

## **Two Decades of Virtual Idol Research: A Literature Review and Prospect at Home and Abroad**

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**Abstract:** Virtual idols are the product of the deep integration of digital technology, artificial intelligence and fan culture. They also serve as an important carrier for the implementation of metaverse scenarios, and have become a significant research topic across media, culture and industrial fields. Using CiteSpace, this paper selects 124 Chinese documents from CNKI and 50 English documents from the Web of Science core database as data samples, and sorts out and summarizes high-quality literature on virtual idols at home and abroad. The results show that domestic research on virtual idols can be divided into three stages, with research hotspots mainly focusing on the metaverse, artificial intelligence and fan culture. Foreign research on virtual idols is also divided into three stages, with hotspots concentrated on social media and the celeb; rity effect. This paper summarizes the stage characteristics and core viewpoints of research at home and abroad, analyzes deficiencies in current studies, forecasts future research trends, and provides a reference for further research in the field of virtual idols.

**Keywords:** Virtual Idols; Artificial Intelligence; Fan Culture; Literature Review; Research Prospects

### **1. Introduction**

Virtual idols are a new type of digital cultural symbol based on digital technology, driven by artificial intelligence and supported emotionally by fan culture. With the gradual expansion of metaverse scenarios and the extensive penetration of social media, their forms have evolved from simple digital images to virtual subjects capable of intelligent interaction and cross-scenario communication. They have not only become an important application scenario for the metaverse and artificial intelligence in China, but also a vital form of celebrity IP extension on foreign social media. Scholars have

conducted extensive research on the technological application, cultural representation, communication paths and audience behavior of virtual idols, forming a differentiated research landscape between China and abroad. To explore the research status and development trends of virtual idols, this paper visually analyzes relevant literature by drawing scientific knowledge maps, summarizes representative research themes, forecasts research trends, and provides a reference for subsequent studies.

### **2. Data Sources and Research Methods**

#### **2.1 Data Sources**

Chinese literature used in this study was obtained from CNKI (China National Knowledge Infrastructure), while foreign literature was collected from the Web of Science (WOS) core database. A keyword search for “virtual idol” was conducted in CNKI, with the document type limited to academic journals, yielding 1,210 initial records. After filtering for PKU Core and CSSCI indexed journals, 124 valid papers were retained, covering the period from 2013 to 2026. For the WOS core database, a keyword search for “virtual idol” was performed, with language restricted to English and document types limited to articles and review papers. Finally, 50 valid English documents were obtained, spanning the years 2000 to 2026.

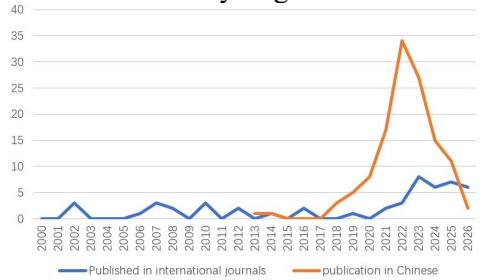
#### **2.2 Research Methods**

CiteSpace software was employed to conduct a visual analysis of the retrieved literature. This study explored the distribution of authors, publishing institutions, and keyword clusters in virtual idol-related research, and analyzed the evolutionary process of the field. Representative literature from different research stages was selected for systematic review and analysis, so as to forecast future research trends.

### **3. Analysis of Research Hotspots on Virtual**

### Idols in China and Abroad

As shown in Figure 1, research enthusiasm for virtual idols has exhibited an obvious phased growth trend both in China and abroad over the past two decades. Before 2018, the annual number of publications remained low in both regions. After 2018, the volume of publications increased significantly. Compared with domestic research, foreign research on virtual idols started earlier and maintained more continuous publication in the early stage.



