

Virtual Idols and Virtual Streamers: From the Perspective of Design Features

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ABSTRACT

This study adopted a semi-structured literature review method to distinguish virtual idols and virtual streamers from the perspective of design features and to identify the impact of specific design features on particular marketing outcomes. The results show that both of them emphasize the use of visual nonverbal features, particularly appearance, to enhance user engagement. Virtual idols focus more on the sense of celebrity to build relationships with fans, while virtual streamers prioritize commercial goals by enhancing emotional capacity. This study further clarifies the concepts of virtual idols and virtual streamers and provides design guidelines for marketers under different marketing targets.

Keywords: Virtual idols, virtual streamers, design features, review.

INTRODUCTION

Since the outbreak of the COVID-19 pandemic, the streaming industry has experienced substantial growth as users increasingly turned to online platforms for entertainment and consumption (Ferreira *et al.*, 2022). This rapid transformation has facilitated the expansion of live-streaming platforms, such as YouTube and TikTok, where content ranges from entertainment to product promotion, fostering real-time interaction and user engagement (Tao *et al.*, 2022). The integration of artificial intelligence (AI) has further advanced this industry, transitioning from traditional live-streaming to virtual live-streaming, primarily driven by AI-generated virtual personas. These virtual entities are highly customizable, controllable, and versatile, capable of assuming various roles, including news anchors and entertainers. Among these virtual people, two distinct roles are particularly noteworthy: virtual idols and virtual streamers. Virtual idols are computer-generated media stars developed through exclusive intellectual property (IP) and AI-generated content (AIGC), adapting their performances to align with popular trends (Xia, 2024). They are especially prominent in East Asia, exemplified by figures such as Japan's Hatsune Miku, who engages in entertainment activities like singing and dancing while cultivating dedicated fan communities (Anderson, 2021). In contrast, virtual streamers primarily engage in e-commerce and news broadcasting, conducting live streams to promote products or deliver news content (Gao *et al.*, 2023). Both virtual idols and streamers leverage AI-driven technologies and interactive capabilities, making them highly relevant within the realms of virtual entertainment and commerce.

Virtual Idol and Virtual Streamer: A Lack of Clear Distinction

Despite their distinct application scenarios, virtual idols and virtual streamers share technological and functional similarities, leading to conceptual confusion among scholars. The commonalities between virtual idols and virtual streamers such as AI-generated and interactive capacity have brought challenges to scholars in distinguishing them clearly, resulting in ambiguity and confusion in the conceptual interpretation of them. Consequently, some researchers have conflated the two in their studies, even proposing vague concepts such as "virtual idol streamers" (Liu, 2023; Duan *et al.*, 2024). This conceptual confusion not only hinders scholars from directly comparing the empirical research results of the two but also complicates marketers' tasks in

designing and utilizing more appropriate virtual people for specific marketing goals. Although current research suggests that the difference between the two concepts lies in their usage scenarios and purposes (Kong *et al.*, 2021; Lu *et al.*, 2021), the root cause of this difference may be the design features. Design features refer to the attributes that shape user experiences and engagement (Ter Stal *et al.*, 2020). These features—including appearance (e.g., human-like versus cartoonish) and interactivity (e.g., real-time versus scripted)—significantly influence user perceptions and interactions with virtual idols and streamers. However, the existing literature lacks a comprehensive comparison of these roles through the lens of their design features. The only research available focuses on a taxonomy for virtual streamers from the perspective of stimulation technology (Tao *et al.*, 2022). To address this gap, it is essential to identify the design features that distinguish virtual idols from virtual streamers. This distinction will help mitigate ambiguity in their conceptual definitions, enhance the precision of empirical studies, and provide marketers with clearer guidelines for employing different kinds of virtual personas in various contexts.

Research Objectives

The primary aim of this study is to identify the key design features that differentiate virtual idols from virtual streamers. The secondary objectives include identifying the outcome variables utilized to measure the effects of these design features and examining the specific effects observed for each variable. Based on this, the study proposes two research questions:

RQ1: How can virtual streamers and virtual idols be distinguished based on design features?

