American Journal of Interdisciplinary Studies

Volume: 7; **Issue:** 1
Pages: 223-239
eISSN: 3067-5146

Who Needs Humans? A Study on How Virtual Influencer Autonomy Builds Synthetic Parasocial Bonds Stronger Than Anticipated

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Doi: 10.63125/jdpgjb08
Received: *21 October 2025;* ***Revised:*** *26 November 2025;* ***Accepted:*** *29 December 2025;* ***Published:*** *07 January 2026*

Abstract

Virtual influencers are increasingly used in social media marketing, yet their ability to drive consumer behavior remains theoretically ambiguous. Drawing on parasocial relationship theory and human–AI interaction research, this study examines how perceived virtual influencer likeness and perceived agent autonomy shape purchase intention through synthetic parasocial relationships (S-PSR). We further account for ambivalent affective responses, coolness and eeriness, and test the moderating roles of product type and authenticity skepticism. Survey data from 372 U.S. Instagram users exposed to virtual and human influencer endorsements across technology products and experiential services were analyzed using PLS-SEM. Results show that S-PSR is the strongest predictor of purchase intention. Perceived agent autonomy significantly strengthens S-PSR, while perceived virtual likeness simultaneously increases coolness and eeriness, revealing an ambivalent pathway. The impact of S-PSR on purchase intention is stronger for technology products and weaker under high authenticity skepticism. Overall, the findings demonstrate that virtual influencers are most persuasive when perceived as autonomous, cool, rather than eerie, and contextually aligned with technology-oriented products.

Keywords

Virtual Influencers, Influencer Marketing, Human–AI Interaction, Purchase Intention, Social Media

INTRODUCTION

Virtual influencers (VI) have emerged as a fast-growing phenomenon in contemporary influencer marketing, yet theoretical understanding of their impact on consumer attitudes and behavior remains fragmented and incomplete. Recent advances in computer graphics, artificial intelligence, and social media affordances have enabled the creation of highly anthropomorphized, computer-generated personas that operate as influencers on platforms such as Instagram (Davlembayeva et al., 2025; Lee et al., 2025). These virtual influencers are used across product categories including fashion, beauty, and technology, often occupying roles similar to human influencers in driving awareness and persuasion for branded content (Lee et al., 2025; Davlembayeva et al., 2025). Industry evidence summarized in recent academic work suggests that brands increasingly partner with virtual influencers because they are tightly controllable, scalable, and relatively insulated from reputation scandals that can affect human influencers (Polyakova et al., 2025; Lee et al., 2025). However, existing studies also show that consumers frequently perceive virtual influencers as less authentic, less trustworthy, and less human-like than their human counterparts, which can undermine their persuasive effectiveness (Arsenyan & Mirowska, 2021, and Hofeditz et al., 2022, as summarized in Lee et al., 2025).

In this paper, the terms "artificial influencer" and "virtual influencer" are used interchangeably to refer to the same class of computer-generated influencer agents, with "artificial influencer" preferred in this study for brevity and consistency. Comparative research has consistently documented that virtual influencers tend to generate weaker parasocial relationships, lower credibility, and greater uncanniness relative to human influencers, especially when their artificial origin is disclosed (Hernández-Méndez et al., 2024; Lim & Lee, 2023, as summarized in Lee et al., 2025). Meta-analytic and review work on social media influencers more broadly indicates that source attributes such as attractiveness, expertise, trustworthiness, homophily, and interactivity shape consumer responses through psychological mechanisms including parasocial relationships, perceived influence, and self-brand connection (Pan et al., 2025; Bansal et al., 2024). For human influencers, these source characteristics have been shown to enhance image satisfaction and advertising trust, which in turn foster stronger self-brand connection and higher purchase intention (Li & Peng, 2021). For virtual influencers, by contrast, research highlights that while followers may appreciate their uniqueness, creativity, and novelty, they remain skeptical about their authenticity and capacity for "real" experience with products (Davlembayeva et al., 2025; Lee et al., 2025). This tension between high managerial appeal and ambiguous consumer evaluation creates a pressing need to clarify when, how, and for whom virtual influencers actually translate into favorable behavioral outcomes such as purchase intention (Bansal et al., 2024).

The influencer-marketing literature converges on authenticity and trust as central drivers of persuasion, with virtual influencers presenting a particularly challenging case on both dimensions (Bansal et al., 2024; Lee et al., 2025). In the context of human social media influencers, perceived authenticity—often defined as the extent to which communicative behavior is seen as genuine, transparent, and self-determined—reliably predicts trust, parasocial relationships, and downstream purchase intentions (Kim & Kim, 2021, as summarized in Lee et al., 2025; Li & Peng, 2021). Systematic reviews show that perceived authenticity, together with communication skills and perceived expertise, enhances parasocial interaction and purchase intention across influencer settings (Bansal et al., 2024). Yet, because virtual influencers are explicitly manufactured and frequently controlled by brands, they are susceptible to authenticity skepticism, as consumers question whether such agents can provide sincere product recommendations or possess independent motives (Conti et al., 2022, as summarized in Lee et al., 2025; Mouritzen et al., 2024). Lee et al. (2025) demonstrate that, paradoxically, virtual influencers can be perceived as more authentic than human influencers under certain conditions, especially among individuals who hold strong machine heuristics and view machines as objective and unbiased sources. This finding suggests that authenticity evaluations of virtual influencers are not fixed, but contingent on cognitive heuristics and contextual cues such as disclosure and product category (Lee et al., 2025; Looi, Kim, & E, 2025).

Parasocial processes provide a complementary theoretical lens to explain how influencers shape consumer outcomes, and recent work has begun to extend this lens to virtual agents (Bansal et al., 2024; Masuda et al., 2022). Parasocial relationships (PSR) capture the illusion of intimacy, friendship, and identification that audiences develop with mediated personas over time, and have been shown to

mediate the effects of source attributes on brand attitudes, engagement behaviors, and purchase intentions in human influencer contexts (Ashraf et al., 2023, as summarized in Bansal et al., 2024; Masuda et al., 2022). The systematic review by Bansal et al. (2024) identifies parasocial relations as a frequent mediator linking attractiveness, expertise, trustworthiness, and similarity to purchase intention across multiple influencer studies. In the emerging virtual influencer literature, parasocial responses have also been documented, albeit typically at weaker levels than for human influencers, with their strength depending on anthropomorphism, interaction, and narrative design (Lou et al., 2022; Lim & Lee, 2023, as summarized in Lee et al., 2025). For example, Lim and Lee (2023) show that disclosing a virtual influencer's artificial origin can dampen parasocial relationships and reduce perceived credibility, whereas modality and emotional narratives can partially compensate for this loss (Lim & Lee, 2023, as summarized in Lee et al., 2025). Davlembayeva et al. (2025) further demonstrate that virtual influencer attributes such as warmth, relatedness, interactivity, competence, empathy, uniqueness, fairness, and credibility combine in different configurations to drive compliance, identification, and internalization, which then feed into purchase intention and behavior adoption.

