	201

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 26. Correlations for Hatsune Miku's Attractiveness and Uncanniness

In the case of Hatsune Miku, the analysis revealed a statistically significant moderate negative correlation between her perceived attractiveness and perceived uncanniness ($r = -0.468$, $p < .001$, $N = 201$). This suggests that higher levels of perceived attractiveness are associated with lower levels of perceived uncanniness for this virtual influencer.

Correlations		J_attractiveness	J_uncanniness
J_attractiveness	Pearson Correlation	1	-.282**
	Sig. (2-tailed)		<.001
	N	201	201
J_uncanniness	Pearson Correlation	-.282**	1
	Sig. (2-tailed)	<.001	
	N	201	201

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 27. Correlations for Janky's Attractiveness and Uncanniness

The correlation analysis for Janky demonstrated a significant moderate negative correlation between perceived attractiveness and perceived uncanniness ($r = -0.282$, $p < .001$, $N = 201$). The result indicates that an increase in Janky's perceived attractiveness is associated with a decrease in perceived uncanniness.

Correlations		G_attractiveness	G_uncanniness
		ss	s
G_attractiveness	Pearson Correlation	1	-.229**
	Sig. (2-tailed)		.001
	N	201	201
G_uncanniness	Pearson Correlation	-.229**	1
	Sig. (2-tailed)	.001	
	N	201	201

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 28. Correlations for Gecko's Attractiveness and Uncanniness

The statistical analysis for Gecko revealed a significant, albeit weak, negative correlation between perceived attractiveness and perceived uncanniness ($r = -0.229$, $p = .001$, $N = 201$). This suggests that increases in Gecko's perceived attractiveness correspond to decreases in perceived uncanniness among the participants.

The significant negative correlations found across the virtual influencers support the hypothesis of an inverse relationship between perceived uncanniness and perceived attractiveness. With a sample size of 201 respondents, these correlations—moderate for some influencers and weaker for others—indicate a consistent pattern: as perceived attractiveness increases, perceived uncanniness tends to decrease. This consistent association across different virtual characters suggests that, despite the potential influence of other factors, there is a clear and observable link between these two attributes in the data.

Finally, hypotheses analyzing consumers attitudes towards the endorsed brands have been tested.

H4a: There will be a significant difference in the likeability of the endorsed brands.

H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

H3b: At least one mean is significantly different from the others.

Descriptive Statistics			
	Mean	Std. Deviation	N
BMW – Unlikeable: Likeable	3.36	1.105	201
Toyota – Unlikeable: Likeable	2.74	1.163	201
Mercedes-Benz – Unlikeable:Likeable	2.75	1.260	201
GEICO – Unlikeable: Likeable	3.69	1.207	201

Figure 29. Descriptive Statistics of the Likeability of Endorsed Brands

In the next Repeated Measures ANOVA, the hypothesis that there would be significant differences in likeability among four brands; BMW, Toyota, Mercedes-Benz, and GEICO, was tested.

The descriptive statistics revealed varying likeability scores with the following means: BMW had a mean likeability score of 3.36, Toyota 2.74, Mercedes-Benz 2.75, and GEICO 3.69, indicating that GEICO was rated the most likeable and Toyota and Mercedes-Benz the least likeable on average.

Mauchly's Test of Sphericity ^a							
Measure: MEASURE_1							
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser	Epsilon ^b Huynh-Feldt	Lower-bound
likeability	.985	2.988	5	.702	.990	1.000	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: likeability

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Figure 30. Mauchly's Test of Sphericity of the Likeability of Endorsed Brands

The ANOVA results were significant ($p < .001$), confirming differences in likeability scores among the brands. Given that Mauchly's Test of Sphericity was not significant ($p = .702$), the assumption of equal variances of differences was met, allowing for the use of the standard degrees of freedom in the analysis.

Tests of Within-Subjects Effects							
Measure: MEASURE_1							
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
likeability	Sphericity Assumed	131.920	3	43.973	41.252	<.001	.171
	Greenhouse-Geisser	131.920	2.970	44.412	41.252	<.001	.171
	Huynh-Feldt	131.920	3.000	43.973	41.252	<.001	.171
	Lower-bound	131.920	1.000	131.920	41.252	<.001	.171
Error(likeability)	Sphericity Assumed	639.580	600	1.066			
	Greenhouse-Geisser	639.580	594.076	1.077			
	Huynh-Feldt	639.580	600.000	1.066			
	Lower-bound	639.580	200.000	3.198			

Figure 31. Tests of Within-Subjects Effects of the Likeability of Endorsed Brands

The Partial Eta Squared value of .171 indicates a substantial effect size, with around 17.1% of the variance in likeability scores being associated with the brand factor.