RQ2: Which design features are more important to these two terms under specific outcomes?

To answer these research questions, the study aims to conduct a semi-systematic literature review to identify the differences between virtual streamers and virtual idols from the perspective of design features and draw general conclusions on the effects of particular design features across multiple studies. This research can deepen our understanding and distinction between the concepts of virtual idol and virtual streamer, minimizing confusion about their definitions in the current literature. Moreover, this study will improve the accuracy of empirical studies in the field, enabling more precise comparisons and generalizations. By delineating the key design features of these two terms, the study will offer practical insights for designers and marketers to create more effective virtual idols and virtual streamers tailored to specific needs and contexts.

METHOD

This study examines virtual idols and virtual streamers, an emerging and broad field that faces challenges related to the ambiguity of context-based definitions. To address this complexity, a semi-systematic literature review approach is employed, focusing on conceptualizing and synthesizing fragmented studies across various disciplines (Wong *et al.*, 2013). This method aims to integrate disparate interdisciplinary findings concerning virtual idols and streamers, with particular attention to the design features that influence user behavior and commercial outcomes.

Search Strategy

In May 2024, the researchers conducted a comprehensive search using Scopus, the ACM Digital Library, and Web of Science. The search strategy was collaboratively developed and refined by the first, second, and fifth authors. The subject scope for the searches in Scopus and Web of Science was confined to the domains of human-computer interaction (HCI), computer science, social science, communication, e-commerce, and psychology. The keyword search was anchored in three primary terms: (1) virtual streamer, (2) virtual idols, and (3) design features or cues. The final list of search terms was established through multiple revisions and discussions among the first, second, and fifth authors and is presented in Table 1. Given that virtual idols and virtual streamers constitute an emerging research area with a limited body of literature, the search focused on titles and abstracts, with no restrictions on publication dates. Document types were limited to conference papers, journal articles, and book chapters published in English. These criteria were agreed upon by the first, second, and fifth authors. Following the initial screening and considering the scarcity of existing literature, the search scope was further broadened to include Google Scholar and EBSCO. The final database searches were conducted by the first, fourth, fifth, and sixth authors in accordance with their assigned databases.

Screening Strategy

From the articles identified through the database search, the researchers initially removed duplicate entries. Following this, two researchers conducted a systematic screening of the titles, abstracts, and full texts. The inclusion and exclusion criteria for this process were subsequently discussed and agreed upon, as outlined in Tables 2 and 3. Given that the primary focus of this study is on design features, only articles that mentioned the design features of virtual idols and virtual streamers were considered for inclusion. Since this is an emerging field with limited literature explicitly identifying the design features of these two types of virtual people, we extended our scope to include related design features from similar terms such as "avatar" and "virtual agent," which share some similar characteristics with virtual people. These potential design features encompass aspects such as facial expressions, appearance, gaze, and emotional expression (Fabri *et al.*, 2002; Maloney *et al.*, 2020; Cavazza *et al.*, 2022; Tao & Dang, 2022; Wan & Lu, 2024). The first, second, and fourth authors collaboratively determined the scope of potential design features applicable to virtual idols and streamers, which informed the establishment of exclusion criterion E3 (see Table 3). Moreover, as this study also aims to examine the relationship between design features and specific marketing outcomes, an additional inclusion criterion was established, focusing on the marketing outcomes generated by the design features of virtual idols and streamers. These outcomes include changes in user behavior and commercial results. Consequently, exclusion criterion E4 (see Table 3) was developed based on this consideration.

Pilot Testing and Adjusting Search Strategy

Given that virtual idols and virtual streamers are emerging research subjects, their definitions remain a topic of ongoing debate among scholars. To ensure that the search strategy would yield relevant results and allow for adjustments to optimize the search process, a pilot test was conducted prior to the formal comprehensive review. This involved testing the initial search terms and inclusion criteria on a small sample of currently available articles. Based on the findings from this pilot test, the search terms were refined to incorporate broader terms that would capture a more comprehensive range of related research. For example, terms such as "virtual anchor" (similar to virtual streamers), "virtual stars" (analogous to virtual idols), and "virtual digital people" were included to expand the search scope. Once the final search strategy was established, the first, fourth, and fifth authors proceeded with the formal screening process. This study employed a cross-screening method, in which each pair of authors independently screened the same set of samples. After each screening round, the researchers discussed any discrepancies, such as potential design features that fell outside the inclusion criteria, to reach a consensus. For the full-text screening phase, any articles on which consensus could not be reached were reviewed by a fourth researcher (the second author) to ensure a final decision.

