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Review

Navigating the age of AI influence: A systematic literature review of trust, engagement, efficacy and ethical concerns of virtual influencers in social media

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Abstract: This systematic literature review (SLR) delves into the realm of Artificial Intelligence (AI)-powered virtual influencers (VIs) in social media, examining trust factors, engagement strategies, VI efficacy compared to human influencers, ethical considerations, and future trends. Analyzing 60 academic articles from 2012 to 2024, drawn from reputable databases, the study applies specific inclusion and exclusion criteria. Both automated and manual searches ensure a comprehensive review. Findings reveal a surge in VI research post-2012, primarily in journals, with quantitative methods prevailing. Geographically, research focuses on Europe, Asia Pacific, and North America, indicating gaps in representation from other regions. Key themes highlight trust and engagement's critical role in VI marketing, navigating the balance between consistency and authenticity. Challenges persist regarding artificiality and accountability, managed through brand alignment and transparent communication. VIs offers advantages, including control and cost efficiencies, yet grapple with authenticity issues, addressed through human-like features. Ethically, VI emergence demands stringent guidelines and industry cooperation to safeguard consumer well-being. Looking ahead, VIs promises transformative storytelling, necessitating vigilance in ethical considerations. This study advocates for continued scholarly inquiry and industry reflection to navigate VI marketing evolution responsibly, shaping the future influencer marketing landscape.

Keywords: AI-powered virtual influencers; social media; trust; engagement; efficacy; ethical concerns; systematic literature review

1. Introduction

Social media is a vital part of modern life, impacting psychology, business profits, and community health. While it serves various purposes, it is more than just a communication tool. Social media encompasses various platforms and technologies that facilitate online interactions (Charlesworth, 2014). It has revolutionized marketing, connecting consumers and marketers in innovative ways (Khan, 2017). Social media includes social networking, consumer reviews, real-time marketing, blogging, viral marketing, and advertising (Barrios-O'Neill, 2015). The history of social media platforms highlights the evolution of technology, enabling new forms of connection and interaction.

Social media has revolutionized communication, with social media influencers playing a significant role (Kiatkawsin and Lee, 2022; Riedl et al., 2023). These influencers, initially ordinary consumers, have gained fame and influence by sharing experiences and recommendations, monetizing their recognizability (Goanta and

Ranchordás, 2020). They impact a broad audience by promoting products, services, and political opinions, blurring the lines between genuine and sponsored content (Niininen, 2022).Social media's influence extends to young people, affecting behaviors, development, and health. The symbiotic relationship between social media and public relations is evident, challenging traditional PR practices.

In social media marketing both Human Influencers (HIs) and Virtual Influencers (VIs) play significant roles (Kiatkawsin and Lee, 2022). Virtual influencers are computer-generated characters that resemble humans and engage with social media users, gaining popularity across various domains like fashion, music, and mental health (Bradley et al., 2023; Conti et al., 2022). These influencers are distinguished by their ability to attract attention and influence users, with human-like virtual influencers (HVIs) perceived as more credible and impactful compared to anime-like virtual influencers (AVIs) (Kim et al., 2023). The interaction between social media users and virtual influencers is driven by parasocial interaction (PSI) and source credibility, leading to user acceptance and brand promotion opportunities (Jhawar et al., 2023). Followers are drawn to virtual influencers due to their visual appeal, creative storytelling, and unique content that transcends physical limitations, making them appealing for diverse industries and non-commercial causes (Choudhry et al., 2022). The emergence of AI powered VIs has sparked interest and raised ethical questions, with society holding varied opinions on this evolving phenomenon. So that understanding the dynamics is crucial for marketers and researchers in navigating the ever-changing landscape of AI powered virtual influencers in social media.

To achieve these objectives, the following research questions (RQs) have been put forward:

RQ1: How do virtual influencers build trust and engagement with audiences?

RQ2: How effective are virtual influencers compared to human influencers?

RQ3: What are the ethical considerations and future advancements of virtual influencers?

The exploration of the questions posed in this study aims to provide insights into the trust-building and engagement strategies employed by AI powered virtual influencers with their audiences. Additionally, it seeks to evaluate the effectiveness of virtual influencers compared to their human counterparts and to identify the ethical considerations and potential future advancements within this domain. Through a systematic literature review of relevant scholarly papers, this study endeavors to offer a comprehensive understanding of these key aspects, thereby informing both researchers and practitioners in the field of virtual influencer communication.

2. Background

2.1. Social media definitions

Social media encompasses various online platforms facilitating user-generated content and community interaction (Golloso et al., 2022; Moore and Barnett, 2022). It has evolved into a crucial part of modern life, impacting psychology, business, and community well-being (Ajijola, 2023). Social media's role extends beyond mere connection and entertainment, with over a quarter of the global population engaging

in platforms like Facebook, Twitter, YouTube, and Pinterest (Şanal et al., 2022). While it offers benefits like enhanced learning, communication, and health information access, it also poses risks such as terrorism, criminal activities, depression, and anxiety. The phenomenon of social media institutionalization among the youth underscores its multifunctional tools for communication, content replication, and image building. **Table 1** provides an overview of various views and definitions of social media presented by scholars in the existing literature.

Table 1. Some social media definitions from previous studies.

N	Definitions	References
1	Social media refers to internet platforms enabling content creation and user interaction. It impacts students positively through information sharing but negatively by fostering judgmental behavior and conflicts.	(Golloso et al., 2022)
2	Social media refers to platforms like Facebook and Twitter, used by a quarter of the global population, with research linking it to mental illnesses like affective disorders, self-harm, addiction, and ADHD.	(Moore and Barnett, 2022)
3	Social media refers to online platforms for user-generated content and community engagement. It impacts society positively through learning, socialization, and health information, but also negatively with issues like terrorism and depression.	(Ajijola, 2023)
4	Social media is a vital part of modern life, impacting psychology, business profits, and community health. While it serves various purposes, it is more than just a communication tool.	(Şanal et al., 2022)
5	Social media is an online platform enabling virtual interactions through feedback, comments, and information sharing, influencing social behavior. It can lead to addiction and negative social impacts, especially among teenagers.	(Aulia et al., 2022)
6	Social media refers to technological platforms facilitating global communication and socialization, aiming to connect individuals for various purposes like friendship, relationships, business, and politics, as outlined in the paper.	(Lisdayanti et al., 2022)
7	Social media is a platform for online social interaction, driven by advancements in technology and offering benefits like easy outreach, but also associated with negative health and social outcomes.	(Lakhan et al., 2023)

2.2. Social media influencer definitions

Social media influencers are individuals who amass a following on digital platforms, leveraging their perceived trustworthiness and expertise to influence their audience's decisions (Haase and Worthington, 2023; Zhang and Mac, 2023). They often start as regular users sharing experiences and recommendations, gradually gaining recognizability and the power to impact their followers' choices (Peter and Muth, 2023). Influencers play a significant role in various spheres, from guiding consumer purchases to shaping attitudes towards social issues like coercive control and intimate partner violence (Kiatkawsin and Lee, 2022). Additionally, influencers are increasingly delving into political topics, impacting young audiences' opinions and even influencing voting intentions (Droz-dit-Busset, 2022). News media representations of influencers vary, with some celebrating them as entrepreneurial successes while others criticize them for lacking work ethic and encroaching on traditional industries. **Table 2** provides an overview of various views and definitions of social media influencer, presented by scholars in the existing literature.

Table 2. Some social media influencer definitions from previous studies.

N	Definitions	References
1	Social media influencers are individuals who impact consumer decisions through self-generated content and online interactions, focusing on affective factors like familiarity and intimacy for marketing effectiveness.	(Zhang and Mac, 2023)
2	"Influencers" on social media regarding coercive control include the Educator, Gaslighter, and the Comedian, influencing attitudes and behaviors towards coercive controlling behavior among young people.	(Haase and Worthington, 2023)
3	Influencers are individuals who sway others' opinions through their views and advice, impacting purchasing decisions. They predominantly use platforms like Instagram, TikTok, Facebook, Twitter, and Pinterest for promotions.	(Yuliati et al., 2022)
4	Social media influencers are individuals with expertise and a large following who impact others through posts. They are crucial for brand promotion and business enhancement on platforms like Instagram and YouTube.	(Fernandes et al., 2022)
5	Social media influencers are key in organizations' marketing. They collaborate in content production, decoding and transmitting commercial messages to their followers, shaping social reality in the digital landscape.	(Vanninen et al., 2023)
6	Social Media Influencers (SMIs) are portrayed in news media with contradictory stances of celebration and derision, legitimizing them as entrepreneurial successes or criticizing their lack of work ethic and industry intrusion.	(Droz-dit-Busset, 2022)
7	A Social Media Influencer (SMI) is a person or entity that influences a specific audience through online platforms to endorse products or services, aiming to boost engagement and brand awareness.	(Yusra et al., 2023)
9	A social media influencer is defined as someone who leverages their digital presence to promote political causes and social issues, distinct from traditional opinion leaders.	(Riedl et al., 2023b)
10	Social media influencers are individuals who influence consumers' perceptions of brands online. They play a crucial role in shaping purchase intentions through credibility and brand promotion.	(Saima and Khan, 2020)
11	Social Media Influencers (SMIs) are opinion leaders who drive brand awareness and consumer behavior. They can be traditional celebrities or 'instafamous' individuals, impacting brand image through social media.	(Piehler et al., 2022)
12	Social media influencers are online celebrities who create content on platforms like Instagram, YouTube, or TikTok, shaping opinions through relatability and engaging with audiences, driven by social exchange theory.	(Giardino, 2021)
13	In Social Media Marketing, Influencers are individuals who promote products/servicesthrough social media, leveraging their following and engagement to reach target audiences effectively.	(Oliveira et al., 2020)
14	Social media influencers are individuals with a large following on platforms like Instagram, used by organizations for marketing. They employ strategies like affiliate marketing and giveaways to promote products.	(Dajah, 2020)
15	Social media influencers (SMIs) are individuals who impact consumer behavior by endorsing brands. Their credibility, including trustworthiness, attractiveness, and expertise, influences followers' purchase intentions, moderated by materialism.	(Koay et al., 2022)

2.3. Social media virtual influencer definitions

Social media virtual influencers are computer-generated avatars or CGI characters that resemble humans and engage with users on social media platforms. These influencers have gained popularity recently, sparking interest and raising questions about their evolution, ethics, and marketing purposes (Jhawar et al., 2023; Laszkiewicz and Kalinska-Kula, 2023). Research suggests that virtual influencers can enhance brand awareness and target young consumers effectively, especially millennials and Gen Z (Conti et al., 2022). A study comparing human-like virtual influencers (HVIs) and anime-like virtual influencers (AVIs) found that HVIs are perceived as more credible and generate better message attitudes, particularly when sponsorship disclosure is absent (Kim et al., 2023). Social media influencers, including virtual ones, leverage their recognizability and influence to shape consumer decisions and monetize their fame through various revenue streams (Kiatkawsin and Lee, 2022). **Table 3** provides an overview of various views and definitions of social media virtual influencer presented by scholars in the existing literature.

Table 3. Some social media virtual influencer definitions from previous studies.

N	Definitions	References
1	Virtual influencers are computer-generated avatars gaining popularity in social media marketing. This paper reviews their emergence, impact on consumer behavior, and research gaps in the field.	(Laszkiewicz and Kalinska-Kula, 2023)
2	Virtual influencers are digital personas on social media platforms. This study explores their rise, interaction with followers, and acceptance theories, highlighting their potential in marketing luxury products to young consumers.	(Jhawar et al., 2023)
3	Virtual influencers on social media are CGI characters resembling humans, gaining popularity for their ability to influence users despite not existing physically, as discussed in the paper.	(Conti et al., 2022)
4	Virtual influencers are computer-generated characters on social media. This study compares human-like and anime-like virtual influencers' effectiveness in brand endorsements, highlighting credibility and message attitudes.	(Kim et al., 2023)
5	Social media influencers are real individuals who gain followers online. Virtual influencers, however, are computer-generated personas designed to engage audiences on social media platforms.	(Kiatkawsin and Lee, 2022)
6	Virtual influencers are computer-generated virtual humans on social media with millions of followers. They engage with consumers online, impacting attitudes and brand attachment, as explored in the research.	(Ham et al., 2023)
7	Virtual influencers are artificially created characters on social media with millions of followers. They are perceived as authentically fake, engaging followers for novelty, information, entertainment, and brand awareness.	(Lou et al., 2023)
8	Virtual Influencers (VIs) are computer-generated characters that resemble humans, engaging as social media influencers in various fields, attracting followers with visual appeal, mystery, and creative storytelling.	(Choudhry et al., 2022)

3. The review methodology

This study is a Systematic Literature Review (SLR)—a repeatable process combining all existing research literature related to a specific topic or particular research question (Kitchenham, 2007). The primary objective of conducting this review is to systematically gather, summarize, and assess evidence about a specific area. This is undertaken to discover any research gaps within existing studies, thereby allowing for the recommendation of further research, and allowing for greater insight and deeper understanding of the phenomenon being addressed (Unterkalmsteiner, 2012). For this review, the authors have broadly adhered to the guidelines set forth by Kitchenham and Charters (Kitchenham, 2007). These guidelines advocate a three-phase structure, encompassing planning, conducting, and reporting. Each phase comprises specific sub-elements, including (1) formulating review questions; (2) developing a review protocol; (3) defining inclusion and exclusion criteria; (4) scrutinizing selection procedures and strategy; (5) conducting quality assessments; and (6) performing data extraction and synthesizing evidence to address research questions RQ1 to RQ3. Each of these steps is systematically elucidated in the subsequent sections.