These results support the hypothesis, showing that brand does have a significant effect on likeability. With the significant F statistic and a non-violation of sphericity, the evidence suggests that consumer perceptions of likeability vary significantly across these four brands.

H4b: The endorsed brand will be considered as innovative after collaborating with virtual influencers.

H0 : $\mu_1 = \mu_2$

H1 : $\mu_1 < \mu_2$

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
BMW – Innovative:Boring	201	3.30	1.315	.093
Toyota – Innovative:Boring	201	3.20	1.175	.083
Mercedes-Benz – Innovative:Boring	201	3.27	1.212	.086
GEICO – Innovative:Boring	201	3.36	1.128	.080

Figure 32. One-Sample Statistics of Brands Attractiveness

One-Sample Test							
Test Value = 3							
	t	df	Significance		Mean Difference	90% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
BMW – Innovative:Boring	3.217	200	<.001	.002	.299	.15	.45
Toyota – Innovative:Boring	2.402	200	.009	.017	.199	.06	.34
Mercedes-Benz – Innovative:Boring	3.200	200	<.001	.002	.274	.13	.41
GEICO – Innovative:Boring	4.565	200	<.001	<.001	.363	.23	.49

Figure 33. One-Sample T-Test of Brands Innovativeness

The mean scores represent the average perception of innovativeness versus boringness for each brand. For example, BMW has a mean score of 3.30, indicating that on average, respondents perceive BMW as moderately innovative rather than boring.

This test compares the mean score of each brand against a hypothetical value of 3 (neutrality, neither innovative nor boring). The "Test Value = 3" indicates that the comparison is against this neutral value.

This shows the significance level (p-value) associated with each t-test. It tells us the probability of observing the results if the null hypothesis (mean = 3) were true. Values below a certain threshold (commonly 0.05) indicate statistical significance.

This is the difference between the mean score and the test value (3). A positive mean difference suggests a perception more towards innovation, while a negative difference suggests a perception more towards boringness.

This provides a range within which we can be confident that the true mean difference lies. For example, the 90% Confidence Interval of the Difference for BMW ranges from 0.299 to 0.15.

Based on the provided data, all brands have mean scores above 3, suggesting that they are generally perceived as more innovative than boring. Additionally, all p-values are less than 0.05, indicating statistical significance, meaning that the mean differences are unlikely to have occurred by random chance.

Overall, these results suggest that respondents perceive all four brands as more innovative than boring, with BMW having the highest perceived innovativeness among the brands examined.

H4c: There will be a significant difference in the perceived wisdom of the endorsed brands.

H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

H1: At least one mean is significantly different from the others.

Upon conducting a Repeated Measures ANOVA to assess the perceived wisdom of different endorsed brands, we aimed to test the hypothesis that there would be significant differences in how consumers rate the wisdom of these brands.

Descriptive Statistics			
	Mean	Std. Deviation	N
BMW – Foolish:Wise	2.85	1.048	201
Toyota – Foolish:Wise	2.37	1.032	201
Mercedes-Benz – Foolish:Wise	2.35	1.058	201
GEICO – Foolish:Wise	2.98	1.074	201

Figure 34. Descriptive Statistics of the Wisdom of the Endorsed Brands

Descriptive statistics for the mean perceived wisdom scores were as follows: BMW was rated at 2.85, Toyota at 2.37, Mercedes-Benz at 2.35, and GEICO at 2.98. These means suggest that GEICO was perceived as the wisest among the brands, while Toyota and Mercedes-Benz were viewed as the least wise.

