

AI Love: An Analysis of Virtual Intimacy in Human-Computer Interaction

Tingying Wu^{1,a,*}

¹*Department of Humanity and Law, Huazhong Agriculture University, Wuhan, China*

a. 1795197223@qq.com

**corresponding author*

Abstract: In the digital age, intimate relationships are gradually becoming scarce, while rapid technological advances are deepening humanity's reliance on virtual relationships. This paper examines the emerging phenomenon of virtual intimacy in human-AI interactions by analyzing recent studies on intimate relationships, virtual intimacy, and human-machine interaction-based virtual intimacy. First, as artificial intelligence technology advances, particularly with the development of affective computing and generative AI, emotional interactions between humans and AI have become more frequent, with virtual companions increasingly being used as tools for emotional support. These relationships can alleviate loneliness and fulfill individual emotional needs to a certain extent. However, AI's emotional responses are generated through algorithms and data processing, lacking genuine emotional resonance, which leads to the risk of emotional dependency and the loss of authenticity in emotional connections. Moreover, privacy and data security issues have become significant challenges in the development of human-AI intimate relationships. Virtual intimacy, as a complex and multi-dimensional research field, still requires further exploration from various perspectives and with diverse subjects.

Keywords: Intimate Relationships, AI, Virtual Intimate Relationships, Human-computer Interaction.

1. Introduction

In recent years, rapid advances in internet technology, artificial intelligence, and big data have not only transformed human interaction patterns and created a digital living environment but have also changed the nature of machines. Robots have become increasingly human-like in their emotional responses, with the ability to “understand” human feelings and offer emotional support.[1, 2] This development has given rise to virtual intimate relationships between humans and AI.[3]

In March 2017, Replika launched customizable AI companions, surpassing 10 million users within six months. The COVID-19 pandemic in 2020 further heightened the global need for intimate connections.[4] The “New York Times” reported in 2020 that over 10 million people worldwide were in relationships with AI “companions”.[5, 6] As societal desires shift, more individuals are engaging in intimate relationships with AI, experiencing feelings of affection, attachment, personal transformation, and even heartbreak. This phenomenon raises important questions about the characteristics of such relationships, how they differ from traditional intimacy, and the reasons why individuals are drawn to these virtual connections. These are key issues that merit deep reflection.

2. Intimate Relationships

Humans are social animals, inherently intertwined with a variety of relationships, and intimate relationships are a crucial part of these connections. Giddens used the term "pure relationship" to describe intimate relationships, characterizing them as relationships not influenced by external factors, based solely on genuine emotional exchange with others, and marked by mutual dependence.[7] American psychologist Rowland S. Miller further proposed that intimacy encompasses passion, understanding, communication, and sharing, suggesting that intimate relationships are emotional and communicative, forming one of the key components of love.[8] Xu Yanyun summarized intimate relationships into three categories: self-centered, focusing only on oneself while lacking intimacy with others;[9] role-centered, acting in accordance with social roles but lacking genuine intimate experience; and individualized intimacy, wherein mature individuals establish developed intimate relationships with others.[10] As societal culture evolves, intimate relationships have gradually shifted from role-centered to individualized intimacy. Marriage is no longer primarily a strategy employed by parents to establish kinship or enhance family socioeconomic status but rather stems from mutual satisfaction between individuals or young couples.

Although love and marriage have become increasingly free, this does not necessarily mean that forming intimate relationships has become easier. The rapid modernization of society has also transformed people's lifestyles and social structures. Zygmunt Bauman, viewing intimacy through the lens of the uncertainty of modernity, pointed out that intimate relationships have become more fluid, unlike the past when they were more sincere and stable.[11] Instead, they have become "a floating feeling of insecurity, instability, and uncertainty." The establishment of intimate relationships aimed at "pure relationships" in modern society is increasingly based on emotional connections and individual satisfaction, rather than solely relying on established marital or traditional systems. Whether in the context of "bowling alone" in the U.S. or Japan's "society without ties," both phenomena illustrate that, while traditional bonds are weakening, establishing intimate relationships between individuals has become more challenging. At the same time, the rapid development of the internet has also introduced multiple dimensions to intimacy,[12] leading to a reassessment of intimacy between humans and non-humans.

The modern market economy has commodified intimate relationships, turning them into generative and consumable goods.[13] The alienation, dilution, falsification, and performativity of emotional relationships have stimulated the modern individual's emotional needs for intimacy. Consumers enjoy emotional products provided through market mechanisms, gaining emotional satisfaction and support.[14] JAMIESON L even suggested that consumerism has replaced social interaction,[1] allowing individuals to use consumption to address many issues within intimate relationships.

3. Virtual Intimate Relationships

Since the 21st century, the internet has rapidly expanded worldwide, not only changing people's lifestyles but also reshaping the ways individuals form intimate relationships. Emotional communication between individuals is no longer limited to real-life social interactions and can transcend temporal and spatial boundaries, enabling individuals to maintain contact and interactions with friends from real life while also developing new, meaningful intimate relationships.