3.1. Review protocol

To undertake this systematic literature review, a comprehensive review protocol was defined that would guide the study and provide a clear path for its progress (Kitchenham, 2007). The review protocol is an important step in performing SLR, specifying the approach that will be used to undertake the completion of the review's objectives, by minimizing the likelihood of researcher bias (Kitchenham, 2004). The review protocol process consists of several stages, including the research setting, the search strategy, the review questions, the criteria for the review selection process, the elements of quality assessment, the data extraction method, and the synthesis of the

extracted data (Kitchenham, 2007). The review questions and research settings have been outlined in the preceding sections of this paper, and the subsequent sub-section provides additional details concerning the remaining listed elements.

3.2. Inclusion and exclusion criteria

The application of inclusion and exclusion criteria serves the purpose of ensuring that all chosen primary studies in the Systematic Literature Review (SLR) are relevant and directly related to the study's objectives. The primary goal of this systematic review is to comprehend the trust factors, engagement strategies, comparative effectiveness against human influencers (HIs), ethical considerations, and future trends surrounding social media virtual influencers. The review encompasses the collection of pertinent data from various sources, including journal articles, conference papers and book chapters, all composed in English and published in digital databases between 2012 and 2024. Employing a peer-review process, the authors of this paper excluded research articles that did not align with the focus on the trust factors, engagement strategies, comparative effectiveness against human influencers (HIs), ethical considerations, and future trends of virtual influencers within the context of social media. The criteria for this review are detailed in **Table 4**.

Table 4. Inclusion and exclusion criteria.

Included articles were:	• Available as full-text • Published in the period between 2012 and 2024 • Were written in English • Related to the research questions • In the domain of AI-powered VIs in SM • Published in selected digital databases
Excluded articles were:	• Had full text not available • Outside the search timeframe • Had a non-English manuscript • Was not related to the research questions

3.3. Search strategy

As depicted in **Figure 1**, the search strategy for the review encompassed both automatic and manual approaches. Employing both methods allowed for a comprehensive exploration of content, thereby incorporating additional studies that could contribute to a more extensive perspective. According to Kitchenham (2007), after an automated search, a manual search was conducted for primary study references. The automated search centered around research keywords, was executed as an electronic search utilizing online scientific databases to address the research questions of this review. This step marked the initial phase of the research process. Subsequently, eight prominent online databases—ScienceDirect, IEEE Explore, ACM Digital Library, Scopus, Springer, Taylor and Francis, JSTOR, and Wiley Online Library—were chosen as the primary sources for the investigation. These databases were selected based on their perceived relevance, offering comprehensive information within the realm of AI-powered virtual influencers in social media.

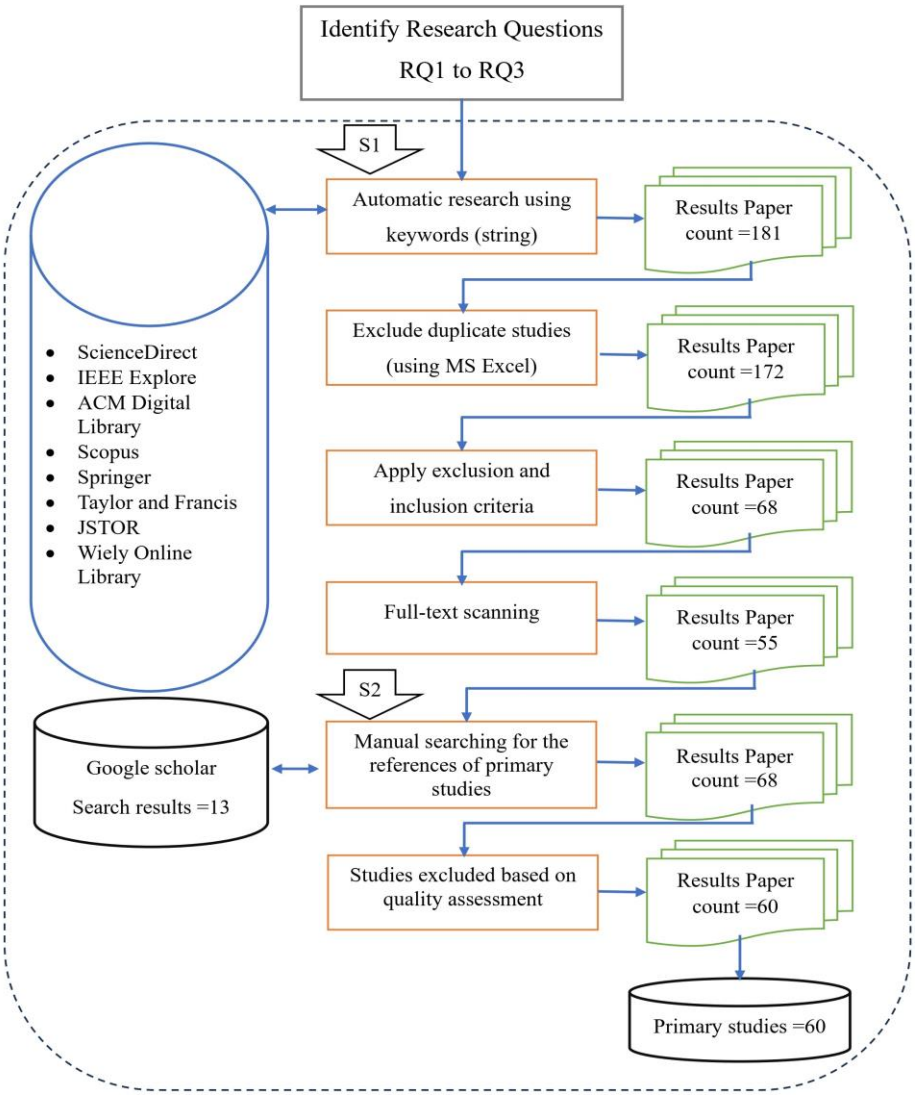

Figure 1. Study selection process.

In this study, to establish clear boundaries for inclusion, the keywords of interest were explored in both research titles and research questions. A combination of artificial intelligence, virtual influencers, social media, trust factors, engagement strategies, comparative effectiveness against human influencers (HIs), ethical considerations, and future trends keywords was employed to search selected databases, aligning identified keywords with published research and relevant literature. Appendix A contains the list of keywords used for the research. The goal was to identify as many pertinent articles as possible within the domain. Following the initial search stage, a second round employed a manual search method. This involved a forward and backward search approach, as outlined by Webster and Watson (2002), to trace collected references for primary studies, ensuring the review met its objectives and addressed the proposed research questions. This manual search also ensured the systematic search was comprehensive and identified any potential oversights (Webster and Watson, 2002; Zhang and Babar, 2011). The MS Excel application played a pivotal role in organizing, sorting, and managing all primary studies from both stages, streamlining the process of removing duplicate studies.

3.4. Study selection process

After accomplishing the first and second round search processes using the defined keywords, this study returned 181 papers. Out of this total, 9 papers were duplicates and were accordingly removed through the use of the MS Excel application. After the duplicated papers were removed, the inclusion/exclusion criteria were applied to the remaining 172 papers, focusing on each paper's title and abstract. This step aimed to eliminate results that were of no use, including results that were not obtained from sources including journals, conference papers, or workshops. 105 studies were excluded through this step, based on their research titles, abstracts and keywords. This left a total of 68 studies. As recommended by Kitchenham (2007), all papers that did not cover issues included in this review were excluded. To determine whether there were unclear or irrelevant studies, the next step involved the full-text scanning of the remaining studies. After reading their full text, 13 studies were excluded, leaving results from 55 studies. In this selection review process's final stage, the 'snowballing' approach (Budgen et al., 2008) was followed as a means of scanning the references of primary studies. In this step, to ensure the review process's accuracy, the authors applied a manual search method that utilized the references of each horizontal and vertical search, using Google Scholar as a means of obtaining more reliable primary studies. Therefore, each of the 55 reference lists of primary studies was screened, and 13 other studies were found. With that, the final result of the systematic review included 68 primary studies. Lastly, this total number of primary studies identified in both automatic and manual searches were subjected to quality assessment criteria, because of which 8 were removed. Accordingly, this paper's authors selected 60 primary studies for the review, which shaped future steps in this SLR stage as tabulated in Appendix B.

Table 5. Study selection process results.

Online database used in SLR	Initial result	Relevant studies
ScienceDirect	43	24
IEEE Explore	01	01
ACM Digital Library	07	01
Scopus	13	06
Springer	93	08
Taylor and Francis	19	14
JSTOR	01	00
Wiley Online Library	04	03
Google Scholar	-	03
Summary	181	60

The circulation of the number of primary studies in this review, as retrieved from different online databases during the systematic searching process, is shown in **Table 5**. The study pointed out that most studies gathered before the selection process was found in Springer (93), followed by ScienceDirect (43), Taylor and Francis (19), Scopus (13), ACM Digital Library (7), Wiley Online Library (4), IEEE Explore (1)

and the JSTOR (1). Google Scholar was not utilized within the first stage of the review process. During the second selection process, the majority of primary studies were found in ScienceDirect (24), followed by Taylor & Francis (14), Springer (8), Scopus (6), Wiley Online Library (3), Google scholar (3) and finally, one each from IEEE Xplore and ACM Digital Library.

3.5. Quality assessment (QA)

The assess the quality of each selected review paper, using a set of criteria, while providing a decision regarding the interpretation and findings of the primary studies (Kitchenham, 2007). Therefore, the authors conducted a quality assessment of this review, as a means of evaluating the quality and accuracy of the selected primary studies. Five QA criteria were developed for this review, as detailed below:

QA1. Does the study focus on AI-powered virtual influencers (VIs) in social media (SM) platforms?

QA2. Does the study directly address the impact of virtual influencers on trust, engagement, efficacy, ethical concerns, or future trends in social media?

QA3. Is the research methodology adequately described?

QA4. Is the process of the data collection methodology clearly explained in the paper?

QA5. Is the data analysis approach accurately evaluated in the paper?

The five quality assessment questions listed above were employed to evaluate the 68 selected research papers, to strengthen the researchers' confidence in the credibility of their findings. To grade quality levels through this criteria, three quality rankings were utilized including 'high', 'medium', and 'low' (Nidhra et al., 2013). Therefore, the quality of each study could be considered through the resulting load score. Based on the quality level criteria, the results were divided into three ratings. Firstly, if a study completely fulfilled quality criteria, it was assigned a rating of 2 that criterion. Secondly, if a study partially fulfilled quality criteria, it was assigned a rating of 1 for that criterion. Lastly, if a study did not meet a quality criterion, it was assigned a rating of 0 for that criterion. Consequently, with regard to the five quality criteria, a study's highest possible score is 10 (or 5 × 2), while its lowest possible score is 0 (or 5 × 0). In this review, the quality of each paper was considered to be high if it scored greater than or equal to 6. A paper which scored 5 was considered to be of medium quality, and a paper that scored less than 5 was considered to be low quality. Through the quality assessment process, it was determined that 08 studies did not fulfil the criteria. These were accordingly excluded from the outcome of the quality assessment. Hence, based on the quality assessment criteria of Nidhra et al. (2013), in terms of QA most articles achieved a relatively high score as indicated in **Figure 2**. The list of QA ratings of each of this review's 60 primary studies, can be found in Appendix C.