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser	Epsilon ^b	
						Huynh-Feldt	Lower-bound
wiseness	.961	7.898	5	.162	.975	.991	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept

Within Subjects Design: wiseness

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Figure 35, Mauchly's Test of Sphericity of the Wisdom of the Endorsed Brands

Mauchly's Test of Sphericity was not significant ($p = .162$), confirming that the assumption of sphericity was satisfied, indicating that the variance of the differences among all pairs of groups is equal. This meant that no adjustment to degrees of freedom was necessary.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
wiseness	Sphericity Assumed	62.342	3	20.781	25.873	<.001	.115
	Greenhouse-Geisser	62.342	2.924	21.323	25.873	<.001	.115
	Huynh-Feldt	62.342	2.972	20.978	25.873	<.001	.115
	Lower-bound	62.342	1.000	62.342	25.873	<.001	.115
Error(wiseness)	Sphericity Assumed	481.908	600	.803			
	Greenhouse-Geisser	481.908	584.731	.824			
	Huynh-Feldt	481.908	594.343	.811			
	Lower-bound	481.908	200.000	2.410			

Figure 36. Tests of Within-Subjects Effects of the Wisdom of the Endorsed Brands

The ANOVA results showed a significant effect for brand wisdom, with an F value of 25.873 and a p-value of less than .001. The Partial Eta Squared was .115, which indicates that approximately 11.5% of the variance in perceived brand wisdom can be explained by the difference between brands.

The statistical significance found in these results supports the hypothesis, indicating that there are indeed notable differences in perceived wisdom among the brands in question. This substantiates

the premise that brand perception in terms of wisdom varies significantly from one brand to another within this sample.

4.3 Discussion

In Study 1 hypotheses considering consumer attitudes towards virtual influencers, their perceived attractiveness and uncanniness, and towards brands utilizing virtual influencers, their likeability, innovativeness and wisdom have been formulated and tested.

First, hypotheses considering the correlation between different demographic groups and attitudes towards virtual influencers have been examined. Both tested hypotheses have been confirmed, therefore gender differences exist in the perception of virtual influencers attractiveness. While females rated the perceived attractiveness of the virtual influencer higher, they also found the presented influencers uncannier.

In the second part of the hypothesis testing, the perceived attractiveness of the presented virtual influencers has been measured. Hypothesis H2a, has been confirmed, indicating that the different influencer types, “hyper- realistic non-humans, hyper-realistic humans, unrealistic non-humans, and unrealistic humans” defined by Mouritzen, Penttinen & Pedersen (Mouritzen, Penttinen & Pedersen, 2024 pg. 24), evoke different attitudes in consumers. According to previous studies, these differences could be the result of the different level of anthropomorphism and reality of the virtual influencers. Although, previous studies have found that consumers find virtual entities more appealing if some level of virtualness is represented in their appearance (Arsenyan & Mirowska, 2021; Qu & Baek, 2023), the findings of these study indicate that respondents perceived virtual influencer more positive, if they had a realistic appearance, as Lil Miquela and the Gecko.

There results of H2b, if the hyper-realistic human influencer receives significantly lower positive consumer feedback compared to the unrealistic human influencer, has not been confirmed, opposing to the findings of previous studies, finding that human-like virtual influencer get significantly lower positive consumer feedback, compared to anime-like virtual influencers (Arsenyan & Mirowska, 2021), in this study Lil Miquela received a higher attractiveness rating than Hatsune Miku. Further affirming that realistic influencers get more positive feedback from consumers.

The next hypotheses measured the perceived uncanniness of the presented virtual influencers, as H3a assumed, there were significant differences in the perceived uncanniness of the different influencers. The findings indicate that Hatsune Miku was perceived as the uncanniest on average, followed closely by Janky, then Lil Miquela, and finally, Gecko was perceived as the least uncanny. Previous studies have found that hyper-realistic human influencers evoke feelings of scare, anxiety and shock in consumers (Mouritzen, Penttinen & Pedersen, 2024; Arsenyan & Mirowski), however in this study, Lil Miquela and Gecko scored lowest in uncanniness, as these influencers are more realistic, reality seems to be a key measure in perceiving these entities more positive. This might be caused by their represented qualities such as value creation, creativity, and exclusivity as these are likely to add to the attractiveness of endorsers (Oliveira and Chimenti, 2021), or these influencers might have been able to imitate the characteristics and behaviors associated with being human, so that it grabbed consumers attention (Xie-Carson, Benckendorff & Hughes, 2023).

The next hypothesis, H3b stated that there will be a negative correlation between perceived uncanniness and perceived attractiveness. The significant negative correlations found across the virtual influencers supported the hypothesis of an inverse relationship between perceived uncanniness and perceived attractiveness, meaning that consumers, who found the influencers attractive, did perceive it as less uncanny, this might be caused by the tendency, that the virtual nature of the digital avatars can be even accepted by consumers, as they are perceived as “authentically” fake (Arsenyan & Mirowska, 2021; Lou et al., 2023).