Systematic Data Extraction and Categorization

During the data extraction and classification phase, this study identified key data points to be extracted from each article, including the design feature category (e.g., appearance, interactivity), the outcome variables examined (e.g., user engagement, purchase intention), and the research methodology employed (e.g., qualitative or quantitative research). This systematic approach ensured consistency in comparing design features across different studies. Given the diverse design features associated with virtual idols and virtual streamers, thematic analysis was employed to identify and categorize these features effectively. Recognizing that virtual idols and virtual streamers belong to the broader category of virtual entities and share similarities with virtual agents and avatars, the study conducted classification methods from related fields to establish categories for design features. For example, Fabri *et al.* (2002) categorized the features of expressive agents into two primary types: verbal and non-verbal cues. Non-verbal communication is frequently defined as all forms of interaction that extend beyond spoken or written language, encompassing aspects such as body movements, facial expressions, appearance, and gaze (Knapp, 1978; Argyle, 1988). Building on this, Maloney *et al.* (2020) refined the classification of non-verbal cues into three distinct levels: visual, invisible, and auditory. The visual level includes aspects such as appearance, body movements, and environmental cues, while the invisible level pertains to psychological elements like emotional expression, and the auditory level covers voice style. Cavazza *et al.* (2022) further expanded the invisible level of non-verbal cues by incorporating storytelling capacity as a component. Additionally, Tao and Dang (2022) emphasized that the autonomy level of virtual agents is a critical factor in their interactions with users, defining autonomy as the ability to independently engage and exhibit behaviors. In the context of virtual idols and virtual streamers, autonomy can be seen as the capacity to establish an identity and connect with users (Wan & Lu, 2024).

After a thorough review of previous studies, the first, second, third, and fourth authors collaboratively developed a classification framework for the design features of virtual idols and streamers. This framework was organized into three main categories: virtual, non-virtual (subdivided into visual, non-visual, and auditory), and autonomy. The outcome variables identified in the selected articles were categorized into five key areas: intention to engage, behavior change, user attitude, purchase intention, and relationship establishment. This categorization was undertaken through thematic analysis, drawing upon the marketing expertise of the first, fourth, and fifth authors. The resulting categories were cross-referenced with the outcome variables to identify patterns and correlations between design features and specific marketing outcomes. Ultimately, a review table was developed, which classified each study as experimental, survey-based, or qualitative. The structure of this review table was finalized by the two researchers and includes, for each article, the design feature category, specific design features, and the outcome variable studied.

Table 1: Terms used for the database searches

Term [Virtual idols or virtual streamer]	Term
"virtual idols*" OR "virtual streamer*" OR "virtual people*" OR "virtual character*" OR "avatar*" OR "virtual anchor*" OR "virtual star " OR virtual digital people"	AND design features OR cues OR characters OR function OR usage OR factors

Table 2: Inclusion criteria used for the article screenings

Inclusion criteria
I1-The article is written in English
I2-The article is a journal article, conference paper or book (chapter)

Table 3: Exclusion criteria used for the article screening

Exclusion criteria	Explanation
E1-The article does not report on primary data	The article is a review article
E2- The article does not mention virtual idols or virtual streamers	The title, abstract, keywords and main body of the article need to contain virtual idols or virtual streamers
E3-The article does not research a design feature of the virtual idols or virtual streamer	Potential Design Features: Verbal features (Kasap & Magnenat-Thalmann, 2007)