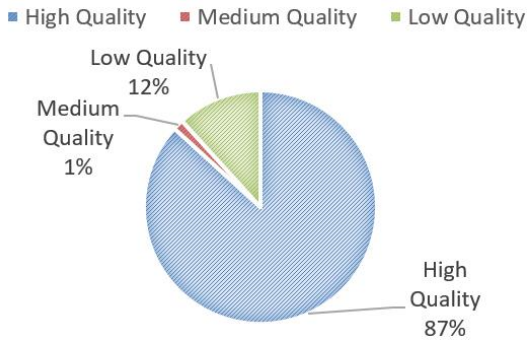

Figure 2. Distribution of research studies.

4. Data extraction and synthesis for SLR

Data extraction is one of the most important activities within the systematic review process. Therefore, in this step, this paper's researchers developed a data extraction form, and with it, they accurately recorded all information from 60 studies. The main objective of this section was to use data extraction forms as a means of accurately recording the information gathered through the review (Kitchenham, 2007). This process was conducted by scanning each study and extracting related information using Microsoft Excel spreadsheets. Essentially, a form shown in **Table 6** drove data extraction for the 60 studies.

Table 6. Data extraction for each study.

Extracted data	Description
SID:	A unique identity for each paper
Authors:	Names of all the authors
Publication date:	The year the paper was published (2012–2024)
Study title:	The name of the paper, appearing in the search stage
Type of paper:	Book chapter, journal, or conference
National/regional:	The countries covered by the primary studies.
Methodology:	The use of quantitative, qualitative, or mixed methodologies
Key findings:	Key Findings of the paper related to the research questions
Data provider:	Source of the paper such as ScienceDirect, IEEE Xplore etc.

4.1. Publication sources overview

Following the systematic review, a total of 60 papers were finally selected as primary studies, published within the field of research regarding AI-powered virtual influencers on social media. These 60 studies were selected after inclusion and exclusion criteria were applied, following a quality assessment. As shown in **Figure 3**, the results were comprised of 57 journal articles, 02 conference papers and 01 book chapters. This study revealed that journal articles were the most popular publication type.

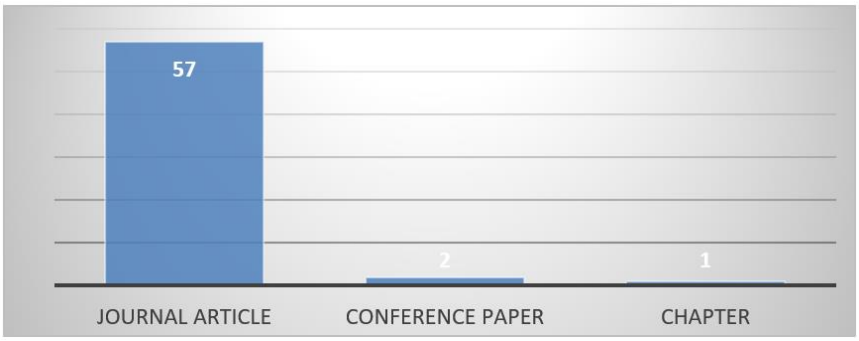

Figure 3. Distribution of research, based on publication source.

Here are the top 03 journals with the highest number of related literatures:

- Journal of Retailing and Consumer Services (11 Journal Papers)
- Journal of Business Research (6 Journal Papers)
- Journal of Interactive Advertising (5 Journal Papers)

A detailed breakdown of the included publication sources by publication type is provided in Appendix D.

4.2. Chronological view

The review of the literature on AI-powered virtual influencers in social media publications, as illustrated in **Figure 4**, reveals a relatively new field of research. While a single relevant study from 2012 might meet the established quality criteria, there's a clear gap in publications between 2013 and 2018. The first two studies meeting these criteria emerged in 2019. Publication activity remained low in 2020, with no studies matching the criteria. However, a significant increase began in 2021, with five qualifying publications. This growth continued in 2022 with seven publications. The most dramatic rise occurred in 2023, with a substantial number (35) of publications meeting the quality criteria. This trend suggests continued growth, with 10 qualifying studies identified in the first quarter of 2024 alone. Projecting cautiously based on this data, we can expect at least 40 publications for the entire year, assuming a similar publication rate. This data clearly demonstrates the rapidly growing interest in researching AI-powered virtual influencers within the social media landscape.

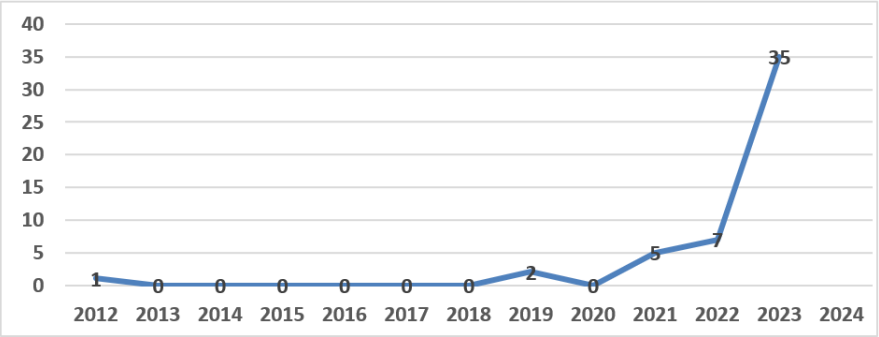

Figure 4. Publication numbers by year (2012–2024).

4.3. Research methodologies

Multiple methodologies have been utilized in research covering AI-powered

virtual influencers on social media, including qualitative and quantitative methods (Zeng and Gerritsen, 2014). The distribution of included studies, concerning research methodologies, is shown in **Figure 5**. The majority AI-powered virtual influencers on social media studies have used quantitative methodology. In a few studies, both qualitative and quantitative methodologies have been used together as a means of complementing each other, as shown in **Figure 5**. Out of a total of 60 studies, 24 used quantitative methodology, and 12 used qualitative methodology. Additionally,14 used mixed methodologies, 05 were conceptual and 04 were reviews. The remaining study was unclear in terms of their nature. These divisions have been presented in the following figure.

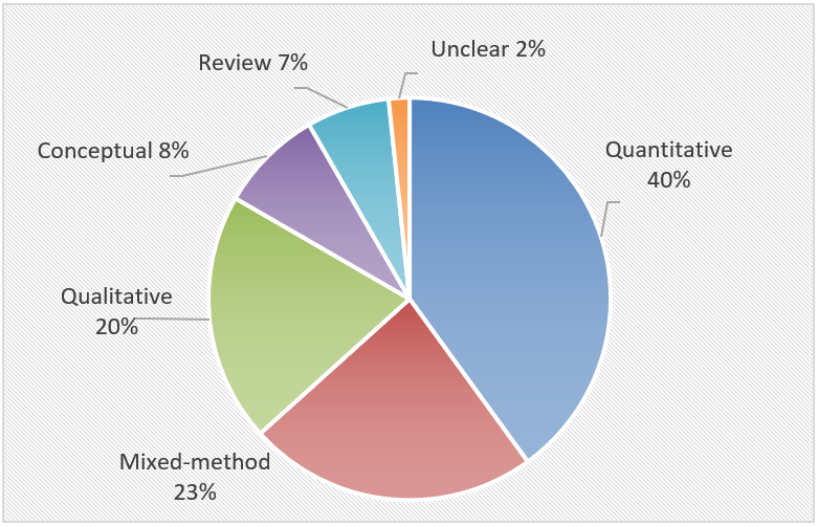

Figure 5. Research methodologies distribution.

4.4. Coverage of research regions

This systematic review analyzed primary research from a broad range of countries, encompassing at least 16 across the globe. As shown in **Figure 6**, Europe stands out as a leader in this field, contributing the most articles (26). Following closely behind is the Asia Pacific region with 19 articles. North America also boasts significant research activity with 18 contributions. The Middle East and Latin America have a more limited presence with 2 articles each. Notably, the review did not identify any research originating from Africa based on the established inclusion criteria.

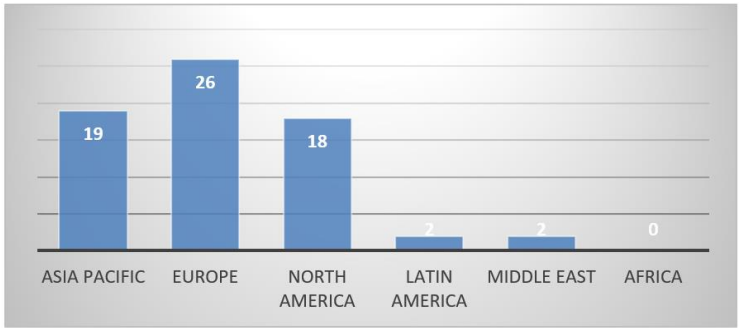

Figure 6. Papers published by region.

This geographic distribution suggests that research on AI-powered virtual influencers on social media is primarily concentrated in Europe, Asia Pacific, and North America. Further studies are necessary to explore the reasons behind this disparity and encourage research in other regions, particularly Africa.

Appendix E, the comprehensive data extraction form, was employed to systematically analyze the aforementioned sections.

5. Discussion

5.1. How do virtual influencers build trust and engagement with audiences? (RQ1)

Virtual influencers (VIs) have emerged as a disruptive force in the marketing landscape, captivating audiences on social media platforms and blurring the lines between reality and artifice. Understanding how AI powered VIs cultivate trust and engagement with audiences is crucial for leveraging their potential and navigating the ethical considerations they present. This review identifies several key aspects through which AI-powered virtual influencers (VIs) cultivate trust and foster engagement with their audiences.

5.1.1. Credibility and perceived authenticity

A cornerstone of trust in VIs is their perceived credibility. Source credibility, encompassing aspects like physical attractiveness, homophily (audience similarity), and sincerity, plays a significant role (Alboqami, 2023; Laszkiewicz and Kalinska-Kula, 2023). Studies suggest that a VI's meticulously crafted persona and outward happiness can foster positive perceptions (Alboqami, 2023). However, the effectiveness of attractiveness as a trust-building tool appears nuanced. While some research suggests a correlation between visual appeal and perceived trustworthiness (Chaihanchanchai et al., 2024), others highlight audience wariness of overly attractive VIs, questioning their genuineness (Sands et al., 2022). This underscores the delicate balancing act VIs must perform—projecting relatability and attractiveness while avoiding an inauthentic facade.

5.1.2. Storytelling and emotional connection

Storytelling emerges as a potent tool for VIs to establish credibility and forge deeper connections with their audience (Allal-Chérif et al., 2024). By crafting compelling narratives that resonate with viewers, VIs can cultivate positive perceptions and emotional engagement, potentially leading to stronger relationships (Ham et al., 2024; Jauffret and Kastberg, 2019). Interestingly, studies suggest that emotional connection can be powerful even without the back-and-forth interaction typical of human relationships. VIs, through their carefully curated online personas, can portray care and stability, fostering emotional bonds with their audience despite the lack of a human element (El-Deeb, 2024). This ability to connect with viewers on an emotional level, even virtually, can be a significant asset for VIs.

5.1.3. Consistency

Unlike their human counterparts, VIs is free from the unpredictability and

imperfections that come with being human. This perceived lack of human flaws can potentially increase their trustworthiness (Allal-Chérif et al., 2024). Additionally, VIs offers the advantage of constant availability, flexibility, and unwavering dedication to a brand's image, providing a sense of consistency for audiences who can always expect a certain level of quality and brand messaging (Allal-Chérif et al., 2024). However, this very consistency can be a double-edged sword. While predictability can be reassuring, it might also lead to a perception of being inauthentic or lacking individuality compared to human influencers who can showcase a wider range of emotions and behaviors.

5.1.4. Interactivity and parasocial relationships

VIs has the potential to engage with audiences in unique ways compared to traditional human influencers (Byun and Ahn, 2023). This interactivity can take various forms, from responding to comments on social media posts to participating in live-streamed events. By fostering a sense of engagement, VIs can cultivate parasocial relationships with their audience. Parasocial relationships are one-sided connections where audiences develop a sense of closeness to the VI, feeling as though they have a personal connection despite the lack of a real-life interaction (Aw and Agnihotri, 2023; Gerlich, 2023). This ability to create a sense of parasocial connection can be a powerful tool for VIs to build a loyal following.