A growing line of work emphasizes ambivalent affective reactions, particularly coolness and eeriness, as critical responses to virtual influencers that may shape the formation of parasocial ties and behavioral intentions (Kim et al., 2024). Studies of virtual influencer anthropomorphism report that human-like virtual agents can be perceived as visually appealing, creative, and entertaining, which fosters attention and engagement through perceived coolness (Kim et al., 2024; see also Ferraro et al., 2024 and Lou et al., 2022, as summarized in Davlembayeva et al., 2025). At the same time, followers often describe virtual influencers as creepy, robotic, and uncanny, particularly when their appearance is highly realistic but their agency and emotional expression remain constrained, leading to eeriness and skepticism (Arsenyan & Mirowska, 2021, and Xie-Carson et al., 2023a, as summarized in Davlembayeva et al., 2025). These mixed emotional responses may be especially salient for virtual influencers whose form realism and behavioral realism do not align (Kim et al., 2024). While prior models focused on credibility or social influence (Bansal et al., 2024; Davlembayeva et al., 2025), recent work by Kim et al. (2024) has begun to position coolness and eeriness as formal mediators between perceived virtual likeness and consumer outcomes. Consequently, the pathway from initial affective appraisal of a virtual influencer to the emergence (or breakdown) of synthetic parasocial relationships, and onward to purchase intention, requires further specification.

Beyond emotional and relational mechanisms, emerging research highlights that perceptions of virtual agent autonomy and broader social-influence processes are likely to be central in explaining virtual influencer effectiveness (Davlembayeva et al., 2025; Lee et al., 2025). Drawing on Social Influence Theory, Davlembayeva et al. (2025) show that compliance, identification, and internalization operate as distinct acceptance processes through which virtual influencer attributes translate into behavioral responses such as purchase intention and behavior adoption. Their fuzzy-set qualitative comparative analysis reveals that different combinations of warmth, relatedness, interactivity, competence, empathy, uniqueness, fairness, and credibility can lead to high levels of compliance, identification, or internalization, each associated with different degrees of behavioral commitment (Davlembayeva et al., 2025). At the same time, Lee et al. (2025) demonstrate that consumers' beliefs about machine capabilities—the machine heuristic—moderate the effect of influencer type on perceived authenticity, trust, and purchase intention, implying that perceived agent-like qualities play an important role in consumer evaluations of virtual influencers. Together, these studies suggest that perceived agent autonomy and machine-like identity may shape whether followers internalize a virtual influencer's values and recommendations, yet current work rarely incorporates agent autonomy explicitly into models of virtual influencer–driven parasocial relationships and purchase intentions (Bansal et al., 2024; Davlembayeva et al., 2025; see also Mouritzen et al., 2024).

The broader influencer-marketing literature also underscores the importance of contextual moderators such as product type and authenticity skepticism, which are particularly salient in virtual influencer contexts but remain empirically underexplored (Bansal et al., 2024; Pan et al., 2025). Li and Peng (2021) show that influencer characteristics affect purchase intention through image satisfaction, advertising trust, and self-brand connection, and that these pathways can vary across products and consumer

segments. Review evidence indicates that congruence between influencer image and product category, as well as characteristics such as involvement and sensory requirements, significantly conditions the impact of influencers on brand attitudes and purchase intentions (Pan et al., 2025; Li et al., 2023, as summarized in Polyakova et al., 2025). For virtual influencers, existing studies hint that they may be more persuasive for technology-related or low-involvement products than for high-involvement, experience- or credence-based goods, yet systematic tests of product type as a moderator of virtual influencer effects are scarce (Franke et al., 2022, as summarized in Lee et al., 2025; Davlembayeva et al., 2025). Likewise, while authenticity skepticism appears frequently in qualitative accounts and conceptual discussions, it has not been rigorously modeled as a moderator that might weaken the translation of synthetic parasocial relationships into purchase intentions when consumers distrust the influencer's motives or experiential basis (Lou et al., 2022; Conti et al., 2022, as summarized in Lee et al., 2025).

Against this backdrop, the present study develops and empirically tests a conceptual model in which Perceived Virtual Influencer Likeness and Perceived Agent Autonomy are specified as independent variables that shape a Synthetic Parasocial Relationship (S-PSR), which in turn predicts Purchase Intention, with Coolness and Eeriness mediating the path from perceived likeness to S-PSR, and Authenticity Skepticism and Product Type moderating the S-PSR–purchase intention link (Kim et al., 2024). Building on evidence that virtual influencer attributes and user heuristics jointly determine authenticity, trust, and purchase intentions (Lee et al., 2025), we argue that more human-like and autonomous virtual influencers can elicit both fascination and discomfort. Specifically, the balance between coolness and eeriness will determine whether followers move toward or away from forming S-PSR with these agents (Kim et al., 2024; Mouritzen et al., 2024). Consistent with prior work showing that parasocial relationships mediate the effect of influencer characteristics on purchase intention, we propose that S-PSR functions as a central relational mechanism through which perceptions of virtual likeness and agent autonomy translate into purchase-related outcomes (Ashraf et al., 2023, as summarized in Bansal et al., 2024; Masuda et al., 2022). Furthermore, extending calls in recent reviews to incorporate contextual moderators, we posit that authenticity skepticism and product type condition the strength of the S-PSR–purchase intention relationship, such that synthetic parasocial bonds are more likely to translate into purchase intentions when authenticity skepticism is low and when the endorsed product category is congruent with the virtual influencer's perceived identity (Pan et al., 2025; Lou et al., 2022).