**Figure 1. Annual Publication Chronology of Virtual Idol Research in China and Abroad (2000–2026)**

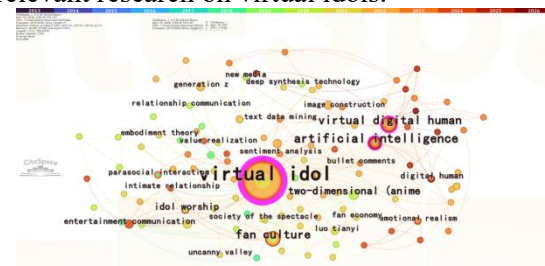
Specifically, the overall number of publications on virtual idols in China and abroad shows a growing trend. The year 2022 witnessed the largest number of domestic publications on virtual idols, with as many as 34 papers; foreign publications reached their peak in 2023, with 8 papers. The period from 2019 to 2023 was the main growth stage for high-quality publications on virtual idols both in China and abroad. Domestic research on virtual idols started relatively late overall, with very few early publications and an obvious fluctuating trend. The fluctuating changes in the publication curves demonstrate the nodal transformation of virtual idol research in China and abroad. According to the changes in publication volume, foreign virtual idol research can be divided into three stages: from 2000 to 2017, annual publications were scattered and generally low, with less than 3 papers in most years; from 2018 to 2022, the number of publications increased steadily; from 2023 to the present, the overall publication volume has remained at a high level and tended to be stable. Domestic virtual idol research can also be divided into three stages: from 2013 to 2017, only sporadic literature appeared, which was in the initial exploration stage; from 2018 to 2022, the number of publications rose rapidly, showing explosive growth; from 2023 to the present, the number of publications has declined but still remained at a high level, entering a stage of fluctuation and

adjustment. Since the development of virtual idol-related research, China has maintained continuous attention and exploration in this field. However, compared with foreign countries, domestic research started later and received relatively low overall attention in the early stage.

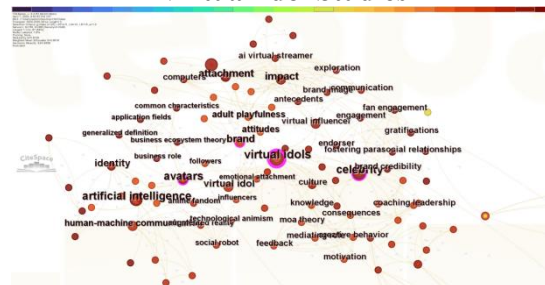
### 4. Research Themes of Virtual Idols

#### 4.1 Theme Selection

According to the statistical data in Table 1, Figure 2 and Figure 3, the keywords of Chinese and English literature on virtual idols in China are ranked as follows. Among Chinese literature, the most frequently occurring keyword is "virtual idol", followed by "metaverse" and "artificial intelligence", and then "fan culture", "digital technology", "digital human" and other keywords. Among English literature, the most frequently occurring keyword is "virtual idols", followed by "artificial intelligence" and "celebrity", and then "social media", "avatars" and others. Combined with Chinese and foreign keywords, this paper finally selects studies related to metaverse, artificial intelligence, fan culture and virtual idols to sort out domestic relevant literature. "Social media" and "celebrity" are selected to sort out foreign relevant research on virtual idols.



**Figure 2. Research Themes of Domestic Virtual Idol Studies**



**Figure 3. Research Themes of Virtual Idols Abroad**

#### 4.2 Domestic Research Hotspots

##### 4.2.1 Scenario integration of the metaverse and virtual idols

The immersive and interactive characteristics of

the metaverse have provided brand-new application scenarios for virtual idols, making it an important research hotspot in China. Xie and He [1] pointed out that virtual idols are an important part of the cultural metaverse. The metaverse offers vital scenario support and technological empowerment for the development of the AI virtual idol industry. In response to the problem that the current AI virtual idol industrial chain has not yet formed a systematic mechanism, industrial innovation can be achieved relying on metaverse scenarios. Wang et al. [2] noted that the development of the metaverse continuously enriches the forms and application scenarios of virtual idols. As a bridge connecting the real world and the metaverse, virtual idols can not only convey the value of the metaverse but also accelerate its maturity and progress. Lv [3] argued that virtual idols are super simulacra constructed by multiple subjects, as well as digital avatars for post-humans to enter the metaverse. They continuously form new interactive forms with various media, and their in-depth integration and development profoundly influence the digital reality of post-humans under the interaction between the metaverse and reality. Xu [4] pointed out that the metaverse promotes virtual idols to continuously

"break the circle", transforming them from doujin culture to mass media and becoming a media bridge connecting real brand value and the metaverse virtual economy. He analyzed the media logic of the popularization of virtual idols from five dimensions: traffic, content, technology, communication and commerce, and proposed that the integrated development of media can be promoted through four layouts in the future: "re-politicization", IP orientation, anthropomorphism and normalization.