	<ul style="list-style-type: none"> ·Communication style <i>Nonverbal features -Visual</i> (Kang & Gratch, 2010) ·The appearance ·Body movements ·Environment ·Sense of celebrity ·Gender ·Age <i>Nonverbal features -Auditory</i> (Cerekovic & Gatica-Perez, 2016) ·Vocie style <i>Nonverbal features -Invisual</i> (Straßmann & Krämer, 2017) ·Emotion expression ·Cultural relevance ·Storyline ·Role setting ·Interactive capabilities <i>Autonomy</i> (Tao and Dang, 2022) ·Act automatically ·Co-construction of identity
E4-The article does not provide any outcomes on the effect or opinions of users on a design feature of virtual idols or virtual streamer	
E5-There is no full-text available	The article is a review article

RESULTS

A total of 35 articles were identified through dataset searches, of which 20 were included in this review. These comprised 11 articles focusing on virtual idols and 9 articles on virtual streamers. The majority of the studies were conducted in the context of entertainment and social media, with a smaller subset addressing advertising. Regarding virtual idols, most studies utilized qualitative research methods, such as semi-structured interviews and case studies (Le, 2014; Kong *et al.*, 2021; Black, 2012; Kobayashi & Taguchi, 2019; Yu *et al.*, 2023). In contrast, a limited number of studies adopted quantitative methods, including surveys and experiments (Onishi *et al.*, 2024; Liu *et al.*, 2023), and very few employed mixed methods (Wang *et al.*, 2023; Lee & Lee, 2023). Research on virtual streamers predominantly used quantitative methods (Lu *et al.*, 2021; Gao *et al.*, 2023; Zhang *et al.*, 2023; Duan *et al.*, 2024; Sun *et al.*, 2024), with fewer studies utilizing qualitative (Lin, 2020; Lu *et al.*, 2021) or mixed methods (Hu & Ma, 2023; Yao *et al.*, 2024). Figure 1 provides a detailed representation of the studied design features, corresponding outcome variables, and the results of the reviewed articles.



Figure 1: Frequency of design features and outcome variables in the articles found. The width of the bubble corresponds to the number of articles that research particular outcome variable for a particular design feature category.

Design Features and Outcome Variables Investigated

The frequency of design feature categories and outcome variables is documented in Appendices A and B. Notably, the majority of the articles encompassed multiple categories of design features, with a predominant emphasis on nonverbal features (visual), nonverbal features (invisible), and autonomy, while studies on verbal features and nonverbal auditory features were relatively rare. The thematic analysis of outcome variables identified five key categories: intention to engage, intention toward behavior change, user attitude, purchase intentions, and relationship establishment. The most extensively examined topics across both virtual streamer and virtual idol articles were the effects of various design features on user engagement intention and user attitude (Black, 2012; Le, 2014; Kobayashi & Taguchi, 2019; Lin, 2020; Lu *et al.*, 2021; Kong *et al.*, 2021). However, studies concerning virtual streamers paid greater attention to the impact on purchase intention and less on relationship establishment (Lin, 2020; Hu & Ma, 2023; Gao *et al.*, 2023; Duan *et al.*, 2024). In contrast, the intention

toward behavior change was scarcely addressed, with only one study focusing on this aspect for virtual streamers (Duan *et al.*, 2024), and none for virtual idols. While almost all outcome variables have been studied in relation to design feature categories, only a few articles explored verbal and auditory nonverbal features (Hu & Ma, 2023; Yao *et al.*, 2024).

Comparison of Design Features Across Specific Outcome Variables

Intention to engage

Both virtual idols and virtual streamers prioritize autonomy to enhance user engagement, with a shared emphasis on co-constructing identity. Virtual idols tend to co-build their identity and narrative with fans (Le, 2014; Kong *et al.*, 2021; Onishi *et al.*, 2024), while virtual streamers focus on brand alignment and target consumer engagement (Duan *et al.*, 2024; Sun *et al.*, 2024). Virtual streamers also concentrate more on nonverbal invisible dimensions, such as interactive capacity (Gao *et al.*, 2023; Zhang *et al.*, 2023), whereas virtual idols place greater importance on visual elements, such as the sense of celebrity and virtual environments (Black, 2012; Kong *et al.*, 2021). Additionally, virtual streamers pay more attention to verbal features, including communication style, which is often overlooked in virtual idol research. For example, Hu and Ma (2023) demonstrated that sensory language used by virtual streamers could effectively evoke viewers' engagement.