5.1.5. Brand alignment and content strategy

Consumers are more likely to trust and engage with VIs who align seamlessly with the brand they represent (Silva et al., 2022). Imagine a VI promoting a sports brand—ideally, they would project an active and healthy lifestyle that resonates with the brand's message. In addition to brand alignment, the type of content VIs create plays a crucial role in establishing trust and connection with the audience (Mouritzen et al., 2024). Studies suggest that content that is informative, entertaining, or inspirational can foster trust and connection with the audience (Mouritzen et al., 2024). Furthermore, using video content can further enhance emotional engagement and strengthen parasocial relationships by allowing viewers to feel a deeper connection with the VI (Zhou et al., 2024).

Building trust with VIs can be a complex endeavor due to the inherent challenges associated with their perceived inauthenticity and lack of accountability compared to human influencers (Angmo and Mahajan, 2024; Wan and Jiang, 2023). Audiences may view VIs primarily as a marketing tool rather than a genuine personality, raising questions about the influencer's true motivations (Xie-Carson, Magor, et al., 2023). Additionally, there's a balancing act between human-like features and AI-like characteristics. While anthropomorphism (human-like qualities) can increase trust and engagement, revealing the non-human nature of a VI can decrease it (Ma and Li, 2024; Muniz et al., 2023). Audiences may feel deceived if they discover a seemingly real person, they've connected with is actually computer-generated.

Virtual influencers build trust and engagement through a combination of perceived credibility, emotional connection via storytelling, consistent presence, interactive engagement, and brand alignment. While they offer unique advantages in control and availability, their success hinges on maintaining a balance between

human-like relatability and the inherent artificiality of their nature. As virtual influencers continue to evolve, it is crucial to address ethical considerations and enhance their authenticity to foster genuine connections with audiences. This evolving landscape requires ongoing research and adaptive strategies to navigate the complexities of AI-powered influencer marketing effectively.

5.2. How effective are virtual influencers compared to human influencers? (RQ2)

The influencer marketing landscape is undergoing a significant transformation. AI powered virtual influencers (VIs), alongside established human influencers, are rapidly emerging as a potent marketing tool. However, the effectiveness of VIs remains a subject of debate. This review explored the potential and challenges associated with VI implementation, comparing them to their human counterparts. The intricate relationship between control, creativity, cost-effectiveness, authenticity, and strategic implementation will be analyzed to determine how VIs can be most effectively utilized within influencer marketing campaigns.

5.2.1. Potentials of virtual influencers

a) Brand control and cost-effectiveness

For brands, VIs offers a unique set of advantages that enhance control over marketing messaging (Muttamimah et al., 2023). Unlike human influencers with unpredictable schedules and potential for controversy, VIs can be meticulously crafted to perfectly align with the brand's vision and messaging, ensuring consistency across campaigns (Muttamimah et al., 2023). This level of control allows brands to mitigate reputational risks associated with human influencers who might make unexpected comments or participate in activities that deviate from the brand image. Additionally, VIs is not bound by geographical limitations or the constraints of the physical world. They can transcend geographical barriers and exist in a perpetual state of youth, potentially offering a cost-effective solution for global marketing campaigns (Muttamimah et al., 2023). Imagine a VI effortlessly promoting a new clothing line across the globe, eliminating the need for expensive travel logistics.

b) Creative content and targeted marketing strategies

Beyond control, VIs brings a potent dose of creativity and novelty to the table (Choudhry et al., 2022). Their ability to push creative boundaries and defy physical limitations opens doors for innovative and visually captivating content that can truly stand out (Xie-Carson, Benckendorff, et al., 2023). This unique aesthetic can be particularly appealing to younger demographics accustomed to digital experiences (Jhawar et al., 2023; Rodrigo et al., 2022). Furthermore, VIs can be strategically targeted to resonate with specific audiences. Whether it's the aspirational world of fashion and beauty, where VI models can showcase the latest trends in a visually stunning way (Kugler, 2023; Lee and Park, 2023), or the dynamic world of live commerce in some regions where VI hosts can seamlessly interact with potential customers (Kim and Park, 2023), VIs can be tailored to perfectly fit the brand and its target market.

5.2.2. Challenges of virtual influencer marketing

a) Authenticity and trust in virtual influencers

Despite the enticing advantages, VI effectiveness is not without its challenges. A significant hurdle lies in the issue of authenticity and trust. Unlike human influencers who build genuine connections with their audience through shared experiences and perceived vulnerability, VIs can sometimes feel inauthentic or even uncanny, leading to a disconnect with consumers (Moustakas et al., 2020; Nissen et al., 2023; Rossi and Rivetti, 2023). The "Uncanny Valley" effect, where something that appears almost human becomes unsettling, can further hinder the effectiveness of VIs (Arsenyan and Mirowska, 2021). This lack of perceived authenticity can translate into a diminished ability to persuade consumers, particularly when it comes to driving purchase decisions (Franke et al., 2023; Lou et al., 2023). Studies have shown that consumers may be less likely to be persuaded by VIs to purchase a product compared to human influencers, especially for products that require a high level of trust. Additionally, VIs may struggle to replicate the emotional connection and vulnerability that human influencers can project. Human influencers can share their personal experiences and struggles, which can help them build strong parasocial relationships with their followers, making them feel like friends or trusted advisors (Jin et al., 2023; Muttamimah et al., 2023). VIs, on the other hand, may struggle to create this same level of connection, which could limit their effectiveness in certain marketing campaigns.

5.2.3. Optimizing the effectiveness of virtual influencers

Despite the challenges around authenticity, research suggests ways to optimize VI effectiveness (Bansal and Pruthi, 2023; Laszkiewicz and Kalinska-Kula, 2023). Here are some key strategies for brands to consider:

a) Human-like design and personality:

As research suggests, VIs with a more human appearance tend to be perceived more favorably and generate greater trust (Kim et al., 2023; Xie-Carson, Benckendorff, et al., 2023). However, achieving a harmonious equilibrium in VI design is crucial to avoid the pitfalls associated with the uncanny valley phenomenon. While a heightened degree of verisimilitude can be advantageous, an overly human-like replica can be counterproductive, leading to an unsettling effect that undermines trust. The key lies in crafting a VI with a relatable personality and backstory, even if it resides within the digital sphere. This synergy between the fantastical and the familiar can be more effective in fostering connections with consumers.

b) Interactivity and companionship:

VIs that engages with their audience through comments, polls, or live streams, or appear alongside human or virtual companions, can be more effective in building trust and fostering a sense of connection (Li and Ma, 2024; Luca et al., 2023). Imagine a VI fashion influencer who interacts with viewers in real-time, answering questions about the clothing they are showcasing. Alternatively, a VI musician performing alongside a human band can create a more engaging and dynamic experience. This interactivity and companionship can help bridge the gap between the virtual and human world, fostering a sense of authenticity and relatability.

c) Product congruence:

The type of product being promoted can influence VI effectiveness. VIs promoting products that align with their overall aesthetic and personality may resonate better with consumers (Franke et al., 2023). For example, a cute and bubbly VI might be a perfect fit for promoting a new line of youthful cosmetics, while a sophisticated and stylish VI might be more effective for promoting luxury clothing. This congruence between VI and product fosters a sense of believability and strengthens the overall marketing message.

d) Transparency:

Indirect disclosure of a VI's virtual nature, rather than explicitly stating they are AI-powered, may lead to more positive responses from audiences (Yeung-Jun and Yoon-Sung, 2023). This allows consumers to form their own perception of the VI and potentially be more receptive to the marketing message. However, complete transparency throughout the campaign is crucial to avoid any potential deception.

By implementing these strategies, brands can leverage the strengths of Vis—control, creativity, and targeted reach—while mitigating the challenges associated with authenticity. This can lead to a more effective and impactful marketing campaign.

Virtual influencers represent a fascinating development in the ever-evolving landscape of influencer marketing. While they offer brands a compelling package of control, creativity, and cost-effectiveness, challenges around authenticity and trust remain. However, by understanding these challenges and employing strategies like human-like design, interactivity, transparency, and strategic implementation, brands can optimize VI effectiveness. As VI technology continues to develop and consumer behavior evolves, the future of influencer marketing may very well involve a dynamic dance between human and virtual influencers, each bringing their unique strengths to the table to create a more engaging and impactful marketing experience.

5.3. What are the ethical considerations and future advancements of virtual influencers? (RQ3)

5.3.1. Ethical considerations

Virtual influencers (VIs) have taken the social media landscape by storm, captivating audiences with their meticulously crafted personas. However, this very construction raises a multitude of ethical concerns that demand scholarly attention. This section delves into the labyrinth of complexities surrounding VIs, exploring the key ethical considerations they present.

a) Transparency and disclosure

Transparency serves as the bedrock of trust in the online world (Conti et al., 2022; Laszkiewicz and Kalinska-Kula, 2023). Consumers possess a fundamental right to be informed about the nature of the entities they interact with. As documented by (Laszkiewicz and Kalinska-Kula, 2023), a scenario where a consumer engages with an aesthetically pleasing beauty influencer on Instagram, only to discover later that this seemingly relatable individual is, in actuality, a digital construct, exemplifies the potential pitfalls. Such a lack of transparency can erode trust, a critical element for any influencer's success in fostering brand loyalty (El-Deeb, 2024; Muniz et al., 2023).

Brands that partner with VIs risk alienating their target audience if they fail to disclose the artificial nature of their influencer, as discussed by El-Deeb (2024).

b) Blurring the lines between reality and marketing

The proliferation of VIs has exacerbated the complexities surrounding the relationship between reality and marketing within social media (Alboqami, 2023) . These digital personas often embody unrealistic physical attributes, flawless complexions, and meticulously curated lifestyles that can be demonstrably misleading and potentially detrimental to consumers' self-esteem, as documented in a study by (Alboqami, 2023). Furthermore, the development of VIs necessitates a focus on inclusivity and diversity to mitigate the perpetuation of harmful cultural stereotypes within marketing campaigns, as argued by (de Boissieu and Baudier, 2023). The constant exposure to unrealistic beauty standards, particularly for younger audiences who are more susceptible to social media influence, can have negative consequences for body image and self-perception, as evidenced in research by Alboqami (2023).

c) Ethical responsibility and attribution

As VI technology advances rapidly, the question of who holds responsibility for the actions and endorsements of these digital entities becomes increasingly complex. VIs can be programmed to endorse specific products or express meticulously crafted opinions. In the event that a VI promotes a misleading product or disseminates misinformation, who bears the brunt of the ethical transgression? Is it the programmer who meticulously crafted the VI's persona, the brand that partnered with the VI, or the AI itself (Liu and Lee, 2024) ? Establishing clear lines of responsibility is paramount to ensuring ethical marketing practices and safeguarding consumers from potential manipulation, as emphasized in research by Liu and Lee (2024).

d) Impact on younger audiences

The influence of VIs on younger audiences necessitates particular scrutiny from an ethical standpoint. Unlike human influencers with relatable flaws and vulnerabilities, VIs can be portrayed as perpetually happy and flawless individuals, potentially leading to feelings of inadequacy and social comparison among young people, as documented in a study by Allal-Chérif et al. (2024). These digital personas can evolve into "false idols," fostering unrealistic expectations and potentially triggering negative emotions such as envy or animosity, according to research by Angmo and Mahajan (2024).

e) Regulation and mitigating manipulation

Children and adolescents are demonstrably more vulnerable to the persuasive power of marketing messages, as documented in research by Silva et al. (2022). VIs, with their seemingly authentic personalities and meticulously crafted narratives, can be powerful tools for influencing purchasing decisions (Silva et al., 2022). The potential for manipulative marketing tactics targeting younger audiences through VIs necessitates the development of stricter regulations and the implementation of robust ethical guidelines within the influencer marketing industry, as argued by Silva et al. (2022).

f) Empowering consumers through disclosure

Clear and age-appropriate disclosure practices are essential to protect younger audiences from the potential harms associated with VI marketing. Simply stating that

a post features a VI might not be sufficient. Disclosures should be crafted with meticulous attention to detail, ensuring they are concise, clear, and readily understandable by children of all ages. Furthermore, educational initiatives targeted at young people can be instrumental in fostering critical thinking skills and empowering them to become more discerning consumers of social media content, as suggested in research by Silva et al. (2022).

g) Algorithmic bias and misinformation

The algorithms that power social media platforms can exacerbate the ethical concerns surrounding VIs. These algorithms have a demonstrably documented tendency to create echo chambers, where users are primarily exposed to content that reinforces their existing beliefs (Park et al., 2023). If VI content is not carefully curated and monitored, it can contribute to the spread of misinformation or perpetuate harmful biases within social media communities, as argued by Park et al. (2023).

h) Authenticity in the digital age

The very essence of an influencer is built on the concept of authenticity - a genuine connection with the audience. However, VIs, by their very nature, are artificial constructs, raising questions about the commodification of authenticity within the influencer marketing space (Sands et al., 2022). Can a computer program truly connect with an audience on an emotional level, or is the pursuit of an "authentic" VI an inherent contradiction? This conundrum highlights the potential for VI marketing to be manipulative, exploiting the emotional vulnerabilities of consumers by creating a false sense of connection.