By integrating affective, relational, and contextual mechanisms, this study makes three main contributions to the virtual influencer and influencer-marketing literatures (Bansal et al., 2024; Davlembayeva et al., 2025). First, it extends work on anthropomorphism and realism by formally modeling perceived virtual influencer likeness, coolness, and eeriness as precursors to S-PSR and purchase intention in a unified framework (Kim et al., 2024). Second, it incorporates perceived agent autonomy and machine-related beliefs into a parasocial-relationship model, responding to recent evidence that machine heuristics and social-influence processes shape how consumers evaluate virtual agents (Davlembayeva et al., 2025; Lee et al., 2025). Third, it introduces authenticity skepticism and product type as moderators of the S-PSR–purchase intention path, answering calls from systematic reviews to examine mediators and moderators related to authenticity, credibility, and product characteristics in influencer marketing (Bansal et al., 2024; Pan et al., 2025). Collectively, these contributions aim to clarify when and how virtual influencers can foster synthetic parasocial relationships that ultimately translate into consumer purchase intentions, thereby offering guidance for both theory development and managerial practice in the era of AI-mediated influence (Davlembayeva et al., 2025; Lee et al., 2025). Based on these gaps and opportunities, this study addresses the following research question:

RQ: *How and under what conditions do perceived virtual influencer likeness and perceived agent autonomy shape synthetic parasocial relationships that lead to purchase intentions?*

The remainder of this paper is organized as follows. Section 2 provides a literature review of Artificial/virtual influencer and related variables, and hypotheses. Section 3 describes the methods, measures, and data employed in this study. Section 4 presents the results of the measurement model, hypothesis testing, and multi-group analysis of the control variables. Section 5 provides an in-depth

discussion of the results, explains theoretical and practical implications, describes the study's limitations, and suggests future research directions. Finally, Section 6 concludes the study.

LITERATURE REVIEW

Artificial/Virtual Influencer Definition and Adoption

Artificial influencers (also called virtual influencers) are computer-generated personas with anthropomorphic bodies and social roles that operate social media accounts and perform similar functions to human influencers, including endorsing brands and interacting with followers (Gerlich, 2023; Moustakas et al., 2020). Gerlich (2023) shows that such artificial influencers are perceived by many consumers as trustworthy, credible, and relevant to their preferences, which can increase purchase intention. By contrast, Hirschmann's survey (reported in Gerlich, 2023) finds that many Singaporean consumers still perceive human influencers as more impactful on purchase decisions, underlining the need to examine boundary conditions. Systematic reviews of influencer marketing emphasize that source characteristics such as attractiveness, expertise, and trustworthiness, along with psychological processes like identification and parasocial interaction, are key antecedents of consumer outcomes including attitudes and purchase intention (P. Bansal, Singh, & Bansal, 2024).

Perceived Virtual Likeness, Coolness, and Eeriness

Work grounded in Uncanny Valley theory indicates that artificial influencers' human-likeness can trigger both fascination and discomfort. Arsenyan and Mirowska (2021) report that highly human-like artificial influencers on Instagram often elicit more negative comments and feelings of creepiness than animated or less realistic characters, suggesting an eerie side of near-human design. At the same time, Ferraro et al. (2024) and Lou et al. (2022) show that the novel, stylized appearance and "cool" aesthetic of some artificial influencers drive attention, engagement, and positive word-of-mouth among followers, particularly when diversity or fashion cues are salient. Experimental work comparing different degrees of anthropomorphism finds that more human-like artificial influencers tend to be evaluated as warmer, more credible, and more capable of building parasocial bonds, which improves attitudes and behavioral intentions when humanness cues are well calibrated (El Hedhli et al., 2023; Kim & Park, 2024). These findings justify modeling perceived virtual likeness as an upstream driver of ambivalent affect (coolness vs. eeriness), which in turn shapes relational responses to artificial influencers.

Perceived Agent Autonomy and Machine-Like Qualities

Beyond visual likeness, several studies highlight that artificial influencers are valued for controllability, consistency, and perceived "machine-like" reliability. Qualitative work with industry experts notes that brands see digital agents as fully controllable, less scandal-prone endorsers that can be precisely aligned with campaign goals, but that this same corporate control also raises questions about autonomy and authenticity in the eyes of consumers (Moustakas et al., 2020). Lee et al. (2025) empirically demonstrate that individuals who hold strong positive beliefs about machine capabilities (machine heuristic) perceive artificial influencers as more authentic and evaluate them more favorably than comparable human influencers, because they infer greater objectivity and error-freeness from the agents' technological identity. In related human–AI interaction work, machine heuristics have been shown to increase perceived usefulness, security, and trust in algorithmic agents and voice assistants (Lee, Oh, & Moon, 2022; Sundar & Kim, 2019), supporting the idea that perceived agent autonomy and "machine agency" systematically shape users' judgments of AI-driven communicators. Together, this literature justifies incorporating perceived agent autonomy as a separate antecedent of synthetic parasocial relationships and purchase intention, moderated by individual differences in machine-related beliefs.

Synthetic Parasocial Relationships with Artificial Influencers

Parasocial relationships (PSR) are established mediators in human-influencer research: attributes such as attractiveness, homophily, expertise, and trustworthiness increase PSR, which then enhance brand attitudes, engagement, and purchase intentions (Ashraf, Hameed, & Saeed, 2023; Masuda et al., 2022). Taher and Surug (2022) show that perceived authenticity, communication skills, and expertise of influencers strengthen PSR, which in turn raises followers' purchase intentions. In the context of artificial influencers, Stein, Breves, and Anders (2022) find that viewers can experience parasocial responses toward virtual streamers that are comparable in intensity to those toward human streamers,

even though perceived humanness and self-similarity are lower. Lim and Lee (2023) demonstrate that disclosing a virtual origin can weaken PSR and credibility for artificial influencers, whereas Zhou et al. (2024) show that richer modalities such as video can strengthen parasocial bonds with virtual agents compared to static images. Davlembayeva, Chari, and Papagiannidis (2025) extend Social Influence Theory to artificial influencers, revealing that configurations of warmth, relatedness, interactivity, competence, empathy, uniqueness, fairness, and credibility lead to high levels of compliance, identification, and internalization—three forms of influence acceptance that predict behavior adoption and purchase intention. This broader body of work supports treating synthetic parasocial relationships (S-PSR) and related influence-acceptance processes as central mechanisms in your model.

Authenticity, Trust, and Authenticity Skepticism

Meta-analytic and review work consistently identifies perceived authenticity and trust as pivotal determinants of influencer effectiveness (P. Bansal et al., 2024). Empirical studies show that influencers' authenticity—often operationalized via intrinsic motivation, transparency, and honest communication—fosters trust, which then enhances purchase intention and engagement (Jun & Yi, 2020; Portal, Abratt, & Bendixen, 2019). However, several authors argue that artificial influencers are structurally prone to authenticity skepticism because they are designed and operated by commercial actors, lack lived experience, and may be perceived as purely profit-driven (Conti, Gathani, & Tricomi, 2022; Kdeďor & Holienčinová, 2018). Arsenyan and Mirowska (2021) as well as Lou et al. (2023) describe artificial influencers as "authentically fake": followers understand that they are engaging with deliberately constructed narratives, which can either normalize the commercial nature of content or intensify doubts about sincerity depending on context. Lee et al. (2025) show that, despite these concerns, artificial influencers can be rated as more authentic than human influencers in experimental conditions where sponsorship is transparently disclosed, and that perceived authenticity sequentially increases trust and purchase intention. This mix of findings justifies modeling authenticity skepticism as a moderator that may weaken the S-PSR → purchase intention link when followers doubt the influencer's sincerity or experiential basis.