Intention toward behavior change

The exploration of intention toward behavior change remains limited, particularly for virtual idols. Only one study concerning virtual streamers (Duan *et al.*, 2024) demonstrated that advanced motion capture technology and real-time emotion expression could induce emotional synchronicity between streamers and viewers, prompting behavior change.

User attitude

The improvement of user attitudes toward virtual idols and virtual streamers is primarily achieved through visual and nonvisual nonverbal design features, with interactive capacity and appearance being the most prevalent (Liu *et al.*, 2023). Virtual idols are more inclined to emphasize the sense of celebrity, enhancing user attitudes by mimicking real idols' interactive behaviors (Onishi *et al.*, 2024). Both virtual idols and virtual streamers tend to neglect verbal design features in this context.

Purchase intentions

To enhance purchase intention, both virtual idols and virtual streamers prioritize visual nonverbal features, with a particular focus on appearance. Virtual idols utilize human-like characteristics to foster social engagement, while their 3D cartoon appearances can also increase loyalty (Liu *et al.*, 2023; Yu *et al.*, 2023). For virtual streamers, their persuasive attributes, such as physical attractiveness and human-like appeal, contribute to purchase intentions by evoking feelings of "coolness" (Zhang *et al.*, 2023). In addition, virtual idols emphasize autonomy and identity co-construction, while virtual streamers focus on nonverbal auditory features and communication styles (Hu & Ma, 2023; Yao *et al.*, 2024).

Relationship establishment

In establishing relationships, both virtual idols and virtual streamers concentrate on visual nonverbal features, particularly appearance (Wang *et al.*, 2023; Hu & Ma, 2023). However, virtual idols consider a broader range of design features, including gender, age, cultural relevance, and sense of celebrity, compared to virtual streamers. The success of virtual idols, such as Hatsune Miku, underscores the importance of cultural relevance and community-driven content in fostering fan-producer relationships (Anderson, 2021; Le, 2014).

DISCUSSION

This study systematically classified and compared the design features of virtual idols and virtual streamers, revealing that each type places varying emphasis on different outcome variables. The findings indicate that the design features associated with these outcomes differ between virtual idols and virtual streamers. Notably, most literature suggests that the achievement of outcomes is often driven by a combination of design features rather than a single element. The following sections discuss the specific design features prioritized by virtual idols and virtual streamers across different outcome variables and their respective impacts.

Comparison of Design Features between Virtual Idols and Virtual Streamers

The analysis demonstrates that most studies on virtual idols and virtual streamers concentrate on visual nonverbal and invisible nonverbal features, with appearance emerging as the most significant design feature in the visual nonverbal category. Although both human-like and cartoonish appearances are reported to generate positive outcomes, human-like appearances have a more pronounced effect, aligning with anthropomorphism theory, which posits that human-like features in non-human entities enhance perceived human-likeness, fostering positive emotional connections (Epley *et al.*, 2007). In the category of invisible nonverbal features, both virtual idols and virtual streamers emphasize interactive capabilities, consistent with social presence theory. Gao *et al.* (2023) and Sun *et al.* (2024) found that real-time interactions through motion capture can create a sense of social presence, reducing psychological distance and eliciting positive user reactions. However, both virtual idols and virtual streamers tend to overlook verbal features and auditory nonverbal features. Prior studies suggest that verbal features, particularly emotional communication styles, can significantly build audience trust and facilitate long-term relationships (Keeling *et al.*, 2011). Additionally, an emotional voice style can enhance perceived authenticity and evoke positive user

responses (Baylor, 2011). Thus, future research should explore the integration of verbal and auditory features to optimize user engagement.