The ethical considerations surrounding VIs paint a complex picture, a labyrinth of interconnected concerns that necessitates a collaborative approach. Transparency, inclusivity, and the protection of vulnerable audiences must be paramount as VI technology continues to evolve. Open dialogue between stakeholders—tech developers, policymakers, brands, and researchers—is crucial for navigating these complexities and ensuring that VIs are a force for positive social impact. Future research efforts should delve into the long-term psychological effects of VI exposure, explore robust disclosure practices, and prioritize the development of media literacy programs to empower consumers, particularly younger audiences, to become discerning participants in the digital landscape. By acknowledging these ethical considerations and fostering a culture of responsible VI development and usage, we can harness the potential of these digital personas to create a more positive and enriching social media experience for all.

5.3.2. Future advancements

Virtual influencers (VIs) have established themselves as a prominent force within the social media landscape, and their influence is projected to continue its meteoric rise (Akhtar et al., 2024) .This section delves into potential future advancements in VI technology, exploring the ramifications for influencer marketing, consumer behavior, and society as a whole.

a) More realistic VIs

Advancements in artificial intelligence (AI) and computer graphics (CG) are likely to usher in the creation of even more realistic VIs, indistinguishable from their

human counterparts (Lou et al., 2023). Deepfakes, a technology capable of manipulating videos to generate realistic portrayals of non-existent events, are already blurring the boundaries between reality and simulation (Lou et al., 2023). As this technology evolves, VI creators will be empowered to craft digital personas with nuanced expressions, lifelike movements, and the ability to engage in real-time conversation (Lou et al., 2023). This heightened realism will undoubtedly have a significant impact on how audiences perceive and interact with Vis (Lou et al., 2023).

b) VIs for specific interests

The VI landscape is poised to become increasingly diverse, with the emergence of VIs catering to specific demographics and niche interests (Shin and Lee, 2023). This targeted approach allows brands to connect with highly engaged audiences who share similar values and preferences (Shin and Lee, 2023). Imagine a VI dedicated to sustainability promoting eco-friendly products, or a VI focused on gaming culture endorsing the latest virtual reality headsets (Shin and Lee, 2023). The ability to tailor VIs to specific audiences can enhance brand partnerships and potentially lead to more effective marketing campaigns (Shin and Lee, 2023).

c) The integration of VIs in the metaverse

The burgeoning concept of the metaverse, a virtual world where users can interact with each other and digital objects, presents a fertile ground for VI integration (Wan and Jiang, 2023). VIs could act as virtual guides, shop assistants, or even event hosts within the metaverse, further blurring the lines between the physical and digital worlds, as envisioned in research by Wan and Jiang (2023). This immersive environment could create new opportunities for brand storytelling, product interaction, and fostering a sense of community around VIs (Wan and Jiang, 2023).

d) VI and HI collaborations

The future of influencer marketing might not be a zero-sum game between VIs and human influencers, but rather a space for collaboration (Shen, 2024). VIs and human influencers can leverage each other's strengths to create dynamic and engaging campaigns (Shen, 2024). Human influencers bring a sense of authenticity and real-world experiences, while VIs offer endless creative possibilities and the ability to target specific demographics (Shen, 2024). Imagine a VI partnering with a human influencer to showcase a new product in a fun and interactive way, appealing to a wider audience (Shen, 2024).

VIs has the potential to revolutionize the way we experience stories and entertainment. Imagine a captivating narrative where the protagonist is a VI, or an interactive music video featuring a VI performer. VIs offers boundless creative possibilities for filmmakers, musicians, and content creators, pushing the boundaries of storytelling and entertainment in the digital age.

The ethical considerations and future advancements of virtual influencers present a multifaceted landscape of opportunities and challenges. Ethically, transparency, responsible marketing, and the protection of younger audiences are paramount. As VIs become more sophisticated and realistic, their potential impact on consumer behavior and societal norms must be carefully managed. Future advancements promise a more immersive and personalized engagement with VIs, but they also necessitate robust ethical guidelines and collaborative efforts among stakeholders. By addressing these

ethical concerns proactively and fostering responsible development, we can ensure that virtual influencers contribute positively to the evolving digital ecosystem.

6. Conclusion

The discussion elucidates key themes emergent from the literature, emphasizing the critical role of trust and engagement in VI marketing. VIs navigates a delicate balance between consistency and perceived authenticity, leveraging factors such as credibility, attractiveness, and narrative prowess to forge connections with audiences. Challenges persist, particularly regarding concerns of artificiality and accountability, necessitating nuanced strategies for brand alignment and content curation to maintain trust.

Comparatively, VIs offers distinct advantages, including enhanced control, cost efficiencies, and tailored demographic targeting for brands. Yet, they grapple with authenticity challenges inherent in their virtual nature, mitigated through judicious integration of human-like features and transparent communication regarding their virtual essence, thereby optimizing their efficacy as complementary tools alongside human influencers.

Ethically, the emergence of VIs unveils a complex terrain fraught with implications for consumer well-being and regulatory oversight. Mitigating risks of misinformation, safeguarding vulnerable demographics, and navigating the nebulous boundaries between marketing and reality demand stringent guidelines and industry-wide cooperation.

Looking ahead, the trajectory of VIs promises a paradigm shift in storytelling and entertainment, characterized by heightened realism, niche specialization, and symbiotic collaborations with human influencers. However, this transformative journey necessitates vigilance towards ethical considerations and regulatory frameworks to ensure the responsible evolution of VI marketing practices.

In conclusion, this study serves as a clarion call for continued scholarly inquiry and industry reflection to navigate the evolving contours of AI-powered virtual influencers with prudence and foresight. Only through a holistic understanding of trust dynamics, engagement strategies, ethical imperatives, and emergent trends can stakeholders chart a course towards sustainable and socially responsible VI marketing practices, thereby shaping the future landscape of influencer marketing.

Despite the comprehensive analysis presented, several research gaps warrant further investigation. Firstly, the long-term psychological effects of prolonged exposure to VIs on different age groups, especially children and adolescents, remain underexplored. Secondly, there is a need for empirical studies examining the effectiveness of various disclosure practices in mitigating ethical concerns related to transparency and consumer manipulation. Thirdly, the intersection of VI marketing with cultural and socio-economic factors, and how these might influence the reception and impact of VIs across diverse demographics, is yet to be fully understood. Finally, the potential for algorithmic biases in the creation and promotion of VIs calls for rigorous scrutiny to prevent the perpetuation of stereotypes and misinformation. Addressing these gaps through interdisciplinary research will be crucial for developing

robust, ethical, and effective VI marketing strategies.

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Appendix A

Keyword List:

1) Virtual influencers
2) AI influencers
3) Artificial intelligence in social media
4) Trust in virtual influencers
5) Engagement strategies virtual influencers
6) Efficacy of virtual influencers
7) Human vs. virtual influencers
8) Ethical concerns virtual influencers
9) Virtual influencer marketing
10) Consumer trust virtual influencers
11) Virtual influencers authenticity
12) Transparency virtual influencers
13) Virtual influencers ethical guidelines
14) Virtual influencers and brand alignment
15) Social media AI influencers
16) Future trends virtual influencers
17) Challenges of virtual influencers
18) Virtual influencers accountability
19) Virtual influencers storytelling
20) Influence of AI on social media
21) Virtual influencers cost efficiency
22) Trust and engagement in influencer marketing
23) AI-generated content in social media
24) Virtual influencers consumer perception
25) Virtual influencers research trends

Appendix B

Table B1. Primary studies references.

SID	References
S1	Akhtar, N., Hameed, Z., Islam, T., et al. (2024). Avatars of influence: Understanding how virtual influencers trigger consumer engagement on online booking platforms. Journal of Retailing and Consumer Services, 78, 103742. https://doi.org/10.1016/j.jretconser.2024.103742
S2	Alboqami, H. (2023a). Trust me, I'm an influencer—Causal recipes for customer trust in artificial intelligence influencers in the retail industry. Journal of Retailing and Consumer Services, 72, 103242. https://doi.org/10.1016/j.jretconser.2022.103242
S3	Allal-Chérif, O., Puertas, R., & Carracedo, P. (2024). Intelligent influencer marketing: how AI-powered virtual influencers outperform human influencers. Technological Forecasting and Social Change, 200, 123113. https://doi.org/10.1016/j.techfore.2023.123113
S4	Almasri, Y. (2023). Fashion Virtual Influencers: Antecedents Influencing Females' Behavioral Intentions in Jordan. Dirasat: Human and Social Sciences, 50(3), 390–402. https://doi.org/10.35516/hum.v50i3.5420
S5	Angmo, P., & Mahajan, R. (2024). Virtual influencer marketing: a study of millennials and gen Z consumer behavior. Qualitative Market Research. https://doi.org/10.1108/QMR-01-2023-0009
S6	Appel, G., Grewal, L., Hadi, R., & Stephen, A. T. (2020). The future of social media in marketing. Journal of the Academy of Marketing Science, 48(1), 79–95. https://doi.org/10.1007/s11747-019-00695-1
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S8	Aw, E. C. X., & Agnihotri, R. (2023). Influencer marketing research: review and future research agenda. Journal of Marketing Theory and Practice, 0(0), 1–14. https://doi.org/10.1080/10696679.2023.2235883
S9	Baudier, P., de Boissieu, E., & Duchemin, M.-H. (2023). Source Credibility and Emotions generated by Robot and Human Influencers: The perception of luxury brand representatives. Technological Forecasting and Social Change, 187, 122255. https://doi.org/10.1016/j.techfore.2022.122255
S10	Belanche, D., Casaló, L. V, & Flavián, M. (2024). Human versus virtual influences, a comparative study. Journal of Business Research, 173, 114493. https://doi.org/https://doi.org/10.1016/j.jbusres.2023.114493
S11	Byun, K. J., & Ahn, S. J. (2023). A Systematic Review of Virtual Influencers: Similarities and Differences between Human and Virtual Influencers in Interactive Advertising. Journal of Interactive Advertising, 23(4), 293–306. https://doi.org/10.1080/15252019.2023.2236102
S12	Lou, C., Kiew, S. T. J., Chen, T., et al. (2022). Authentically Fake? How Consumers Respond to the Influence of Virtual Influencers. Journal of Advertising, 52(4), 540–557. https://doi.org/10.1080/00913367.2022.2149641
S13	Choudhry, A., Han, J., Xu, X., & Huang, Y. (2022). "I Felt a Little Crazy Following a 'Doll'": Investigating Real Influence of Virtual Influencers on Their Followers. Proc. ACM Hum. Comput. Interact., 6. https://doi.org/10.1145/3492862
S14	Claudia Franke, A. G. K., & Müller, K. (2023). Consumers' Responses to Virtual Influencers as Advertising Endorsers: Novel and Effective or Uncanny and Deceiving? Journal of Advertising, 52(4), 523–539. https://doi.org/10.1080/00913367.2022.2154721
S15	Conti, M., Gathani, J., & Tricomi, P. P. (2022). Virtual Influencers in Online Social Media. IEEE Communications Magazine, 60(8), 86–91. https://doi.org/10.1109/MCOM.001.2100786
S16	de Boissieu, E., & Baudier, P. (2023). The perceived credibility of human-like social robots: virtual influencers in a luxury and multicultural context. Journal of Organizational Change Management, 36(7), 1163–1179. https://doi.org/10.1108/JOCM-05-2023-0182
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Table B1. (*Continued*).