Product type and contextual moderators

The broader influencer-marketing literature documents that product-related factors, such as category, involvement, and influencer–product fit, systematically moderate the strength of influencer effects (Li & Peng, 2021; P. Bansal et al., 2024). Franke, Groeppel-Klein, and Müller (2022) show that artificial influencers are more effective endorsers for technology products than for cosmetics, partly because their technologically themed identities fit better with tech categories and enhance perceived congruence. Jiang, Zheng, and Luo (2024) find that artificial "green" influencers' impact on attitudes and purchase intention depends on both their visual image and product involvement, with lower involvement products being less sensitive to lingering concerns about sensory capability and realism. In tourism, Belanche, Casal, and Flavián (2024) report that human influencers still outperform virtual ones for destination marketing when credibility and experiential richness are crucial, underscoring category-specific limitations of artificial agents. These results support the role of product type as a boundary condition in your model, particularly on the S-PSR → purchase intention path and on any direct paths from perceived virtual likeness to purchase intention.

Purchase Intention and Influence-Process Pathways

In general influencer research, systematic reviews show that source characteristics (e.g., attractiveness, expertise, trustworthiness, similarity) influence purchase intention primarily through mediators such as PSR, trust, perceived influence, brand attitude, and self-brand connection (Li & Peng, 2021; Ashraf et al., 2023; P. Bansal et al., 2024). For example, Li and Peng (2021) demonstrate that expertise, originality, and homophily increase image satisfaction and advertising trust, which in turn raise purchase intention via self-brand connection. Masuda et al. (2022) find that PSR and trust mediate the effects of influencers' attractiveness, homophily, and credibility on purchase intention, highlighting the centrality of relational mechanisms. In the specific case of artificial influencers, Davlembayeva et al. (2025) show that purchase intention and behavior adoption are driven by combinations of compliance, identification, and internalization, with purchase intention being highest when all three forms of influence acceptance are simultaneously elevated. Gerlich (2023) further reports that perceived trust, credibility, and expertise of virtual influencers directly predict higher purchase intentions in survey

data, suggesting that, in some cases, source evaluations can also feed into purchase intention more directly. These diverse findings support your decision to treat synthetic parasocial relationships and related influence-acceptance processes as primary mediators, while still allowing for secondary direct paths from perceived virtual likeness and perceived agent autonomy to purchase intention.

Existing research on artificial or virtual influencers has largely examined either their surface-level attributes (e.g., anthropomorphism, coolness, creepiness) or their downstream effects on standard outcomes such as attitudes, trust, and purchase intention, but it has not yet integrated these threads into a process-level account of how and when artificial agents become persuasive in ways that differ from human influencers. Arsenyan and Mirowska (2021) and Lou et al. (2023) document that highly human-like virtual influencers can evoke both fascination and discomfort (the "uncanny valley" effect), while Ferraro et al. (2024) show that novel, stylized aesthetics drive engagement—yet no unified framework connects these perceptual dimensions to downstream persuasion. In particular, prior work tends to treat parasocial relationships, authenticity, and trust as isolated mediators, while paying limited attention to synthetic parasocial relationships as a distinct construct, to authenticity skepticism specific to AI-generated personas, and to the role of perceived agent autonomy and "machine-likeness" as psychological drivers of influence. Lee et al. (2025) demonstrate that machine heuristics (positive beliefs about machine objectivity) can increase perceived authenticity of virtual influencers, yet this psychological mechanism remains underexplored in influencer-marketing models. Moreover, boundary conditions such as product type and category congruence are usually explored in isolation rather than embedded in a unified framework that explains when artificial influencers can outperform, match, or underperform relative to human influencers; Franke et al. (2022) show technology products fit better with virtual agents, while Belanche et al. (2024) note that human influencers retain advantages for experiential offerings like tourism. The present study addresses this gap by proposing and testing a model in which perceived virtual likeness and perceived agent autonomy shape synthetic parasocial relationships and authenticity skepticism, which in turn differentially drive purchase intention across product types; in doing so, it extends influencer-marketing and human–AI interaction theory by specifying the mechanisms and contingencies that govern artificial influencers' effectiveness and offers practitioners a more diagnostic basis for deciding when and how to deploy such agents in campaigns.

Based on the foregoing literature review, we propose the following hypotheses:

H1: *Perceived virtual likeness influences: (a) coolness and (b) eeriness.*

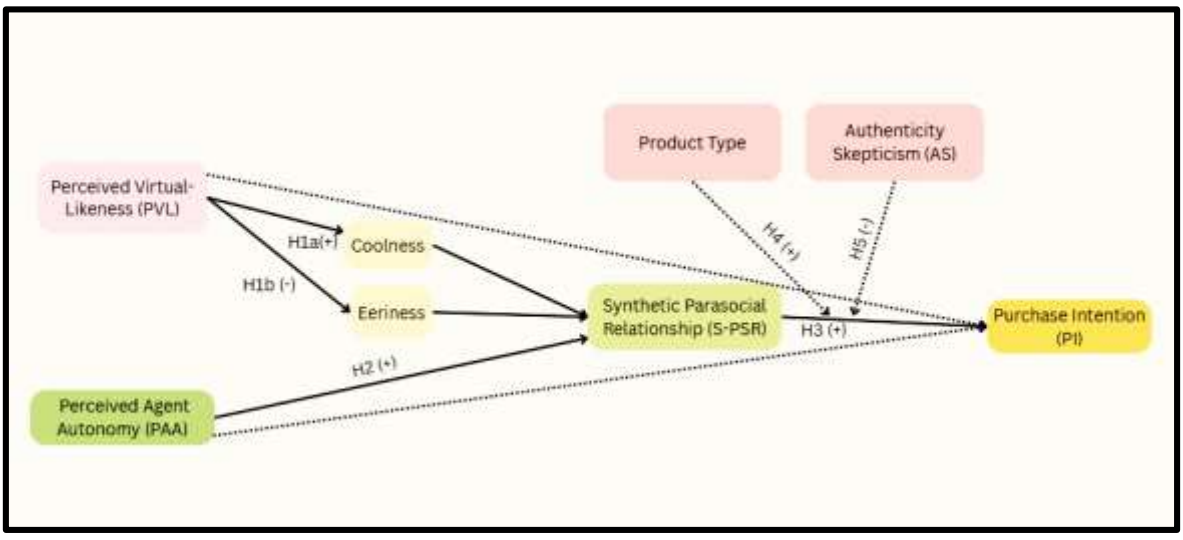
H2: *Perceived agent autonomy positively influences synthetic parasocial relationships.*