The metaverse is an important carrier for virtual idols to expand application scenarios and achieve industrial upgrading, which is also a core consensus in current domestic research. Integrating metaverse scenarios with the virtual idol industry is an important direction for the development of the digital culture industry. At present, a relatively consistent understanding has been formed in domestic research on the role of the metaverse in scenario empowerment, value transmission and media integration for virtual idols. Regarding the metaverse as an important supporting scenario for the development of virtual idols helps promote virtual idols from subculture to the mass market and realize the dual innovation of industrial ecology and media forms.

**Table 1. Top 20 Keyword Frequency Ranking in Chinese and International Academic Literature**

No.	Keyword	Frequency	Keyword	Frequency
1	virtual idols	4	virtual idol	57
2	artificial intelligence	4	metaverse	12
3	celebrity	4	artificial intelligence	9
4	social media	4	fan culture	6
5	avatars	3	digital technology	3
6	impact	3	digital human	3
7	virtual idol	3	consumerism	2
8	attachment	3	digital labor	2
9	character animation	2	cultural consumption	2
10	identity	2	entertainment communication	2
11	brand	2	VTuber	2
12	popular music	2	image construction	2
13	culture	2	body	2
14	censorship	2	idol worship	2
15	human-machine communication	2	intimate relationship	2
16	virtual influencer	2	post-human	2
17	hla antigens	1	Luo Tianyi	2
18	anti-hla antibody	1	simulacrum	2
19	plasmapheresis	1	technology	2
20	transplantation	1	Generation Z	2

4.2.2 Empowerment mechanism of artificial intelligence for virtual idols

Artificial intelligence technology serves as the core support for virtual idols to realize

"intelligent interaction" and "personalized expression", and is also a key field in domestic research. Jian Shengy Artificial intelligence technology serves as the core support for virtual idols to realize "intelligent interaction" and "personalized expression", and is also a key field in domestic research. Yu and Yang [5] pointed out in their research that artificial intelligence technology provides important empowerment for the development of virtual idols. Among them, embodied intelligence represented by humanoid robots is the core support for the physical development of virtual idols. The physical presentation of virtual idols (i.e., the physical form of virtual digital humans) takes AI technology as the core driving force. Product application and operation under the "AI+" model endow them with core development momentum and constitute the "soul" of the physicalization of virtual idols, which is also the core embodiment of embodied intelligence empowering virtual idols. Meanwhile, the deep integration of artificial intelligence and virtual digital humans promotes the upgrading of content production and industrial applications related to virtual idols, becoming an important support for the development of the virtual idol industry. It realizes technological and industrial empowerment for virtual idols, providing technical guarantee and application support for the standardized and large-scale development of virtual idols. Zhang and Shen [6] noted that the extensive application of virtual digital humans in the field of online audio-visual cannot be separated from the important support of artificial intelligence technology. Their characteristics such as deep human-machine integration and intelligent content production precisely reflect the important empowerment of artificial intelligence on virtual digital humans. The study further proposed that the "data + algorithm" system can be adopted to reduce costs and improve efficiency in the R&D and application of virtual digital humans, and promote aesthetic breakthroughs. Scholars including Zeng and Wang [7] pointed out that against the background of the rapid development of artificial intelligence, the intimate relationship between humans and machines has attracted much attention, and the authenticity of emotional bonds formed between humans and machines is beyond doubt. The configurability of machines allows users to establish ideal emotional connections. The interest-free and burden-free

emotional experience provided has become an important way for people to relieve social pressure and confirm self-identity, while also offering pure emotional support for users. Jian [8] stated that virtual digital humans are products of social digital transformation with strong market demand. Current virtual digital humans only have visual appearance but lack independent thinking; AI technologies such as ChatGPT can serve as their internal driving force and endow them with "human-like intelligence".

Artificial intelligence is the core technological support for the intelligent and interactive development of virtual idols, as well as the key driving force for the iteration and upgrading of the virtual idol industry. Artificial intelligence technology empowers virtual idols in an all-round way, from image generation and content production to emotional interaction, becoming the core element for them to break through form limitations and improve experience quality. At present, domestic research has generally recognized the technology-driven role of artificial intelligence in virtual idols. Strengthening the R&D and application of AI technology can effectively promote the development of virtual idols toward greater intelligence, authenticity and emotional connection.