SID	References
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S21	Ferrari, F., & McKelvey, F. (2023). Hyperproduction: a social theory of deep generative models. Distinktion: Journal of Social Theory, 24(2), 338–360. https://doi.org/10.1080/1600910X.2022.2137546
S22	Gerlich, M. (2023). The Power of Virtual Influencers: Impact on Consumer Behavior and Attitudes in the Age of AI. Administrative Sciences, 13(8). https://doi.org/10.3390/admsci13080178
S23	Haikel-Elsabeh, M. (2023). Virtual Influencers versus Real Influencers Advertising in the Metaverse, Understanding the Perceptions, and Interactions with Users. Journal of Current Issues & Research in Advertising, 44(3), 252–273. https://doi.org/10.1080/10641734.2023.2218420
S24	Ham, J., Li, S., Looi, J., & Eastin, M. S. (2024). Virtual humans as social actors: Investigating user perceptions of virtual humans' emotional expression on social media. Computers in Human Behavior, 155, 108161. https://doi.org/10.1016/j.chb.2024.108161
S25	Marie-Nathalie, J., & Landaverde Kastberg, V. (2019). Biodigital Influencers: A New Alternative for Fighting Loneliness. In B. Fox (Ed.), Emotions and Loneliness in a Networked Society. Springer International Publishing. pp. 283–307. https://doi.org/10.1007/978-3-030-24882-6_15
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S27	Jin, S. V. (2023). "To comply or to react, that is the question:" the roles of humanness versus eeriness of AI-powered virtual influencers, loneliness, and threats to human identities in AI-driven digital transformation. Computers in Human Behavior: Artificial Humans, 1(2), 100011. https://doi.org/10.1016/j.chbah.2023.100011
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S29	Kim, D., & Wang, Z. (2023). The ethics of virtuality: navigating the complexities of human-like virtual influencers in the social media marketing realm. Frontiers in Communication, 8. https://doi.org/10.3389/fcomm.2023.1205610
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S32	Kim, M., & Baek, T. H. (2023). Are Virtual Influencers Friends or Foes? Uncovering the Perceived Creepiness and Authenticity of Virtual Influencers in Social Media Marketing in the United States. International Journal of Human—Computer Interaction, 1–14. https://doi.org/10.1080/10447318.2023.2233125
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S34	Laszkiewicz, A., & Kalinska-Kula, M. (2023). Virtual influencers as an emerging marketing theory: A systematic literature review. International Journal of Consumer Studies, 47(6), 2479–2494. https://doi.org/https://doi.org/10.1111/ijcs.12956
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S37	Liu, F., & Lee, Y. H. (2024). Virtually responsible? Attribution of responsibility toward human vs. virtual influencers and the mediating role of mind perception. Journal of Retailing and Consumer Services, 77, 103685. https://doi.org/10.1016/j.jretconser.2023.103685
S38	Ma, Y., & Li, J. (2024). How humanlike is enough? Uncover the underlying mechanism of virtual influencer endorsement. Computers in Human Behavior: Artificial Humans, 2(1), 100037. https://doi.org/10.1016/j.chbah.2023.100037
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S40	Liu, S., Aw, E. C. X., Tan, G. W. H., & Ooi, K. B. (2023). Virtual Influencers as the Next Generation of Influencer Marketing: Identifying Antecedents and Consequences. In: Al-Sharafi, M. A., Al-Emran, M., Tan, G. W. H., & Ooi, K. B. (editors). Current and Future Trends on Intelligent Technology Adoption. pp. 23–39. Springer, Cham. https://doi.org/10.1007/978-3-031-48397-4_2
S41	Papaporn Chaihanchanchai, S. A., & Ruangthanakorn, N. (2024). Unlocking the persuasive power of virtual influencer on brand trust and purchase intention: a parallel mediation of source credibility. Journal of Marketing Communications, 1–23. https://doi.org/10.1080/13527266.2023.2301390
S42	Park, S., Wei, X., & Lee, H. (2023). Revisiting the elaboration likelihood model in the context of a virtual influencer: A comparison between high- and low-involvement products. Journal of Consumer Behavior, n/a(n/a). doi:10.1002/cb.2290
S43	Ahn, R. J., Cho, S. Y., & Sunny Tsai, W. (2022). Demystifying Computer-Generated Imagery (CGI) Influencers: The Effect of Perceived Anthropomorphism and Social Presence on Brand Outcomes. Journal of Interactive Advertising, 22(3), 327–335. https://doi.org/10.1080/15252019.2022.2111242
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Table B1. (*Continued*).

SID	References
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S54	Zhou, Q., Li, B., Li, H., & Lei, Y. (2024). Mere copycat? The effects of human versus human-like virtual influencers on brand endorsement effectiveness: A moderated serial-mediation model. Journal of Retailing and Consumer Services, 76, 103610. https://doi.org/10.1016/j.jretconser.2023.103610
S55	Miyake, E. (2023). I am a virtual girl from Tokyo: Virtual influencers, digital-orientalism and the (Im)materiality of race and gender. Journal of Consumer Culture, 23(1), 209–228. https://doi.org/10.1177/14695405221117195
S56	Mouritzen, S. L. T., Penttinen, V., & Pedersen, S. (2024). Virtual influencer marketing: the good, the bad and the unreal. European Journal of Marketing, 58(2), 410-440. https://doi.org/10.1108/EJM-12-2022-0915
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S58	Liyanaarachchi, G., Mifsud, M., & Viglia, G. (2024). Virtual influencers and data privacy: Introducing the multi-privacy paradox. Journal of Business Research, 176, 114584. https://doi.org/10.1016/j.jbusres.2024.114584
S59	Gerrath, M. H. E. E., Olya, H., Shah, Z., & Li, H. (2024). Virtual influencers and pro-environmental causes: The roles of message warmth and trust in experts. Journal of Business Research, 175, 114520. https://doi.org/10.1016/j.jbusres.2024.114520
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Appendix C

Table C1. Quality assessment scores for each selected studies.

SID	QA1	QA2	QA3	QA4	QA5	Total Score
S1	2	2	2	2	2	10
S2	2	2	1	1	1	7
S3	2	1	2	1	1	7
S4	2	1	2	2	2	9
S5	2	1	2	1	1	7
S6	2	2	2	1	1	8
S7	2	1	2	1	1	7
S8	2	1	2	1	1	7
S9	2	2	2	2	2	10
S10	2	1	2	1	1	7
S11	2	2	1	1	1	7
S12	2	2	1	1	1	7
S13	2	2	1	1	1	7
S14	2	1	1	1	1	6
S15	1	2	1	1	1	6
S16	2	2	2	2	2	10
S17	2	2	1	1	1	7
S18	2	1	2	2	2	9
S19	2	1	2	1	2	8
S20	2	2	2	1	1	8
S21	2	2	1	0	0	5
S22	2	2	1	1	1	7
S23	2	1	1	1	1	6
S24	2	2	1	1	1	7
S25	2	1	1	1	1	6
S26	2	2	2	2	2	10
S27	2	1	2	1	1	7
S28	2	1	2	1	1	7
S29	2	2	1	1	1	7
S30	2	1	2	1	1	7
S31	2	2	2	2	2	10
S32	2	1	2	2	2	9
S33	1	2	2	2	2	9
S34	1	2	1	1	1	6
S35	2	1	1	1	1	6
S36	2	2	2	2	2	10
S37	2	1	2	1	1	7
S38	2	1	2	1	2	8

Table C1. (*Continued*).

SID	QA1	QA2	QA3	QA4	QA5	Total Score
S39	2	2	2	2	2	10
S40	2	2	2	2	2	10
S41	2	2	2	2	2	10
S42	2	1	2	1	1	7
S43	2	2	1	1	1	7
S44	2	2	1	1	1	7
S45	2	2	1	1	1	7
S46	2	2	1	1	1	7
S47	2	2	1	2	1	8
S48	2	1	1	1	1	6
S49	2	2	1	1	1	7
S50	1	2	2	2	2	9
S51	2	2	1	1	1	7
S52	2	1	2	2	2	9
S53	2	2	2	2	2	10
S54	1	2	2	1	1	7
S55	2	1	2	1	1	7
S56	2	2	1	1	1	7
S57	1	2	2	1	1	7
S58	2	2	1	1	1	7
S59	2	2	2	2	2	10
S60	2	1	2	1	1	7

Appendix D

Table D1. Journals, conferences papers, and book chapters.

Acronym	Full name of journals, conferences papers, or book chapters	Type	Count
AI & S	AI & SOCIETY	Journal	1
CFTITA	Current and Future Trends on Intelligent Technology Adoption	Chapter	1
AdminS	Administrative Sciences	Journal	1
B & S	Body & Society	Journal	1
CHB	Computers in Human Behavior	Journal	2
CHB: AH	Computers in Human Behavior: Artificial Humans	Journal	2
Dirasat	Dirasat: Human and Social Sciences	Journal	1
DJST	Distinktion: Journal of Social Theory	Journal	1
ELNS	Emotions and Loneliness in a Networked Society	Chapter	1
EJM	European Journal of Marketing	Journal	1
FIC	Frontiers in Communication	Journal	1
HSSC	Humanities and Social Sciences Communications	Journal	1
IEEE CM	IEEE Communications Magazine	Journal	1
IJCS	International Journal of Communication Systems	Journal	1
IJHCI	International Journal of Human–Computer Interaction	Journal	1
IJHCS	International Journal of Human-Computer Studies	Journal	2
JoA	Journal of Advertising	Journal	2
JBR	Journal of Business Research	Journal	6
JCB	Journal of Consumer Behaviour	Journal	1
JCC	Journal of Consumer Culture	Journal	1
JCI & RA	Journal of Current Issues & Research in Advertising	Journal	2
JIA	Journal of Interactive Advertising	Journal	5
JMC	Journal of Marketing Communications	Journal	1
JMTP	Journal of Marketing Theory and Practice	Journal	1
JOCM	Journal of Organizational Change Management	Journal	1
JRCS	Journal of Retailing and Consumer Services	Journal	11
JAMS	Journal of the Academy of Marketing Science	Journal	1
MST	Marketing and Smart Technologies	Journal	1
PACM HCI	Proceedings of the ACM on Human-Computer Interaction	Conference	1
QMR	Qualitative Market Research	Journal	1
RLCS (en)	Revista Latina de Comunicación Social, English ed.	Journal	1
SNA&M	Social Network Analysis and Mining	Journal	1
TFSC	Technological Forecasting & Social Change	Journal	2
JVNKKNU	The journal of V. N. Karazin Kharkiv National University	Journal	1
TM	Tourism Management	Journal	1

Appendix E

Table E1. Data extraction form.

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S01	(Akhtar et al., 2024)	Avatars of influence: Understanding how virtual influencers trigger consumer engagement on online booking platforms	China	Qualitative	Virtual influencers positively influence consumer engagement in hotel booking platforms by impacting informational and normative social influence. Virtual influencers play a significant role in sharing information effectively and promoting digitalization in the hospitality industry, ultimately driving consumer engagement on online platforms.	Science Direct
S02	(Alboqami, 2023)	Trust me, I'm an influencer! - Causal recipes for customer trust in artificial intelligence influencers in the retail industry	Saudi Arabia	Quantitative	Trust in AI influencers is influenced by a combination of source attractiveness, source credibility, and congruences, rather than a single factor, leading to high trust among consumers.	Science Direct
S03	(Allal-Chérif et al., 2024)	Intelligent influencer marketing: how AI-powered virtual influencers outperform human influencers	English and French	Mixed-method	AI-powered virtual influencers outperform human influencers in various aspects of influencer marketing, offering benefits such as increased brand promotion, target engagement, and authenticity, while also mitigating risks associated with human influencers.	Science Direct
S04	(Almasri, 2023)	Fashion Virtual Influencers: Antecedents Influencing Females' Behavioral Intentions in Jordan	Jordan	Quantitative	Information usefulness, perceived expertise, and fashion innovativeness of virtual influencers significantly influence females' behavioral intentions in Jordan regarding fashion consumption.	Scopus
S05	(Angmo and Mahajan, 2024)	Virtual influencer marketing - a study of millennials and gen Z consumer behaviour	India	Mixed-method	Opinions about virtual influencers were mixed among millennials and Gen Z consumers. Two main themes emerged: challenges and potential, and decision-making and psychological aspects. Participants highlighted the importance of credibility, authenticity, transparency, and accountability in virtual influencer marketing. Trust in virtual influencers was influenced by factors such as credibility and authenticity.	Scopus
S06	(Appel et al., 2020; Arsenyan and Mirowska, 2021)	The future of social media in marketing	USA, UK and Australia	Conceptual	Identified nine key themes that will shape the future of social media in marketing, encompassing aspects such as omni-social presence, the rise of influencers, privacy concerns, combating loneliness, integrated customer care, social media as a political tool, increased sensory richness, online/offline integration, and social media by non-humans. These themes provide a comprehensive framework for understanding the evolving landscape of social media and offer valuable insights for future research and marketing strategies.	Springer