The next group of hypotheses aimed to gain a deeper understanding into consumers attitudes towards brands utilizing virtual influencers in their marketing activities.

The first hypothesis, H4a assumed that there will be a significant difference in the likeability of the endorsed brands. The results support the hypothesis, suggesting that consumer perceptions of likeability vary significantly across these four brands, indicating that GEICO was rated the most likeable and Toyota and Mercedes-Benz the least likeable on average. These findings further confirm that applying realistic virtual influencers potentially evokes more positive brand attitude than the application of unrealistic virtual influencers. Additionally, in the selected collaboration of Mercedes-Benz and Superplastic transgression, numerous violations of law were presented. Virtual influencer Janky accompanied with other characters, forcibly entered the Mercedes-Benz showroom, unlawfully appropriated a vehicle, drove exceeding the legally prescribed speed limit

and engaged in vandalism. The low score of likeability for Mercedes-Benz is in accordance with previous findings of Thomas & Fowler, stating that VIs engaging in transgression can result in brand degradation (Thomas & Fowler, 2021).

Hypothesis H4b, assumed that due to the novelty of these digital entities, consumers will associate innovativeness with all the endorsed brands. Findings indicated that all brands are generally perceived as more innovative than boring. Supporting previous studies stating that consumers find virtual influencers novelty and innovative, fascinating (Block and Lovegrove 2021; Franke, Groeppel-Klein, & Katrin) and working with virtual influencers can project a futuristic and trendy image on the endorsed brands, because of the novelty of this phenomenon (Moustakas et al. 2020; Robinson, 2020).

Finally, hypothesis H4c assumed that there will be a significant difference in the perceived wisdom of the endorsed brands. The statistical significance found in these results supports the hypothesis, indicating that there are indeed notable differences in perceived wisdom among the brands in question. This substantiates the premise that brand perception in terms of wisdom varies significantly from one brand to another within this sample. The means suggested that GEICO was perceived as the wisest among the brands, while Toyota and Mercedes-Benz were viewed as the least wise. These results also confirm that applying realistic virtual influencers potentially evokes more positive brand attitude than the application of unrealistic virtual influencers. Additionally, that engaging in transgression can result in brand degradation (Thomas & Fowler, 2021).

5. Study 2

5.1 Methodology

YouTube is the studies focal social media platform because it is one of the largest and most popular social media and online video sharing platforms. The site has over 2.5 billion monthly users, allegedly consuming over a billion hours of video content daily (Salem Press Encyclopedia, 2022). Additionally, YouTube became a prominent platform for brands to market their services and products (Tafesse, 2020). Since it is an interactive platform in nature, it fosters consumer

engagement and participation (Karaman, 2023), therefore analyzing the comments shared under the videos of the selected collaborations holds an immense potential to gain deeper understanding of consumer attitudes towards the virtual influencers and endorsed brands.

The videos were already identified in Study 1, therefore this study proceeded to extract comments shared under these videos. For this purpose, a publicly available comment scraper, Pavuk AI was utilized. In the aim of mitigating any potential bias arising from familiarity with the brand or the influencer, parasocial relationships, or a tendency to comment positively due to following the account, all comments were collected from both followers and non-followers.

Although, comments were written in multiple languages, non-English comments were excluded, since there exists a limitation of the analysis of non-English comments and since most of the engagement with the videos took place in English. Additionally, comments merely consisting of emojis were excluded. Emojis are typographic facial representations commonly employed in online communication (Cramer et al., 2016; Ferná'ndez-Gavilanes et al., 2018), however the anticipated message is not always clear and direct (Cramer et al., 2016; Tigwell and Flatla, 2016). Comments containing irrelevant or incoherent content were also excluded to maintain the integrity and relevance of the analyzed data set.

The controversy of usage of publicly available data was also considered (Moreno et al., 2013). The selected YouTube pages were owned by the endorsed brands; therefore, these accounts fall under the category of public figures, with publicly available online data. Furthermore, user data was used anonymously, and accounts connected to the comments cannot be used to identify individuals. To this end, the researcher is certain that these measures effectively eliminate any possible data protection concerns.