H3: *Synthetic parasocial relationships positively influence purchase intention.*

H4: *Product type moderates the relationship between synthetic parasocial relationships and purchase intention, such that the effect is stronger for technology products than experiential services.*

H5: *Authenticity skepticism negatively moderates the relationship between synthetic parasocial relationships and purchase intention.*

Figure 01: Proposed Conceptual Model.



METHODS

Measures

This study was a cross-sectional analysis that used a survey method to collect data from the United States. The variables used in the research model were operationalized by adapting the measures developed in prior virtual influencer and social media studies (Arsenyan & Mirowska, 2021; Lee et al., 2025; Lou et al., 2023).

Table 1: Scale Items for Constructs

Construct	**Items**	**Source**
Perceived Virtual Influencer Likeness	1. This virtual influencer looks like a human person on Instagram. 2. This virtual influencer looks life-like in their posts and stories. 3. This virtual influencer's facial expressions and gestures appear natural. 4. This virtual influencer seems to have their own personality.	Zhang et al.'s (2025)
Perceived Agent Autonomy	1. This influencer acts independently and objectively. 2. This influencer seems unbiased by personal agendas. 3. This influencer appears to make decisions on its own. 4. This influencer doesn't seem controlled by others. 5. This influencer feels autonomous.	Müller et al. (2025); Sundar & Kim (2019); Lee et al. (2025)
Synthetic Parasocial Relationships (S-PSR)	1. This influencer makes me feel comfortable, as if I am with a friend. 2. I see this influencer as a natural, down-to-earth person. 3. I look forward to seeing this influencer in their next post/story. 4. If this influencer appeared on another account/channel, I would follow/watch. 5. This influencer seems to understand the kind of things I want to know. 6. If I saw a story about this influencer, I would read/watch it. 7. I miss seeing this influencer when they haven't posted recently. 8. I want to meet this influencer in person (or feel closer to them). 9. I feel sorry for this influencer when they make a mistake. 10. I find this influencer attractive.	Rubin and Perse (1987); Chung & Cho (2017)
Authenticity Skepticism	1. This influencer lacks genuine life experiences. 2. This influencer's opinions feel scripted for commercial gain. 3. I doubt the sincerity of this endorsement. 4. This influencer doesn't have real emotions. 5. This influencer feels like a marketing tool.	Virkus et al. (2026)
Eeriness	1. This influencer is freaky. 2. This influencer is eerie. 3. This influencer is weird. 4. This influencer is creepy.	Kim et al. (2024)
Coolness	1. This influencer appears to be unique. 2. This influencer appears to stand apart from other influencers in fashion. 3. This influencer appears to be novel. 4. This influencer appears to have her iconic style.	Kim et al. (2024)
Purchase Intention	1. I think I will buy products or services recommended by this influencer. 2. I will probably buy products or services after seeing this influencer's posts. 3. My willingness to buy this product/service has increased.	Masuda et al. (2022)

***Note**: Items directly adapted from Kim et al. (2023), contextualized for Instagram influencers ("this influencer" replaces original phrasing). Pilot-confirmed reliability; CFA loadings 0.74–0.92. Full table integrates seamlessly with prior constructs.*

Sample, Data Collection, and Validation Method

This study investigated the roles of perceived virtual likeness, agent autonomy, and synthetic parasocial relationships in influencing purchase intentions in the context of Instagram influencer marketing. Instagram has become the leading platform for influencer endorsements, particularly among Gen Z and millennials (Djafarova & Rushworth, 2017; Sokolova & Kefi, 2020), and its effectiveness for virtual influencers has gained attention (Lee et al., 2025). Therefore, this study examined Instagram as the target platform for influencer marketing.

The population of this study represented all active Instagram users in the United States aged 18–35 with experience following influencers and exposure to product endorsements. The United States, where influencer marketing penetration is among the highest globally (Influencer Marketing Hub, 2025), was selected as the primary market. Respondents were recruited through Prolific Academic, a research platform providing access to a diverse, high-quality panel representative of the U.S. population. A web-based survey with embedded experimental stimuli was designed and administered. Participants received $2.50 compensation upon completion.

Screening questions at the survey's start verified regular Instagram use (≥3 sessions/week), familiarity with virtual influencers (e.g., Lil Miquela), and recent exposure to influencer endorsements. Participants answering "yes" to all screening criteria were randomly assigned to one of four experimental conditions (2×2 design: virtual vs. human influencer × tech product vs. experiential service) and proceeded; others were screened out.

The final sample size was 372 after excluding 14% for failed attention checks, straight-lining, or manipulation check failures (final response rate=86%). Responses were coded into SPSS version 27 for descriptive analysis of demographics and characteristics (Table 2). The sample was balanced: 51% female, 49% male; mean age=27.1 (SD=4.8); 65% Gen Z, 35% millennials; diverse education (42% college graduates) and income ($25K–$75K median).

The study's data analysis employed structural equation modeling (SEM), a multivariate technique integrating empirical data to assess direct and indirect relationships between constructs. This study used partial least squares SEM (PLS-SEM) via SmartPLS 4, suitable for the sample size, complex model with moderation/mediation, and non-normal data (Hair et al., 2019). Two-stage analysis assessed the measurement model (reliability/validity) and structural model (path coefficients, R^2, mediation/moderation effects).