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S07	(Arsenyan and Mirowska, 2021)	Almost human: A comparative case study on the social media presence of virtual influencers	France	Mixed-method	Users react differently to virtual influencers based on their human-likeness, with more human-like virtual influencers receiving lower positive reactions. Negative reactions towards ambiguous virtual influencers suggest an "Uncanny Valley" effect, and the study highlighted potential tensions arising from the embodiment and claimed human-like mind of virtual influencers.	Science Direct
S08	(Aw and Agnihotri, 2023)	Influencer marketing research: review and future research agenda	Malaysia, USA	Review	Provide a comprehensive review of influencer marketing research, presented an integrative framework, and outlined a future research agenda to guide further studies in the field of social media influencer marketing.	Taylor and Francis Online
S09	(Baudier et al., 2023)	Source Credibility and Emotions generated by Robot and Human Influencers: The perception of luxury brand representatives	France	Qualitative	The luxury brands are transitioning from traditional brand/customer relationships to a triadic relationship involving influencers. Choosing influencers that align with brand values and emotions is crucial. The research highlighted the importance of Robot Influencers (RI) in enhancing interactions with brand communities on social media. Perceived humanness and emotions play a significant role in the acceptance of RI by luxury brands for future social media communications.	Science Direct
S10	(Belanche et al., 2024)	Human versus virtual influences, a comparative study	Spain	Quantitative	Consumers identified more with human influencers than virtual influencers. However, messages from virtual influencers were perceived as more useful, especially when endorsing utilitarian products. The type of influencer had a stronger impact on usefulness perceptions when promoting utilitarian products.	Science Direct
S11	(Byun and Ahn, 2023)	A Systematic Review of Virtual Influencers: Similarities and Differences between Human and Virtual Influencers in Interactive Advertising	Korea, USA	Review	Virtual influencers (VIs) and human influencers (HIs) share similarities in their roles as sources of advertising messages but also have critical differences that impact the limitations and potentials of VIs in interactive advertising. The research aimed to provide a conceptual definition of VIs, compare them directly with HIs, and offer insights for practical implementations of VIs in advertising while guiding future research in this area.	Taylor and Francis Online
S12	(Lou et al., 2023)	Authentically Fake: How Consumers Respond to the Influence of Virtual Influencers	Singapore	Qualitative	Consumers tend to trust human influencers more than virtual influencers due to factors such as lack of similarity, weak parasocial relations, and authenticity concerns.	Taylor and Francis Online

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S13	(Choudhry et al., 2022)	"I Felt a Little Crazy Following a 'Doll'": Investigating Real Influence of Virtual Influencers on Their Followers	USA	Qualitative	The study investigated why online users engage with virtual influencers on social media and how they perceive their interactions with these digital beings. The findings shed light on the real influence of virtual influencers on their followers and explored the dynamics of engagement in this emerging form of social media interaction.	ACM Digital Library
S14	(Franke et al., 2023)	Consumers' Responses to Virtual Influencers as Advertising Endorsers: Novel and Effective or Uncanny and Deceiving?	Germany	Quantitative	The study found that consumers had difficulty identifying virtual influencers as such and often mistook them for human beings. It also highlighted the importance of disclosing the nature of endorsers to avoid consumer confusion or deception. Additionally, the research suggested that virtual influencers could be perceived as novel and innovative in advertising, but the novelty factor may not last long.	Taylor and Francis Online
S15	(Conti et al., 2022)	Virtual Influencers in Online Social Media	Italy, India	Review	Virtual influencers offer more flexibility, exclusivity, brand safety, and innovation compared to real human influencers. It highlighted the rising trend of virtual influencers and the potential for continued growth in the future. The study also discussed concerns regarding the transparency and authenticity of virtual influencers, emphasizing the need for further research and understanding in this evolving field.	IEEE Xplore
S16	(de Boissieu and Baudier, 2023)	The perceived credibility of human-like social robots: virtual influencers in a luxury and multicultural context	France	Qualitative	Consumers' perceptions of human-like virtual influencers in the luxury context are influenced by factors such as physical and content attractiveness, expertise, similarities, and trustworthiness. Cultural settings and familiarity with technology play a significant role in shaping how millennials and Gen-Z consumers perceive virtual influencers. The study highlights the importance of understanding these factors when considering the credibility of virtual influencers in a multicultural context.	ScienceDirect
S17	(Silva et al., 2022)	Avatar marketing: a study on the engagement and authenticity of virtual influencers on Instagram	Brazil	Mixed-method	The study found that virtual influencers on Instagram, such as Lil Miquela and Rozy Gram, effectively engage with their audience, with varying levels of likes, comments, and brand endorsements. Virtual influencers like Lu of Magalu and Dai of Dailus, designed to embody specific brands, showed high engagement rates and audience reach. The research highlighted the importance of regular posting, brand endorsements, and audience interaction in building influential virtual personas on social media platforms.	Springer

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S18	(Deng and Jiang, 2023)	Effects of human versus virtual human influencers on the appearance anxiety of social media users	China	Quantitative	The study suggests that virtual influencers (VIs) may have a mitigating effect on appearance anxiety among social media users compared to human influencers (HIs). This finding highlights the potential for VIs to positively influence individuals' perceptions of appearance and reduce the negative impact of idealized imagery on body image concerns.	Science Direct
S19	(El Hedhli et al., 2023)	Stereotyping human-like virtual influencers in retailing: Does warmth prevail over competence?	UK	Quantitative	The study found that consumers' perceptions of virtual influencers were influenced more by warmth stereotypes than competence stereotypes, impacting their willingness to follow recommendations.	Science Direct
S20	(El-Deeb, 2024)	Computer-Generated Imagery Influencer Marketing—Which Ends of the Continuum Will Prevail? Humans or Avatars?	Egypt	Qualitative	Consumer attitudes towards computer-generated imagery influencers (CGIIs) are positive, with a growing interest and engagement observed on social media platforms. There has been a noticeable increase in followers and connections towards CGIIs over the past two years, indicating their potential to revolutionize influencer marketing by becoming more human-like characters. The research suggests that CGI influencers are likely to play a significant role in the future of influencer marketing.	Springer
S21	(Ferrari and McKelvey, 2023)	Hyperproduction: A Social Theory of Deep Generative Models	UK	Conceptual	The study on hyperproduction of deep generative models underscores the importance of regulating AI-generated media to protect human rights, promote fair competition, and uphold democratic values. It advocates for a broader analysis beyond deep fakes, emphasizing the need to consider the cross-industrial impact of synthetic media and envision alternative trajectories for its beneficial use, guiding present and future regulatory actions.	Taylor and Francis Online
S22	(Gerlich, 2023)	The Power of Virtual Influencers: Impact on Consumer Behavior and Attitudes in the Age of AI	Switzerland	Mixed-method	Consumers perceive virtual influencers as more trustworthy, reliable, and relevant compared to human influencers, leading to increased purchase intention. Virtual influencers were found to have a significant impact on consumer behavior and preferences, indicating a preference for virtual influencers over human influencers in social media marketing.	Scopus
S23	(Haikel-Elsabeh, 2023)	Virtual Influencers versus Real Influencers Advertising in the Metaverse: Understanding the Perceptions and Interactions with Users	France	Qualitative	The study found that individuals responded positively to advertising in the metaverse and that virtual influencers had a significant impact on brand perceptions. Additionally, the study highlighted the importance of the extended service robot acceptance model in explaining perceptions of virtual influencers.	Taylor and Francis Online

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S24	(Ham et al., 2024)	Virtual humans as social actors: Investigating user perceptions of virtual humans' emotional expression on social media	USA	Mixed-method	The study found that the display of happiness in virtual influencer's social media posts led to high perceptions and a positive attitude towards the virtual influencer, while the display of sadness and lust was recommended to be avoided. Additionally, the virtual influencer's perceived emotional intelligence, anthropomorphism, and authenticity were significant mediators of users' attitudes towards the virtual influencer.	Science Direct
S25	(Jauffret and Kastberg, 2019)	Biodigital Influencers: A New Alternative for Fighting Loneliness	Monaco, France	Qualitative	The study on biodigital influencers found that followers' interactions with these influencers, such as Lil Miquela and Bermuda, positively impacted their emotional states, particularly in reducing feelings of loneliness and social isolation. The qualitative analysis of comments revealed that biodigital influencers played a beneficial role in fostering a sense of community among followers and helping them combat negative emotions like loneliness and solitude.	Springer
S26	(Yang et al., 2023)	Human versus Virtual Influencer: The Effect of Humanness and Interactivity on Persuasive CSR Messaging	USA	Quantitative	The study found that human influencers were more persuasive than virtual influencers in conveying corporate social responsibility (CSR) messages, particularly when authenticity and genuine communication were required. Additionally, high interactivity levels positively influenced perceived interactivity, influencer credibility, CSR engagement, and brand reputation.	Taylor and Francis Online
S27	(S. V. Jin, 2023)	To comply or to react, that is the question" the roles of humanness versus eeriness of AI-powered virtual influencers	USA	Quantitative	The study found high levels of awareness and knowledge of AI-powered virtual influencers among US social media users, with moderate levels of exposure and engagement. It confirmed that empathy and engagement with virtual influencers mediate the effects of perceived humanness versus eeriness on social media users' intention to purchase products recommended by virtual influencers. Loneliness was identified as a moderator affecting the relationship between humanness versus eeriness and empathy.	Science Direct

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S28	(S. V. Jin and Viswanathan, 2024)	Threatened and empty selves following AI-based virtual influencers: a comparison between followers and non-followers of virtual influencers in AI-driven digital marketing	USA	Quantitative	The study found significant differences between followers and non-followers of AI-based virtual influencers in terms of perceived threat to human identities, AI awareness, perceived benefits of AI-based virtual influencers' personalization, the need to belong, and intention to use AI-based virtual influencers in the future. Followers showed higher levels of intention to use AI-based virtual influencers compared to non-followers. The study also identified mediating mechanisms (perceived threats and benefits) and a moderating variable (need to belong) relevant to behavioral intentions to adopt AI-based virtual influencers in AI-driven digital marketing.	Springer
S29	(D. Kim and Wang, 2023)	The ethics of virtuality: navigating the complexities of human-like virtual influencers in the social media marketing realm	USA	Conceptual	The study highlighted the ethical concerns surrounding virtual influencers, their impact on traditional notions of authenticity and agency, and emphasized the importance of transparency in differentiating between human and virtual influencers to address potential deception and ethical implications in social media marketing.	Scopus
S30	(H. Kim and Park, 2023)	Virtual influencers' attractiveness effect on purchase intention: A moderated mediation model of the Product–Endorser fit with the brand	South Korea	Quantitative	Virtual influencers' attractiveness positively influences consumers' purchase intentions through the mediating effects of mimetic desire and brand attachment, with the moderation of the fit between the product and endorser.	Science Direct
S31	(H. Kim and Park, 2024)	When digital celebrity talks to you: How human-like virtual influencers satisfy consumer's experience through social presence on social media endorsements	Korea	Quantitative	The perceived anthropomorphism of virtual influencers positively influences consumer satisfaction with their experience on social media. Additionally, perceived usefulness, credibility, perceived enjoyment, and flow play significant roles in the relationship between perceived anthropomorphism, social presence, and satisfaction with the virtual influencers.	Science Direct
S32	(M. Kim and Baek, 2023)	Are Virtual Influencers Friends or Foes? Uncovering the Perceived Creepiness and Authenticity of Virtual Influencers in Social Media Marketing in the United States	USA	Quantitative	The study found significant relationships between perceived creepiness, perceived authenticity, emotional attachment, and word-of-mouth intention regarding virtual influencers. Specifically, creepiness was influenced by attitude homophily, while perceived authenticity was affected by language similarity, interest similarity, physical attractiveness, and attitude homophily.	Taylor and Francis Online