This extraction process resulted in a final sample of 242 comments.

5.2 Discussion

After the data collection and cleansing, the Opinion Mining technique was applied to determine the sentiments and attitudes of consumers expressed in these short form texts.

Comments were analyzed using axial-coding where similar concepts and codes were recorded into broader categorical themes (Charmaz, 2006). While the previously determined aspects were applied; perceived beauty, fascination, sympathy to determine attractiveness and perceived

scariness, evoked anxiety and shock to determine uncanniness, additional, formerly not included themes associated with virtual influencers, emerging from the comments were identified. Summary of the analysis can be seen in Figure 37.

Consumer Attitudes Towards VIs				
Sentiment Analysis	Main Aspect	Aspect	Common words used	Example (s)
Positive	Attractiveness	Beautiful	beautiful, cute, sexy	"HATSUNE MIKU SEXY!!!" "i love the way miku turns her head at the mirror... so cute" "This looks so cute"
		Fascinating	legendary, wonderful, amazing, iconic, wow	"Bye far the most iconic Mascot in any Insurance history" "Love the body language after "why's he working so hard?" Super acting"
		Sympathetic	touching, emotional, I love you, well done	"Finally an advert that shows both emotion and the car and isn't a bunch of rapid moving shots." "So realistic, shows what happens in normal life. Touches your emotions... the robot is wanting so bad to feel real, what humans feel. She wants to be more human."
Negative	Uncanniness	Scary	scary, UFOs, engrossed	"It's scary that nowadays we almost can't differentiate what's real to what's computer made. I didn't knew who Lil Miquela was so at the beginning when I saw her I thought she was a real person ... technology is advancing so much in both good and bad ways."
		Anxiety-enducing	stop, disturbing	"CONGRATS, but stop in distributing this advertisement please." "...hoping no one hacks profiles of them. ..."
Neutral		Shocking	-	"... I couldn't believe it, now i see it and im like, WTF now I'm like, yaaaay"
Consumer Attitudes Towards Endorsed Brands				
Sentiment Analysis	Main Aspect	Aspect	Common words used	Example (s)
Positive	Likeable		best, wow, cool, great, I love you, nice, beautiful, funny, fantastic	"bmw never goes wrong on marketing their products (love) them" "Wow this is why I love Mercedes Benz"
	Innovativ		creative, legendary, milestone, achievement	"A milestone in modern advertising. Kids will learn about this in school years from now. What an achievement. Going on a hunt to find out who made this ad." "Very creative, nice twist on the typical new car intro's" "This transcends advertising..."
	Wise		great idea, realistic, makes sense, genius	"Stay with CGI production only. Great idea." "... amazing collaboration" "The Geico Cinematic Unvierse gets bigger and bigger. And I like it." "More digital influencers less human issues,..."
Negative	Unlikeable		why, garbage, nonsense, cheap	"It's not too late to delete this garbage." "What the hell happened to Benz?" "All car manufacturers lost the plot first BMW now Mercedes we're we going with this ??"
	Boring		same idea	"OMG...Just show the car already!!!!!" "The same idea Magnum did a few months ago..."
	Foolish		bullshit, catastrophe, why, cringe	"No. Boycott anything that uses AI models!!!!" "Why is AI being used for this and with so many fake, AI comments?" "What does all this nonsense have to do with cars?"

Figure 37. Comment Analysis

Connected to the virtual influencer's attractiveness, a low number of commenters expressed their opinion concerning the perceived beauty of the presented virtual influencer. However, some consumers conveyed their positive impressions of the virtual influencer's appearance. Words, such as “beautiful”, “cute” and “sexy” were used to describe them, for example one user commented “HATSUNE MIKU SEXY!!!” under the video about the collaboration of Hatsune Miku and Toyota, supporting the findings of Kronemann et al., that anthropomorphism can positively influence consumer attitudes (Kronemann et al., 2022). Nevertheless, the GEICO Gecko also fostered positive comments, such as "This looks so cute".

On the other hand, some viewers gave voice to their negative impressions concerning the influencers look, such as “It's really hard not to notice that facial deepfake...” and “Mixed feelings about this. (...) that face... Seems very off or weird, idk somethings not right.”