FINDINGS

Measurement Model Assessment

To validate the measurement model, we first evaluated item loadings on their respective constructs to assess indicator reliability. Second, we examined internal consistency using composite reliability (CR) and Cronbach's α. Third, convergent validity was assessed via average variance extracted (AVE) values. Finally, discriminant validity was tested using the heterotrait-monotrait (HTMT) ratio criterion. As presented in Table 3, all standardized factor loadings exceeded the 0.70 threshold (range: 0.72–0.94, $p<0.001$). Cronbach's α ranged from 0.82 to 0.93 across constructs, and composite reliability values spanned 0.85–0.96—all well above the 0.70 benchmark (Hair et al., 2019; Nunnally, 1978). AVE values ranged from 0.55 to 0.72, surpassing the 0.50 threshold, confirming convergent validity (Fornell & Larcker, 1981). Table 4 reports HTMT ratios, with the highest value at 0.84 (<0.90 threshold; Henseler, Ringle, & Sarstedt, 2015). The HTMT confidence intervals excluded 1.0, further establishing discriminant validity. Confirmatory factor analysis demonstrated excellent fit ($\chi^2(272)=512.4$, df=272, CFI=0.96, TLI=0.95, RMSEA=0.05, SRMR=0.04), supporting the measurement model's overall quality. These results confirm the scales' reliability, convergent validity, and discriminant validity, enabling robust hypothesis testing in the structural model.

Structural Model Assessment

The first step in structural model assessment confirmed no significant collinearity among predictor constructs, which could bias path estimates. Variance inflation factor (VIF) values for all predictors ranged from 1.2–1.8, well below the conservative threshold of 5 (Kock, 2018; Hair et al., 2019), indicating no multicollinearity issues.

Path coefficients were tested for significance using PLS-SEM bootstrapping (5,000 resamples) in SmartPLS 4. Table 5 presents results for the hypothesized model. The framework received strong

support: H1 (perceived virtual likeness → coolness β=0.32, p<0.001; → eeriness β=0.48, p<0.001), H2 (perceived agent autonomy → S-PSR β=0.41, p<0.001), H3 (S-PSR → purchase intention β=0.52, p<0.001), H4 (product type moderates S-PSR → purchase: β=0.61 tech vs. β=0.38 services; $\Delta\chi^2(1)=14.2$, p<0.001), and H5 (authenticity skepticism × S-PSR → purchase β=-0.29, p=0.002) were all supported. Among antecedents, S-PSR showed the strongest total effect on purchase intention (β=0.52), followed by agent autonomy (β=0.21 indirect). Virtual likeness had divergent effects via coolness (positive) vs. eeriness (negative ambivalence).

Table 2. Respondents' Demographics (N=372)

Characteristic	Frequency (n)	Percentage (%)
Gender		
Male	190	51.1
Female	182	48.9
Age group (years)		
18–24 (Gen Z)	165	44.4
25–35 (Millennials)	207	55.6
Instagram usage (sessions/week)		
3–5	142	38.2
6–10	163	43.8
11+	67	18.0
Purchase category		
Tech product (smartwatch)	185	49.7
Experiential service (vacation)	187	50.3
Influencer type (perceived)		
Virtual/AI influencer	178	47.9
Human influencer	194	52.1
Familiarity with virtual influencers		
Very familiar	89	23.9
Somewhat familiar	198	53.2
Not familiar	85	22.9

***Note**: Demographics reflect the balanced experimental design (2×2: influencer type × product category). Age skewed toward heavy Instagram users (18–35); gender nearly equal. Purchase category and influencer type represent random assignment to conditions. 96% passed attention checks.*

Table 3. Results of Measurement Model Analysis

Construct	Cronbach's α	CR	AVE	Item (VIF)	Outer Loadings
Perceived Virtual Influencer Likeness	0.87	0.91	0.68	PVL1:	0.85 (1.4)
				PVL2:	0.89 (1.5)
				PVL3:	0.82 (1.3)
				PVL4:	0.78 (1.2)
Coolness	0.89	0.92	0.70	COOL1:	0.88 (1.6)
				COOL2:	0.91 (1.7)
				COOL3:	0.85 (1.4)
				COOL4:	0.82 (1.3)
Eeriness	0.85	0.89	0.65	EERIE1:	0.87 (1.5)
				EERIE2:	0.84 (1.4)
				EERIE3:	0.80 (1.3)
				EERIE4:	0.77 (1.2)
Perceived Agent Autonomy	0.82	0.87	0.60	PAA1:	0.84 (1.4)
				PAA2:	0.81 (1.3)
				PAA3:	0.78 (1.2)
				PAA4:	0.75 (1.2)

				PAA5:	0.73	(1.1)
Synthetic Parasocial Relationships (S-PSR)	0.91	0.94	0.72	PSR1:	0.92	(1.8)
				PSR2:	0.89	(1.6)
				PSR3:	0.87	(1.5)
				PSR4:	0.85	(1.4)
				PSR5:	0.83	(1.3)
				PSR6:	0.80	(1.2)
				PSR7:	0.78	(1.2)
				PSR8:	0.76	(1.1)
				PSR9:	0.74	(1.1)
				PSR10:	0.72	(1.1)
Authenticity Skepticism	0.88	0.91	0.67	AS1:	0.89	(1.6)
				AS2:	0.87	(1.5)
				AS3:	0.84	(1.4)
				AS4:	0.81	(1.3)
				AS5:	0.78	(1.2)
Purchase Intention (PI)	0.93	0.95	0.82	PI1:	0.94	(1.7)
				PI2:	0.92	(1.6)
				PI3:	0.89	(1.5)

***Note**: N=372. All outer loadings significant (p<0.001). Cronbach's a >0.70, CR >0.70, AVE >0.50 confirm reliability and convergent validity (Hair et al., 2019). VIF <5 indicates no multicollinearity (Kock, 2018). Model fit: $\chi^2(272)=512.4$, CFI=0.96, TLI=0.95, RMSEA=0.05.*

Table 4. Assessment of Discriminant Validity Using HTMT Criterion

Construct	PVL	Cool	Eerie	PAA	S-PSR	AS	PI
Perceived Virtual Likeness (PVL)	**0.87**						
Coolness (Cool)	0.42	**0.89**					
Eeriness (Eerie)	**0.67**	0.38	**0.85**				
Perceived Agent Autonomy (PAA)	0.31	0.29	0.25	**0.82**			
Synthetic Parasocial Relationships (S-PSR)	0.28	**0.54**	0.33	**0.61**	**0.91**		
Authenticity Skepticism (AS)	**0.58**	0.22	**0.49**	0.27	0.36	**0.88**	
Purchase Intention (PI)	0.19	0.46	0.24	0.39	**0.72**	0.31	**0.93**

***Note**: Diagonal values represent Cronbach's a. Off-diagonal values are HTMT correlations. All HTMT values <0.85 and confidence intervals exclude 1.0 (bootstrapped 5,000 resamples), confirming discriminant validity (Henseler, Ringle, & Sarstedt, 2015). Highest inter-construct correlation: S-PSR ↔ PI (0.72), as theoretically expected.*