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S33	(Koles et al., 2024)	The authentic virtual influencer: Authenticity manifestations in the metaverse	France, USA, Germany, Netherlands, Austria	Qualitative	The study on authenticity manifestations in virtual influencers found that three types of authenticity—true-to-ideal, true-to-fact, and true-to-self—apply to and manifest in the context of virtual influencers. The research highlighted the importance of authenticity in virtual influencer marketing and provided insights into how consumers and industry experts perceive authenticity in the realm of virtual influencers. The study also emphasized the need for further research in this area and offered theoretical contributions, managerial recommendations, and suggestions for future research directions.	Science Direct
S34	(Laszkiewicz and Kalinska-Kula, 2023)	Virtual influencers as an emerging marketing theory - A systematic literature review	USA, UK, Spain	Review	Virtual influencers are gaining popularity in influencer marketing, driven by advancements in AI technology. There is a need for further research to understand how audiences perceive virtual influencers, as existing academic work in this area is limited. The study emphasized the importance of influencer marketing in consumer decision-making and highlighted the evolving nature of this field, calling for a comprehensive review of existing research on virtual influencers.	Wiley Online Library
S35	(D. Lee and Ham, 2023)	AI versus Human: Rethinking the Role of Agent Knowledge in Consumers' Coping Mechanism Related to Influencer Marketing	USA	Quantitative	Consumers perceive AI influencers as lacking autonomy and the mental capacity for intentionality compared to human influencers. This perception of AI influencers led to negative effects on attitudes and behavioural changes in influencer marketing. Additionally, the research demonstrated that consumers' agent knowledge of influencers influences their coping responses to recommendations, with AI influencers being perceived differently in terms of autonomy and intentionality compared to human influencers, impacting persuasion mechanisms and outcomes.	Taylor and Francis Online
S36	(H. Li et al., 2023)	Can you sense without being human? Comparing virtual and human influencers endorsement effectiveness	China, USA	Mixed-method	Consumers have less favourable brand attitudes towards virtual influencers compared to human influencers. Additionally, the type of influencer (virtual vs. human) can impact brand attitude and purchase intention. The research also highlighted the moderating role of sensory cue salience in influencing endorsement effectiveness.	Science Direct

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S37	(F. Liu and Lee, 2024)	Virtually responsible: Attribution of responsibility toward human vs. virtual influencers and the mediating role of mind perception	USA	Quantitative	Virtual influencers were perceived as less responsible compared to human influencers when the endorsement was successful. However, when the endorsement was unsuccessful, virtual influencers were attributed similar levels of responsibility as human influencers. Mind perception played a mediating role in shaping consumers' attitudes and intentions towards endorsements by human and virtual influencers.	Science Direct
S38	(Ma and Li, 2024)	How humanlike is enough? Uncover the underlying mechanism of virtual influencer endorsement	USA	Quantitative	Virtual influencers with higher human likeness lead to stronger connections with users, resulting in more positive brand attitudes and higher purchase intentions. Mindless anthropomorphism had a greater impact on para-social interactions compared to mindful anthropomorphism.	Science Direct
S39	(Muniz et al., 2023)	Are they humans or are they robots? The effect of virtual influencer disclosure on brand trust	Brazil	Quantitative	The study revealed that when consumers are informed that a virtual influencer is not human but a robot, it leads to a decrease in consumer trust towards the brand associated with the influencer. This suggests that the disclosure of a virtual influencer's nonhuman nature negatively impacts consumer perceptions and trust in the brand.	Wiley Online Library
S40	(S. Liu et al., 2023)	Virtual Influencers as the Next Generation of Influencer Marketing: Identifying Antecedents and Consequences	China	Quantitative	Virtual influencers' anthropomorphism and interactivity positively influence parasocial interactions with consumers, leading to increased brand credibility, brand attachment, and electronic word-of-mouth promotion. Enhancing these traits in virtual influencers can strengthen emotional connections with consumers and boost brand trust and dependence.	Springer
S41	(Chaihanchanchai et al., 2024)	Unlocking the persuasive power of virtual influencer on brand trust and purchase intention: a parallel mediation of source credibility	Thailand	Quantitative	Brand trust positively influences purchase intention through the mediating effect of source credibility, specifically expertise, trustworthiness, and attractiveness. Additionally, the virtual influencer's attractiveness was identified as the main mediator in this relationship.	Taylor & Francis Online
S42	(Park et al., 2023)	Revisiting the elaboration likelihood model in the context of a virtual influencer: A comparison between high- and low-involvement products	South Korea	Quantitative	The perceived attractiveness significantly influences attitudes towards ads promoted by virtual influencers, and there is a significant online-to-offline dynamics resulting from virtual influencer ads. Additionally, the study revealed that virtual influencers' attractiveness has a positive influence in both high- and low-involvement product scenarios, contrary to conventional assumptions in the Elaboration Likelihood Model.	Wiley Online Library

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S43	(Ahn et al., 2022)	Demystifying Computer-Generated Imagery (CGI) Influencers: The Effect of Perceived Anthropomorphism and Social Presence on Brand Outcomes	USA	Quantitative	Perceived anthropomorphism and social presence of CGI influencers positively influence brand outcomes, specifically affecting attitudes towards endorsement posts and the endorsed brand.	Taylor & Francis Online
S44	(Rodrigo-Martín et al., 2021)	Virtual Influencers as an Advertising Tool in the Promotion of Brands and Products: Study of the Commercial Activity of Lil Miquela	Spain	Mixed-method	Virtual influencers, exemplified by Lil Miquela, are powerful commercial tools, especially for engaging younger audiences and driving consumer desire for products, brands, and lifestyles. Their controlled online presence offers unique advertising opportunities, making them valuable assets in digital marketing.	Scopus
S45	(Sands et al., 2022)	False idols: Unpacking the opportunities and challenges of falsity in the context of virtual influencers	Australia	Conceptual	Virtual influencers offer opportunities for brands to enhance their marketing strategies by leveraging evolving consumer perceptions and creating personalized, interactive experiences to reach new audiences and drive engagement.	ScienceDirect
S46	(Shao, 2024)	From human to virtual: Unmasking consumer switching intentions to virtual influencers by an integrated fsQCA and NCA method	UK	Mixed-method	The study highlighted the importance of balancing AI technology-like, human-like, and social attributes of virtual influencers to enhance consumer engagement and trust, providing valuable guidance for influencer marketing practitioners to customize virtual influencers according to consumer preferences and optimize marketing strategies.	ScienceDirect
S47	(Shen, 2024)	Shall brands create their own virtual influencers? A comprehensive study of 33 virtual influencers on Instagram	China	Mixed-method	Non-branded virtual influencers on Instagram have higher engagement levels compared to branded virtual influencers. As a result, the study suggests that brands should collaborate with existing virtual influencers rather than creating their own to increase customer-brand engagement	Springer
S48	(Shin and Lee, 2023)	Issues of virtual fashion influencers' reproduced bodies: a qualitative analysis based on body discourse	Korea	Qualitative	The study revealed that the bodies of virtual fashion influencers often perpetuate standardized stereotypes, cater to the male gaze, exhibit power dynamics, and reinforce colonial gender hierarchies. This suggests that the representation of virtual fashion influencers' bodies is influenced by and contributes to societal norms and power structures related to gender, race, and cultural perceptions.	Springer
S49	(Wan and Jiang, 2023)	Can Virtual Influencers Replace Human Influencers in Live-Streaming E-Commerce? An Exploratory Study from Practitioners and Consumers' Perspectives	China	Mixed-method	Consumers did not view virtual influencers more favorably than human influencers in live-streaming e-commerce, contradicting industry practitioners' beliefs.	Taylor & Francis Online

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S50	(Xie-Carson, Magor, et al., 2023)	All hype or the real deal? Investigating user engagement with virtual influencers in tourism	Australia	Quantitative	Users engage more with humanlike virtual influencers in tourism marketing. Factors such as human likeness, presentation of tourism context, and textual content influence user preferences for virtual influencers. The study did not find evidence of the "uncanny valley" effect, suggesting that advanced CGI technology can create engaging virtual influencers.	Science Direct
S51	(Feng et al., 2024)	AI Influencers in Advertising: The Role of AI Influencer-Related Attributes in Shaping Consumer Attitudes, Consumer Trust, and Perceived Influencer–Product Fit	USA	Mixed-method	Consumers perceive AI influencers based on attributes such as admiration, appreciation of content, comparison to other influencers, speculation about identity, and mixed feelings towards the AI influencer. These attributes play a significant role in shaping consumer attitudes, trust in the influencer, and perceived fit between the influencer and the products they endorse.	Taylor & Francis Online
S52	(Yi and Lee, 2023)	A Study on the Regulatory Fit Effects of Influencer Types and Message Types	South Korea	Quantitative	Combination of influencer types (human vs. virtual) and message types (rational vs. emotional) significantly influences consumer attitudes, particularly in terms of sharing and purchase intentions. Additionally, the interaction between these factors and consumer regulatory focus plays a crucial role in shaping consumer attitudes towards influencer content on social media platforms.	Taylor & Francis Online
S53	(Yu et al., 2024)	Artificial intelligence-generated virtual influencer: Examining the effects of emotional display on user engagement	China	Quantitative	The study found that emotional expressions, such as happiness, sadness, disgust, and surprise, by CGI influencers significantly impact user engagement on social media platforms. The research highlighted the importance of emotional displays in influencing user interactions with virtual influencers, providing valuable insights for designing AI-generated content for marketing purposes.	ScienceDirect
S54	(Zhou et al., 2024)	Mere copycat: The effects of human versus human-like virtual influencers on brand endorsement effectivenesss: A moderated serial-mediation model	China	Quantitative	Human-like virtual influencers have a negative impact on brand endorsement effectiveness compared to human influencers. This negative effect is mediated by weakened emotional engagement and parasocial relationships. Additionally, the post-content modality (video vs. image) of influencers can influence brand endorsement effectiveness, with videos enhancing emotional engagement and parasocial relationships, leading to more effective brand endorsements.	Science Direct
S55	(Miyake, 2023)	I am a Virtual Girl from Tokyo: Virtual Influencers, Digital Orientalism, and the (Im)materiality of Race and Gender	Scotland	Qualitative	The study found that virtual influencers like Imma play a role in shaping gender and racial ideologies in digital consumption, highlighting the impact of digital Orientalism and the (im)materiality of race and gender in online spaces.	Google Scholar

Table E1. (*Continued*).

SID	Authors and year	Study title	National regional	Methodology	Key findings	Data provider
S56	(Mouritzen et al., 2024)	Virtual influencer marketing: the good, the bad and the unreal	Denmark, Finland	Conceptual	The study highlighted the opportunities and risks of using virtual influencers in social media marketing, emphasizing the need for transparency and ethical practices. They defined unique attributes of virtual influencers and proposed future research directions related to consumer behavior and relationships with virtual influencers.	Scopus
S57	(Barari, 2023)	Unveiling the dark side of influencer marketing: how social media influencers (human vs virtual) diminish followers' well-being	Australia	Mixed-method	The study found that virtual influencer posts lead to lower levels of negative emotions and well-being compared to human influencer posts. Fear of missing out (FOMO) mediates the relationship between influencer marketing and consumer well-being. Regulatory focus moderates this relationship, with a lower impact on well-being among prevention-focused individuals.	Google Scholar
S58	(Liyanaarachchi et al., 2024)	Virtual influencers and data privacy: Introducing the multi-privacy paradox	UK, France, Italy	Qualitative	The study identified concerns about data privacy with virtual influencers, discussed the responsibility for virtual influencers' behavior, highlighted the impact of cybercrime and fake profiles on privacy perceptions, and introduced the concept of the multi-privacy paradox in the context of virtual influencers within the metaverse.	Science Direct
S59	(Gerrath et al., 2024)	Virtual influencers and pro-environmental causes: The roles of message warmth and trust in experts	UK	Mixed-method	Virtual influencers, when perceived as warm and trustworthy, can effectively promote pro-environmental causes and engage audiences in sustainable behaviors. Trust in experts plays a crucial role in influencing individuals' responses to messages from virtual influencers regarding environmental initiatives.	Science Direct
S60	(Belova, 2021)	Virtual influencers in multimodal advertising	Ukraine	Unclear	The study found that virtual influencers, created using advanced technologies, are increasingly used in social media marketing to appeal to millennials. These digital identities, designed to resemble real people, are popular due to their novelty. The future of virtual influencers may involve combining CGI and AI for automated communication with followers. Understanding the demographics of the target audience is crucial for effective use of virtual influencers in advertising.	Google Scholar