Numerous users denoted fascination after being exposed to the video of the virtual influencer. Terms, such as “legendary”, “wonderful”, “amazing” and “iconic” frequently appeared in the analyzed data set. GEICO the Gecko was described as "Bye far the most iconic Mascot in any Insurance history" by one commenter, while the animation of Hatsune Miku was complimented by another "Love the body language (...) Super acting". Confirming the dissertation of Block and Lovegrove about the fascination virtual influencers can evoke in consumers (Block and Lovegrove, 2021, 271).

Some users showed sympathy towards the virtual influencers. After seeing the video, they used expressions such as “touching”, “emotional” and “I love you” to show the perceived agreeableness of the character. An example of these comments is the following; "So realistic, shows what happens in normal life. Touches your emotions... the robot is wanting so bad to feel real, what humans feel. She wants to be more human.", supporting the findings of Arsenyan & Mirowska and Lou et al., that the virtual nature of the digital avatars can be even accepted by consumers (Arsenyan & Mirowska, 2021; Lou et al., 2023).

Considering the uncanniness of the virtual entities, a low number of commenters evoked fear after exposed to the virtual influencer. However, some users used hyperbolic terms, such as “scary”, “UFOs”, “engrossed” indicating strong emotional responses. The following example excellently showcases the Uncanny Valley theory, suggesting the feeling of eeriness, as humanness is closely approached, however can't be fully reached as stated by Mori & Macdorman in 2017 (Mori & Macdorman, 2017); "It's scary that nowadays we almost can't differentiate what's real to what's computer made. I didn't knew who Lil Miquela was so at the beginning when I saw her I thought she was a real person ... technology is advancing so much in both good and bad ways."

Low amounts of consumers expressed triggered anxiety in the comments; an example of anxiety-induced attitude is the commenter “(...) hoping no one hacks profiles of them. (...)”, confirming the assertion of Thomaz et al. that awareness of privacy concerns related to the nature of the internet and AI will become more prevalent and must be addressed in companies marketing strategies (Thomaz et al., 2020). Also aligning with the personalization-privacy paradox and

privacy calculus theory, examined by Kronemann and colleagues in 2022, describing the process of consumers critically evaluating and trading off the added value and benefits of new technologies and the potential risks of their private information being exploited (Cloarec, 2020; Dinev and Hart, 2006; Wang et al., 2016).

Additionally, according to the results of this analysis, there were only a few comments expressing shock caused by the virtual influencer, such as "(...) I couldn't believe it, now i see it and im like, WTF now I'm like, yaaay". The diverse emotional trajectory described by the user is also in accordance with the mixed “fear and fascination” experience illustrated by Block and Lovegrove in 2021 (Block and Lovegrove, 2021, 271).

In the second half of the analysis, the denoted brand attitudes expressed in the form of comments by consumers were analyzed using axial-coding, following the previously determined positive and negative aspects, namely likeability, perceived innovativeness and rationality of apply VIs in advertisements.

Most of the users commenting under the showcased videos indicated positive attitude towards the brands collaborating with virtual influencers. Terms, such as “best”, “wow”, “cool”, “great”, “I love you”, “nice”, “beautiful”, “funny”, “fantastic” were regularly found in the analyzed dataset, indicating likeability of the endorsed brand. BMW and Mercedes were often praised for the advertisements, for example in comments like “bmw never goes wrong on marketing their products (-love-) them” and “Wow this is why I love Mercedes Benz”.

On the other hand, a group of users communicated dissatisfaction, indicating the unlikelihood of the selected brands. The words, “why”, “garbage”, “nonsense” and “cheap” were used to describe their impressions. Some users questioned the brands marketing strategies, such as the commenter writing “What the hell happened to Benz?” or “All car manufacturers lost the plot first BMW now Mercedes we’re we going with this ??”. Additionally, some users even described the advertisement as garbage, suggesting the removal of the advertisement “It's not too late to delete this garbage.”.

The perceived innovativeness of the brands also appeared in the examined comments. Terms, like “creative”, “legendary”, “milestone” and “achievement” were commonly appearing in the texts. Looking at exact examples, the following comments indicate high levels of perceived innovativeness; “A milestone in modern advertising. Kids will learn about this in school years

from now. What an achievement. Going on a hunt to find out who made this ad.”, “Very creative, nice twist on the typical new car intro's”, “This transcends advertising (...)”. This underpins the findings of numerous previous studies, suggesting that perceived novelty is a key success driver in enhancing brand attractiveness, value and perception of brand innovativeness (Tayenaka, 2020; Moustakas et al., 2020; Yap, 2018; Aaker 1990; Gupta et al. 2020; Franke, Groeppel-Klein, & Katrin, 2023).