#### 4.2.3 Fan culture and emotional bond with virtual idols

Fan culture provides the emotional and traffic support for the sustainable development of virtual idols. Domestic research focuses on the emotional bond, identity construction and cultural representation between fans and virtual idols. Chen and Yu [9] pointed out that, as a typical fan group in the virtual idol circle, "mom fans" have deeply reflected the emotional connection between fan culture and virtual idols through their practices. The study clarified that this group transforms emotional projection toward virtual idols into concrete behaviors such as digital labor and companionate care through "cyber mothering" practices. In collective nurturing and self-identity imagination, they construct a strong emotional attachment and intergenerational emotional bond with virtual idols. Dou [10] argued that in the era of intelligent communication featuring rapid development of the Internet and artificial intelligence, teenagers have formed emotional attachment to virtual idols through diversified interactions. Based on interviews with 19 young

users following the virtual idol group A-Soul and three-level coding analysis using grounded theory, the study concluded that young users' emotional attachment to virtual idols mainly includes four dimensions: virtual idol identification, intimate relationship construction, development and promotion support, and user self-connection. Moreover, online interactions between young users and virtual idols have achieved hyper-personal effects comparable to or even exceeding face-to-face communication. Ma and Jing [11] noted that previous fan studies mostly neglected male groups. However, male fans of the virtual idol group A-SOUL, in social scenarios constructed by platforms and algorithms, perform hegemonic masculinity by objectifying virtual idols and practicing technological idol chasing. Influenced by platforms, algorithms and capital, the gender hegemony they construct is illusory. Liu and Zhao [12] took the virtual idol group A-SOUL as the research object and conducted netnography from the perspective of fan participatory culture. They held that fans project emotions and interact with virtual idols under parasocial relationships, and form identity recognition through participatory shaping and consumption, demonstrating diversified, equal and decentralized behavioral characteristics.

Fan culture is the emotional foundation and traffic guarantee for the sustainable development of virtual idols. Fans' participation, emotional projection and identity construction directly affect the communication power and vitality of virtual idols. Domestic studies generally focus on parasocial relationships, emotional attachment and participatory cultural practices between fans and virtual idols, believing that diversified interactions of fan groups constitute important support for the virtual idol industry. Existing studies have revealed the significance of fan culture to the development of virtual idols, but further exploration of the interaction mechanism between the two from more dimensions is still needed.

#### **4.3 Foreign Research Hotspots**

Foreign research on virtual idols takes social media scenarios as the carrier and the celebrity effect as the core, focusing on the communication laws of virtual idols on social media, the operation strategies of celebrity virtual images, and users' emotional responses, forming a research pattern differentiated from

domestic research.

##### **4.3.1 Communication mechanism between social media and virtual idols**

The communicative characteristics of social media have facilitated the widespread dissemination of virtual idols. Foreign research focuses on the communication paths, effect evaluation and operation strategies of virtual idols on social media. Chen and Skey [13] took the virtual idol Luo Tianyi as a case and pointed out that fans' original content production and online interaction on social media are key forces driving the communication and public visibility of virtual idols. Such digital practices further strengthen the emotional bond and group identity of fan communities. March [14] studied the music video Daisy 2.0, a collaboration between the virtual idol Hatsune Miku and pop singer Ashnikko. Through textual analysis of the video on YouTube and observation of audience discourse in the comment section, the study pointed out that in social media scenarios, the narrative content of the video and the comment discourse of platform audiences jointly restrict and expand the cultural symbol of Hatsune Miku. Meanwhile, under the background of cross-cultural commercial cooperation, the communication of virtual idols not only relies on social platforms for content diffusion and audience interaction but is also constrained by cultural and commercial factors. Wang et al. [15] stated that the communication of virtual idols cannot be separated from fan creation and community interaction. Through UGC production and community atmosphere building, the communication scope has been expanded. Fans' creative behaviors (such as content output and word-of-mouth communication) constitute the core support for the social media communication of virtual idols, which improves communication effectiveness and sustainability compared with the traditional one-way communication model. Lee and Lee [16] conducted a case study on the multi-platform communication of virtual YouTuber concerts and found that platform types, fan creation motivations and community participation jointly affect audience experience. Fans' voluntary content production has also become an important mechanism for the diffusion of virtual idols on social platforms. Li et al. [17] proposed, based on the S-O-R framework and the perspective of psychological distance, that in e-commerce live streaming scenarios, the intelligence level of AI

virtual idols affects audiences' impulsive purchase intention by influencing their psychological distance, while technology readiness plays a moderating role in the above relationship.