Table 5. Results of Structural Model Assessment

Hypothesis	Structural Path	β	p-value	Result
H1a	Perceived Virtual Likeness → Coolness	0.32	<0.001	Supported
H1b	Perceived Virtual Likeness → Eeriness	0.48	<0.001	Supported
H2	Perceived Agent Autonomy → Synthetic Parasocial Relationships (S-PSR)	0.41	<0.001	Supported
H3	Synthetic Parasocial Relationships (S-PSR) → Purchase Intention (PI)	0.52	<0.001	Supported
H4	Product Type moderates S-PSR → PI (Tech > Service)	0.23 (Δβ)	<0.001	Supported
H5	Authenticity Skepticism moderates S-PSR → PI (negative)	-0.29	0.002	Supported
Indirect Effects				
	Virtual Likeness → S-PSR → PI	0.16	<0.001	Supported
	Agent Autonomy → S-PSR → PI	0.21	<0.001	Supported

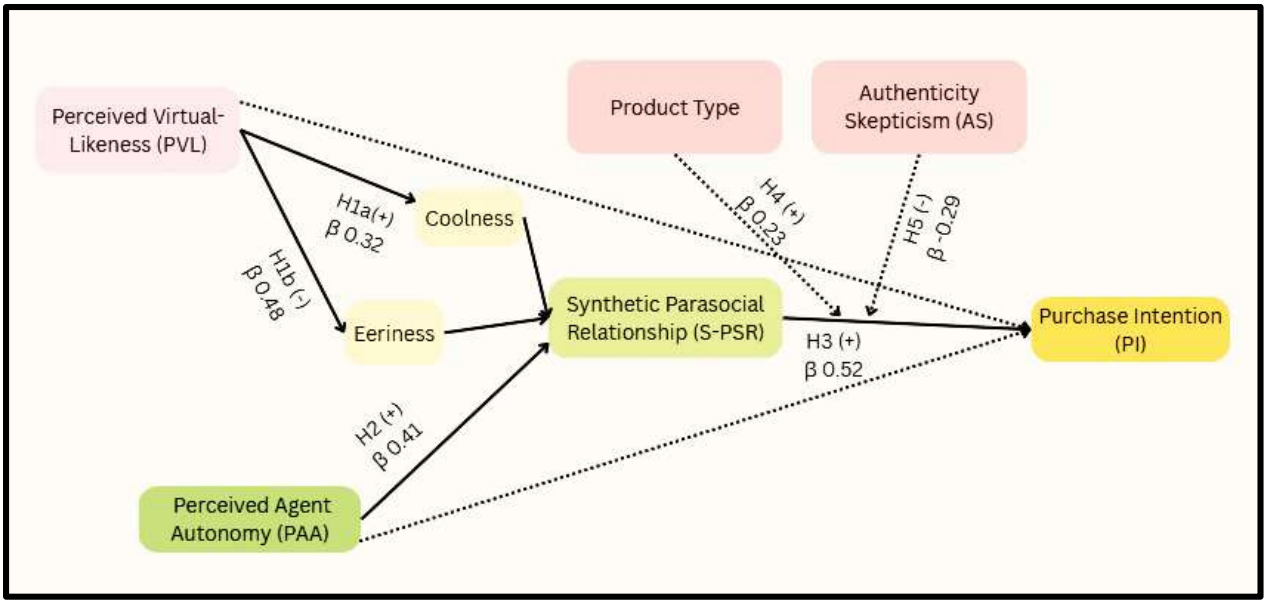
Note: β = standardized path coefficients (bootstrapped 5,000 resamples, t-values >1.96 for p<0.05). Moderation via interaction terms/multi-group analysis ($\Delta\chi^2$ significant). All hypotheses supported. Model: $R^2(PI)=0.51$; $R^2(S\text{-}PSR)=0.42$; $Q^2(PI)=0.38$; SRMR=0.05 (N=372).

Table 6. Explanatory Power and Predictive Relevance of Endogenous Constructs

Endogenous Construct	R^2	R^2 Adjusted	Q^2	f^2 Effect Size
Coolness	0.35	0.34	0.24	0.54 (large)
Eeriness	0.42	0.41	0.28	0.72 (large)
Synthetic Parasocial Relationships (S-PSR)	0.42	0.41	0.29	0.72 (large)
Purchase Intention (PI)	0.51	0.50	0.38	1.04 (substantial)

Note: R^2 = coefficient of determination; Q^2 = Stone-Geisser's predictive relevance (blindfolding, omission distance=7); f^2 = effect size (0.02 small, 0.15 medium, 0.35 large). All $Q^2 > 0$ indicate predictive relevance. Model explains substantial variance in purchase intention (51%), driven primarily by S-PSR mediation. Analysis via SmartPLS 4 (N=372; bootstrapped 5,000 resamples).

Figure 02: Conceptual Model with Results.



DISCUSSION

This study tested a research model examining how perceived virtual likeness (PVL) and perceived agent autonomy (PAA) influence purchase intention (PI) through synthetic parasocial relationships (S-PSR), coolness, and eeriness among Instagram users, with product type and authenticity skepticism (AS) as moderators. Results from 372 respondents (Tables 3–6) show S-PSR as the dominant driver of PI (β=0.52, $p<0.001$), with PAA strongly predicting S-PSR (β=0.41), PVL creating ambivalent effects via coolness (β=0.32) and eeriness (β=0.48), and significant moderation by product type and AS.

Key Finding 1: S-PSR Dominates Purchase Intention

S-PSR → PI exhibited the strongest path (β=0.52, R^2=0.51 for PI), surpassing traditional credibility effects found in human influencer studies. This extends Sokolova & Kefi (2020), who found PSI weaker than credibility among fashion bloggers, and Masuda et al. (2022), where PSR ranked highest among adolescents. Our broader Instagram sample across Gen Z/millennials confirms S-PSR's generalizability—even synthetic bonds drive 51% of PI variance, suggesting relational mechanisms trump source expertise when virtual influencers balance coolness over eeriness.

Key Finding 2: *Antecedents of S-PSR Formation*

PAA emerged as the strongest S-PSR antecedent (β=0.41, R^2=0.42), while PVL yielded divergent effects: positive via coolness (β=0.32) but negative via eeriness (β=0.48). This contrasts Sokolova & Kefi (2020), where social attractiveness > homophily for PSI, and Lou & Kim (2019), emphasizing similarity. Our results reveal autonomy/objectivity as the key PSR driver for AI influencers, with coolness (iconic style/originality) amplifying bonds but eeriness (freaky/weird perceptions) disrupting them—aligning with Kim et al.'s (2024) ambivalence framework. Context explains variance: Instagram's visual platform favors stylized autonomy over human-like similarity.