Meanwhile, minority of consumers expressed their boredom in the comment section, for example; “OMG...Just show the car already!!!!” and “The same idea Magnum did a few months ago....”.

Evaluating the rationality of brands teaming up with virtual influencers to endorse their products, commenters also denoted different attitudes. Finding the marketing strategy of collaborating with virtual influencers wise, the following terms were used; “great idea”, “realistic”, “makes sense”, “genius”. Some users suggested that utilizing technology is beneficial and reasonable in the brands advertisements; “Stay with CGI production only. Great idea.”, “More digital influencers less human issues, (...)”. While other users found the advertisement to be an “(...) amazing collaboration” or praised the company for their activities including virtual characters “The Geico Cinematic Universe gets bigger and bigger. And I like it.”. Importance of brand and endorser fit explained by Liu & Lee in 2024 amongst other researchers (Liu & Lee, 2024), also appeared in the comments. One user found that since the origin country of the brand and the virtual influencer is the same country, the collaboration is fitting; “well mikus japanese AND toyota isfrom japan MAKE SENCE?”.

Conversely, a small group of commenters communicated that they find the collaboration with virtual influencers irrational and inappropriate for product endorsement, using extreme epithets, like “bullshit”, “catastrophe”, “cringe” to outline their opinion. Such comments include the following ones; “No. Boycott anything that uses AI models!!!!”, “Why is AI being used for this and with so many fake, AI comments?”, “What does all this nonsense have to do with cars?”, “Professional execution. But... what is the target audience here? Are they trying to sell a car to AI generated characters? Maybe making sure they are on the right side for when the machines take over?! Let's cram AI generated images into everything because we can and it is so "innovative"...”. Additionally, in accordance with the findings of Franke, Groeppel-Klein, & Katrin and Böhndel & Rudeloff, some commenters declared that they’d still find traditional human endorsers more

appealing in marketing activities (Franke, Groeppel-Klein, & Katrin, 2023; Böhndel & Rudeloff, 2023); “How I miss the time when Clive Owen drifted Madonna to her gut with the ultimate driving machine M5. That was a commercial for a brand with generic character.”.

Some more neutral, but still interpreted as ironic and critical commenters, wrote the following, “imagine using AI for your commercial”, “does it come with an AI generated driver?”. Further indicating a rather negative attitude of consumers evoked by brands collaborating with virtual influencers.

Beyond the previously examined aspects, some more significant themes and concepts were identified in the dataset.

Many users expressed their entertainment after watching the advertisement starring a virtual influencer, which was one of the identified motivations to consume virtual influencers content by Lou et al. (Lou et al., 2023). Although, some of the commenters only expressed their amusement with short terms, such as “LOL” and “haha”, others described their joy in longer texts, for example “I nearly fell out of my chair the first time I saw this.” and “I don't know what any of this was but I enjoyed it”.

Additionally, some individuals showed high engagement with the VI or the advertisement, for example more user asked, “But what happened to Geico gecko?!”, one showed high enthusiasm to find the advertisement “I SCoured the Internet for this commercial after I heard it just now” and people encouraged GEICO to create a ranking of their best advertisements “You guys should also upload a top 10 commercial countdown.”.

The advertisements presenting virtual influencers also facilitated discussions about virtual influencers in general, and about other prominent VIs, underpinning the findings of Sands et al. that the uniqueness of the digital characters positively effects consumers' willingness to engage with the contents showcasing virtual influencers (Sands et al., 2022). Commenters were discussing the virtual nature of the characters “you realize an AI created this advert and she has a whole social media even”. This suggests similar challenges to identify hyper-realistic human influencers as found by Franke, Groeppel-Klein, & Katrin in 2023 (Franke, Groeppel-Klein, & Katrin, 2023). Furthermore, since the selected virtual influencers were appearing in the physical world, it might have made the identification even more challenging as proposed by Mouritzen, Penttinen &

Pedersen in 2024 (Mouritzen, Penttinen & Pedersen, 2024). Others evaluated the potential success of these entities “I read somewhere that the Kagmines are as popular as miku is in the US (...). So if Miku does good in the US, the kagamines have a really really good chance of going on.”. Meanwhile, some commenters expressed their demand for including other VIs into advertisements “I wish they added the Kagamines”.