Social media is a core field for virtual idols to achieve global communication and build fan communities. Foreign studies generally focus on the promoting effect of social media on virtual idol communication, emphasizing the key influence of fan creation, community interaction and platform mechanisms. At present, foreign research has reached a consensus on the communication relationship between social media and virtual idols. Operation and communication based on social platforms are important paths for virtual idols to achieve cross-cultural and cross-regional diffusion.

#### 4.3.2 Integrated development of the celebrity effect and virtual idols

Foreign studies regard virtual idols as an extended form of celebrity IP, focusing on the creation and operation of virtual celebrity images and their impacts on users. Lee and Lee [16] noted that the audience's role perception of virtual YouTubers (whether as idols or streamers) significantly affects their sense of presence and immersive experience. The integration of the celebrity effect and virtual idols lies in converting the influence of real celebrities into the attractiveness of virtual idols. Huang et al. [18] pointed out that virtual idols can achieve deep binding with the celebrity effect by learning from the image packaging of real-life K-pop idols and strengthening fans' worship psychology. Gong et al. [19] proposed a two-stage speech-driven 3D facial animation framework based on uncertainty-guided time-frequency feature enhancement. By improving the alignment between speech emotional features and facial expressions, this framework enhances the emotional richness and naturalness of virtual idols' expressions, effectively solves the problem of poor coordination between speech and facial movements, and is more suitable for scenarios such as virtual live streaming. Wang et al. [20] systematically sorted out the value co-creation and value realization mechanisms of virtual idols from the perspective of business ecology. They argued that virtual idols can extend the celebrity effect to the digital field by constructing celebrity-like role relationships and fan identification systems, providing an industrial theoretical framework for the

integrated development of the two. Chen et al. [21] found that the physical attractiveness and professional competence of virtual idols can significantly improve fan engagement and parasocial relationships. This is similar to the formation logic of the real celebrity effect and is an important factor driving virtual idols to achieve celebrity-like communication. Du et al. [22] confirmed that virtual idols can trigger audience parasocial interaction through external features, content features and similarity, forming emotional bonds and influence mechanisms highly similar to real celebrities, indicating that the celebrity effect can be effectively extended and integrated into virtual idol scenarios.

The celebrity effect provides an important reference for IP development, fan operation and commercial monetization of virtual idols, and virtual idols have also become an important form of digital extension of celebrity IP. Most foreign studies regard virtual idols as digital carriers of the celebrity effect, focusing on their image construction, charm transmission and emotional bonding mechanisms, confirming that virtual idols can achieve value transformation by drawing on the operation logic of real idols. At present, foreign studies have recognized the feasibility and commercial value of integrating the celebrity effect with virtual idols. Their combination helps promote the industrialization and branding of virtual idols.

## 5. Summary and Prospect

This paper systematically reviews and summarizes high-quality literature on virtual idols at home and abroad in the past two decades, so as to provide a reference for subsequent research in the field of virtual idols. Overall, domestic research mainly focuses on three aspects: scenario integration of the metaverse and virtual idols, the empowerment mechanism of artificial intelligence for virtual idols, and the emotional bond between fan culture and virtual idols. It mainly discusses technical support, scenario expansion, audience participation and industrial development, forming relatively rich theoretical achievements. Foreign research on virtual idols pays more attention to the communication mechanism of social media and the integrated development of the celebrity effect, focusing on the communication paths of virtual idols on social platforms, fan interaction modes, digital extension of celebrity IP and commercial value transformation, with research

perspectives more inclined to communication practice and market operation.

Looking forward, domestic virtual idol research can focus on issues such as the construction of virtual idol industrial ecology, media integration development and industry standard guidance under the background of the metaverse at the macro level. At the micro level, research on the impact of artificial intelligence technology on the interactive experience and emotion generation of virtual idols can be deepened, and discussions on behavioral motivation, identity recognition and emotional bonding mechanisms of fan groups can be strengthened. In addition, research combining technological innovation and cultural connotation should be further strengthened, with emphasis on the in-depth application of artificial intelligence, metaverse and digital human technologies in the creation, operation and communication of virtual idols, so as to promote the development of virtual idol research in a more systematic direction that is more in line with industrial practice.

This work was supported by the project "Z-Generation Virtual Idols' Impact Mechanism on College Students' Mental Health: A Study Based on the SOR Model" under the Southeast University Chengxian College College Students' Innovation and Entrepreneurship Project (Project Number: XCX2026116).

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