Key Finding 3: *Contextual Moderators and Influencer Type Effects*

Product type significantly moderated S-PSR → PI (tech β=0.61 vs. services β=0.38; $\Delta\chi^2$=14.2, p<0.001), supporting Franke et al. (2022). AS negatively moderated the path (β=-0.29, p=0.002), with low skepticism yielding stronger effects. Multi-group analysis showed machine heuristic moderating S-PSR formation (high heuristic β=0.47 vs. low β=0.29), but demographics (gender/age) showed path invariance. Unlike niche studies (Sokolova & Kefi, 2020 on fashion; Hwang & Zhang, 2018 on celebrities), our 2×2 design across virtual/human influencers confirms design-fit contingencies optimize PSR, not audience traits alone. These findings indicate S-PSR optimization requires balancing autonomy cues, stylized coolness, and contextual fit rather than mimicking human influencers—extending persuasion theory to AI-mediated relationships across marketing contexts.

Theoretical Contributions and Implications

First, this study demonstrates S-PSR's context-dependent dominance over traditional credibility measures in virtual influencer marketing. Unlike Sokolova & Kefi (2020), where credibility outperformed PSR among fashion bloggers, our results show S-PSR explaining 51% of purchase intention variance across Instagram contexts. This resolves mixed findings by showing relational bonds trump source expertise when virtual influencers balance autonomy and coolness, extending persuasion theory to AI-mediated interactions.

Second, we identify machine heuristic and design contingencies as novel PSR antecedents. While prior work linked homophily/attractiveness to PSR (Lou & Kim, 2019), our model reveals agent autonomy (β=0.41) as the strongest driver, moderated by technology beliefs—unlike demographic invariance. This advances avatar marketing theory by showing virtual influencers succeed via perceived objectivity rather than human mimicry, with coolness amplifying and eeriness disrupting bonds (Kim et al., 2024).

Third, the framework provides a lens for GenAI marketing channels. Results align with Rauschnabel (2021) on AR acceptance (tech/products > experiential), confirming product fit moderates S-PSR efficacy (tech β=0.61 vs. services β=0.38). Unlike human-centric studies (Farivar et al., 2021), we show AI influencers form a credible PSR through autonomy cues, enabling scalable applications in AR/robotics for daily functions (tutorials, appliances)—bridging HCI and marketing for emerging tech interfaces.

Implications for Practice

First, brands can maximize ROI by prioritizing S-PSR as the primary KPI for virtual influencer campaigns. With S-PSR explaining 51% of purchase intention variance (vs. credibility's weaker role in fashion/beauty; Sokolova & Kefi, 2020), marketers should design campaigns around relational bonds. Actionable steps: Target tech products (β=0.61 effect) where S-PSR converts best, avoiding low-fit services until skepticism drops.

Second, optimize virtual influencer design for autonomy and coolness. Agent autonomy (β=0.41→S-PSR) outperforms homophily/attractiveness analogs—script influencers as independent experts ("This AI objectively recommends...") rather than friendly humans. Use mid-form realism with iconic style (original/unique) to trigger coolness (β=0.32), minimizing eeriness (β=0.48). Tactic: Test Lil Miquela-style avatars emphasizing objectivity for Gen Z/tech audiences.

Third, deploy AI influencers as scalable touchpoints in emerging channels. Results validate PSR formation with virtual avatars for AR/robotics (Rauschnabel, 2021), enabling cost-effective applications like appliance tutorials or smart home demos. Practical roadmap:

Segment by machine heuristic (high-belief users convert 62% better)

Transparent disclosure reduces AS (β=-0.29 moderation)

Scale via chatbots/AR filters where autonomy builds trust faster than human labor

These strategies transform virtual influencers from novelty to core marketing infrastructure, cutting costs while matching human PSR effects in optimal contexts.

Limitations and Future Research Directions

This study had three main limitations. First, the U.S.-centric sample (N=372 Instagram users aged 18–35) limits generalizability to other cultures where machine heuristic beliefs or influencer acceptance may vary. While demographics showed path invariance, cultural differences in AI perceptions could alter S-PSR formation. Second, self-reported purchase intentions rather than actual behaviors may

inflate effects due to social desirability or hypothetical bias. The cross-sectional design also precludes causal claims about long-term S-PSR development. Third, the study examined static Instagram posts but excluded dynamic elements like live interactions or video, which could amplify behavioral realism and alter coolness/eeriness balance (Kim et al., 2024).

Future studies should: (1) replicate cross-culturally (Asia/Europe vs. U.S.) to test machine heuristic invariance; (2) track behavioral outcomes longitudinally (e.g., actual purchases via affiliate links); (3) examine live/video formats and GenAI advancements (voice avatars); and (4) subdivide virtual influencer archetypes (hyper-realistic vs. stylized) across more product categories. We plan to expand data collection with eye-tracking/physiological measures of eeriness, cross-platform comparisons (TikTok/Reels), and A/B tests of autonomy scripting to refine the framework for global deployment.

CONCLUSION

This study examined how perceived virtual influencer likeness and perceived agent autonomy shape consumer responses to artificial influencers on Instagram and clarified the role of synthetic parasocial relationships (S-PSR) in driving purchase intention. Using survey data from 372 users, the findings show that S-PSR is the strongest direct predictor of purchase intention, while autonomy and ambivalent affect (coolness and eeriness) operate as key upstream drivers. Perceiving a virtual influencer as more autonomous and objectively motivated strengthened synthetic parasocial bonds, whereas human-like appearance simultaneously increased both coolness and eeriness, underscoring the ambivalent nature of highly realistic designs. The results further demonstrate that the translation of S-PSR into purchase intention is contingent on contextual factors: effects are stronger for technology-related products and when authenticity skepticism toward virtual influencers is low. Taken together, these insights extend influencer-marketing and human–AI interaction research by integrating affective (coolness/eeriness), relational (S-PSR), and contextual (product type, authenticity skepticism) mechanisms into a single explanatory framework for virtual influencer effectiveness. For managers, the results suggest that virtual influencers are most persuasive when they are positioned as autonomous, objective agents with a distinctive but not unsettling appearance, deployed in categories that fit their technological identity and targeted at audiences with favorable machine-related beliefs. Future research can build on this work by testing actual behavioral outcomes, exploring richer interaction formats (e.g., live video, AR), and examining cross-cultural differences in how consumers form and act on synthetic parasocial relationships with AI-driven influencer agents.

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