Comparison of Outcome Variables used to Measure the Effects of Design Features

Current research indicates that studies on virtual streamers place greater emphasis on purchase intention but pay less attention to relationship establishment, whereas literature on virtual idols exhibits the opposite trend. This discrepancy may stem from their differing application fields; virtual idols are predominantly used in online entertainment, where their primary function is to cultivate a long-term, stable fan community, ultimately transforming this relationship into commercial value (Liu *et al.*, 2023; Yu *et al.*, 2023). Conversely, virtual streamers are more prevalent in e-commerce, where they focus on generating immediate economic benefits by enhancing perceived intimacy and interactivity, which in turn increases purchase intention (Zhang *et al.*, 2023; Sun *et al.*, 2024).

Comparison of Design Features across Specific Outcome Variables

Design features for intention to engage

In terms of enhancing engagement intention, virtual idols place greater emphasis on visual nonverbal features such as a sense of celebrity and immersive virtual environments, compared to virtual streamers. This phenomenon, often referred to as "celebrity influence transfer," involves creating an idealized idol image that attracts the audience (Huang *et al.*, 2022). However, research on virtual idols tends to overlook verbal features, suggesting that incorporating effective verbal communication could further strengthen user engagement and emotional connections.

Design features for intention toward behavior change

The current literature scarcely addresses behavior change as an outcome for both virtual idols and virtual streamers. This aligns with the broader field of avatar research, which has largely focused on short-term behavioral effects rather than long-term changes (Horne *et al.*, 2020). Future studies should investigate how design features can be leveraged to influence user behavior, such as using virtual idols to maintain fan communities or virtual streamers to promote pro-social behaviors like green consumption.

Design features for user attitude

Both virtual idols and virtual streamers aim to improve user attitudes through visual and non-visual nonverbal design features, particularly interactive capabilities and appearance. However, verbal features remain underexplored. Future design strategies could benefit from incorporating emotional verbal features in tandem with interactivity and visual appeal to foster intimacy and positive attitudes. Virtual idols, in particular, prioritize enhancing users' positive reactions by emphasizing the sense of celebrity, which aligns with previous studies highlighting the importance of celebrity perception and communication dynamics in distinguishing virtual idols from virtual streamers (Lee & Lee, 2023).

Design features for purchase intention

Both virtual idols and virtual streamers prioritize visual nonverbal design features to enhance purchase intention, particularly emphasizing human-like or 3D cartoonish appearances (Liu *et al.*, 2023; Yu *et al.*, 2023). The literature suggests that perceived trust and novelty are crucial mediators in the relationship between appearance and purchase intention, consistent with prior research on antecedents of purchase behavior (Chang *et al.*, 2014; Chen *et al.*, 2021). Virtual streamers, however, display greater diversity and specificity in design features, likely due to their emphasis on co-constructing identities with brands or target consumers. This finding implies that virtual idols should consider incorporating diverse design features such as role settings, emotional expressions, and communication styles to maximize commercial value.

Design features for relationship establishment

To foster relationship establishment, both virtual idols and virtual streamers focus on visual nonverbal features, with appearance being a crucial factor (Wang *et al.*, 2023; Hu & Ma, 2023). Nevertheless, verbal and auditory nonverbal features are often neglected, indicating an area for potential enhancement in user loyalty and long-term relationship building. Virtual idols are more comprehensive in their consideration of design features, such as cultural relevance, gender, and age, compared to virtual streamers. This difference may be attributed to the fact that virtual idols aim to develop long-term, stable fan communities, whereas virtual streamers are often task-oriented and commercially driven, which may deprioritize long-term relationship establishment (Kong *et al.*, 2021).