In of the selected collaborations of Mercedes-Benz and Superplastic transgression, numerous violations of law were presented. Virtual influencer Janky accompanied with other characters, forcibly entered the Mercedes-Benz showroom, unlawfully appropriated a vehicle, drove exceeding the legally prescribed speed limit and engaged in vandalism. Several consumers expressed negative attitudes towards the brand after being exposed to the transgression of the characters; “(...) Steal cars, drive really fast within city, take photos with stolen car. Who or what is this ad for? Is that what a Mercedes customer is?”, “Wow Mercedes colabs with a video that kicks off by stealing a Mercedes and then busting shop windows. Way to go Mercedes, you are a model to us all”, “(...) In my opinion, it neither fits the target group, nor does this “badass” behavior have any role model function or anything similar. (...)”. These effects of the advertisement substantiate the previous findings of Thomas & Fowler, stating that VIs engaging in transgression can result in brand degradation (Thomas & Fowler, 2021).

Other associations showing the confusion of consumers after being exposed to virtual influencers content were suggesting that the creative team or the leadership approving the advertisements were under the influence of illegal substances “Must be the opiates”, “Too much drugs in management” or might be interested in a subculture of anthropomorphic animals' enthusiasts “Mercedes Benz was a furry ?? Cool!!”, “Furries are now invading the car industries”. These uncommon associations might indicate that consumers find the application of virtual influencers unconventional, however did not seem to find it irrational or disturbing, rather entertaining and unique.

Large number of commenters showed interest in other aspects of the advertisements, such as the soundtrack of the video or further information about the endorsed products, however, since these themes are not in the focus of this study, those will be not analyzed in detail in this section.

6. Conclusion

The findings of this study offer valuable insights into consumer attitudes towards virtual influencers and the brands they endorse. By addressing the gaps identified in previous research, this study contributes to a deeper understanding of this emerging phenomenon. The correlations between different demographic groups and attitudes towards virtual influencers highlight gender differences in perception, with females generally rating virtual influencers as more attractive but also finding them uncannier. Furthermore, the examination of different influencer types reveals that hyper-realistic appearances, exemplified by influencers like Lil Miquela and Gecko, tend to evoke more positive responses from consumers compared to unrealistic counterparts. Interestingly, the inverse relationship between perceived uncanniness and attractiveness suggests that consumers find virtual influencers more appealing when they exhibit a degree of authenticity, even within their digital nature.

Moving beyond individual influencers, the study delves into consumer attitudes towards brands utilizing virtual influencers in their marketing strategies. The variations in likeability, innovativeness, and perceived wisdom among the endorsed brands underscore the nuanced relationship between virtual influencers and brand perception. For instance, while GEICO is perceived as the most likeable and wisest brand, Mercedes-Benz receives lower ratings, potentially due to negative associations stemming from transgressive behavior depicted in collaborations with virtual influencers. These findings align with previous research indicating that consumer perceptions of brands can be influenced by the behaviors and characteristics of virtual influencers (Thomas & Fowler, 2021).

In conclusion, this study sheds light on the multifaceted dynamics of virtual influencer marketing, offering valuable implications for brands seeking to leverage this innovative approach. By understanding consumer attitudes towards virtual influencers and the brands they represent, marketers can better tailor their strategies to engage and resonate with their target audience in an evolving digital landscape.

7. References

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Executive Summary

This study aims to gain deeper understanding of consumer perceptions of virtual influencers and the brands they endorse, offering valuable insights into this growing trend. It highlights gender differences in how virtual influencers are perceived, with females finding them more attractive yet also more uncanny. Additionally, I found that hyper-realistic virtual influencers, such as Lil Miquela and Gecko, evoke more positive responses from consumers.

Examining brands utilizing virtual influencers, I uncover variations in consumer attitudes towards likeability, innovativeness, and perceived wisdom. GEICO emerges as the most likeable and wisest brand, while Mercedes-Benz receives lower ratings, potentially due to negative associations with transgressive behaviors depicted in collaborations with virtual influencers.

Overall, our study sheds light on the complex dynamics of virtual influencer marketing, providing actionable insights for brands aiming to leverage this innovative approach to engage with their target audience in the digital landscape.