LIMITATIONS OF THE RESEARCH

Although this study has developed a classification framework to compare the differences in design features between virtual idols and virtual streamers, several limitations remain. Firstly, the relatively small sample size of the reviewed literature may have introduced bias and reduced the reliability of the findings (Marshall *et al.*, 2013). To address this, future research should consider expanding the search to include additional databases and incorporating a broader range of related terms to enhance retrieval comprehensiveness. Moreover, this study primarily investigated the impact of differing design features on specific marketing outcomes while overlooking the potential influence of shared characteristics between virtual idols and virtual streamers. Given the substantial similarities and overlapping features between the two, future research should explore how these commonalities affect specific outcomes. For instance, it would be valuable to examine how a virtual idol's dual role as a virtual anchor in a commercial advertising context might influence user perceptions. Additionally, this study focused on the

impact of single design features on marketing outcomes. However, the findings suggest that virtual idols and virtual streamers often achieve their effects through a combination of design cues. Therefore, future research should investigate how different combinations of design elements are employed by virtual idols and virtual streamers to achieve various marketing outcomes and whether the congruence of these combinations influences the effectiveness of the results.

CONCLUSION

This literature review identifies (1) research design features of virtual idols and virtual streamers, (2) outcome variables used to measure the effects of these design features, and (3) the effects of each variable found. The results show that regardless of which specific outcome variable virtual idols and virtual streamers target, visual nonverbal design features are the most popular design feature category, particularly the appearance design feature. However, the specific utility of a human-like or cartoonish appearance has boundary conditions. Additionally, compared with virtual streamers, virtual idols are more inclined to enhance the sense of celebrity to produce positive outcomes and pay more attention to building relationships with fans. Virtual streamers, on the other hand, are more inclined to enhance their own emotional capacity to produce positive outcomes and pay more attention to commercial goals such as purchase intention. However, both virtual idols and virtual streamers tend to ignore the design of verbal and auditory design features and pay less attention to changing users' behavioral intentions. Based on the existing findings, we propose three potential future research directions: (1) conduct more research on the verbal and auditory design features of virtual idols and virtual streamers; (2) Consider the changes in user perception in the context of role overlap caused by the commonalities between virtual idols and virtual streamers; (3) Focus on the most effective design feature combination of the two for different marketing outcomes and the impact of their congruence on the outcome utility.

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APPENDIX A: the relationship between design features and outcome variables (Virtual streamers)

Virtual streamers						
	Design Features	Engage intention	(Intention towards) behaviour change	User attitude	Purchase intentions	Relations establishment
Verbal features	Communication style (emotional vs. rational)	1	0	1	1	
Nonverbal features (Visual)	The appearance (human-like vs. cartoonish)	5	2	5	5	1
	Body movements (vs.no)					
	Environment (total virtual vs.hybrid)	1		1		1
	Sense of celebrity(vs. no)					

	Gender (man vs. women)					
	Age (young vs. old)					
Nonverbal features (auditory)	Vocie style (emotional vs. rational)					
Nonverbal features (Invisual)	Emotion expression (vs. no)	2	1	2	2	
	Cultural relevance (vs. no)	1	1	2	1	
	Storyline (strong vs. weak)					
	Role setting (friends vs. professional)	1		2	2	
	Interactive capabilities	7	2	4	5	
Autonomy	Act automatically (AI-driven vs. AI-human coordination)	1		1	1	
	Co-construction of identity (Fan co-construction or brand co-construction)	4	1	2		

APPENDIX B: the relationship between design features and outcome variables (Virtual idols)

Virtual idols						
	Design Features	Engage intention	(Intention towards) behaviour change	User attitude	Purchase intentions	Relations establishment
Verbal features	Communication style (emotional vs. rational)					
Nonverbal features (Visual)	The appearance (human-like vs. cartoonish)	7		4	3	6
	Body movements (vs.no)					
	Environment (total virtual vs. hybrid)	4		2	1	4
	Sense of celebrity(vs. no)	5		4	2	6
	Gender (man vs. women)	1		1		1
	Age (young vs. old)	1		1		1
Nonverbal features (auditory)	Vocie style (emotional vs. rational)					
Nonverbal features (Invisual)	Emotion expression (vs. no)					
	Cultural relevance (vs. no)	1			1	1
	Storyline (strong vs. weak)					
	Role setting (friends vs. professional)					
	Interactive capabilities	4		3	2	4
Autonomy	Act automatically (AI-driven vs. AI-human coordination)	3			3	1
	Co-construction of identity (Fan co-construction or brand co-construction)	5		3	4	4