With the development of digital technology and artificial intelligence, individuals can overcome spatial barriers, reshaping the boundaries of intimate relationships. In the virtual space supported by network technology and social media, the personas with whom individuals interact are often constructed and imagined, leading to a trend of virtualized intimacy. Since the advent of the internet, virtual intimate relationships have continuously evolved, ranging from internet friendships to virtual

idols,[15, 16] virtual romantic companionship,[17] and immersive romance games,[18] all of which fall under the category of virtual intimate relationships.

Among the various types of virtual intimacy, the earlier forms were based on idol culture: in the network era, the intimate relationship attributes of idol fandom, established during the pre-internet era, have taken on a virtualized form—fans acquire their fan identities and participate in fan economic production through a virtual persona, and the idols themselves, as material for imagined intimate relationships, have fully revealed their virtual reality essence.[15] The formation of these new intimate relationships is the result of a combination of emotional needs from fans, the packaging of idol personas, and relentless commercial capital.[19] Meanwhile, fan communities that pursue the same idol have built deep community friendships based on their virtual intimate relationships with the idol. Through the establishment of these virtual intimate connections with their "idols" and the completion of supportive actions, fans gain self-affirmation and a relative sense of autonomy. This virtual circle of interactions reflects the active participation and personal meaning-making by Chinese youth in the cultural context of the internet era.[20]

With the advancement of the digital age and the increasing isolation and anxiety of individuals, emotional labor has gradually emerged. Emotional labor in the online environment has shaped various forms of virtual intimacy. Many scholars have focused their research on "virtual romantic partners" on the internet, delving into the emotional labor processes and the construction of intimacy in these interactions. A "virtual romantic partner" is a professional service that sells emotions. The provider of this service interacts with the purchaser online, satisfying the purchaser's emotional needs in exchange for monetary compensation. The emotional labor produced by virtual romantic partners fosters a fluid form of intimacy.[9] At the same time, live-streaming companions, who build intimate relationships through emotional labor on live-streaming platforms, also represent another form of virtual intimacy. This type of relationship not only offers stable provision and a wide range of choices but also establishes a set of standardized operational procedures,[21] marking a decisive step toward institutionalizing and industrializing intimate labor. Through predefined storylines or algorithms, game characters and virtual idols can also offer intimate relationships.[14]

To date, users no longer need to choose from pre-existing online chat companions for emotional services or search for emotional support in pre-set narratives. Instead, they can customize personalized artificial intelligence companions within AI virtual companion programs.[22] As proposed by Cao and Luo, AI companions possess the unique ability to learn and adapt to individual users' language patterns and preferences.[6] Furthermore, these sophisticated systems are capable of dynamically modifying their output in response to the evolving context of conversations, thereby facilitating the provision of tailored emotional support.

4. Virtual Intimacy in Human-AI Interaction

AI is commonly defined as technology that uses conventional computer programs to emulate human intelligence. Traditionally, AI research has focused on enabling machines to simulate cognitive functions such as learning and problem-solving.[23] From early conceptualizations in the mid-20th century to the deep learning revolution of the 21st century, human-computer interaction (HCI) has undergone significant evolution. Alan Turing's 1950 proposal of the Turing Test marked a milestone in assessing machine intelligence, establishing a foundation for subsequent AI research.[24]

In the 1960s, the development of ELIZA, a chatbot created by Joseph Weizenbaum at MIT, signaled the early exploration of natural language processing (NLP) and human-machine dialogue systems.[25] ELIZA utilized pattern matching and reorganization to respond to user input, sparking interest in machines' potential to understand human language. As time progressed, expert systems emerged, simulating expert decision-making in specific fields such as medical diagnosis or legal advice, though their ability to engage in deep interactions with users remained limited. By the 1990s,

with the rise of the internet, chatbots began interacting more broadly with human users, albeit with limited conversational capacity, laying the groundwork for more sophisticated dialogue systems.

The first decade of the 21st century witnessed significant advances in speech recognition and processing technologies, allowing AI to engage with humans through voice interactions. Personal assistants like Apple's Siri and Amazon's Alexa became common features on household and mobile devices, capable of understanding and responding to voice commands.[26]

In recent years, developments in deep learning have significantly advanced NLP. Deep neural networks, especially transformer models, have achieved breakthroughs in language translation, sentiment analysis, and language generation. Algorithm-driven social robots not only foster innovation in digital content production but also facilitate seamless human-machine interaction. Compared to earlier chatbots, which often failed to respond accurately, social robots in the AIGC era possess enhanced natural language comprehension and processing capabilities. Their ability to recognize, mimic, and express emotions continues to improve, allowing them to understand users' speech quickly and accurately, and even discern deeper emotional needs.[27] These robots offer emotional companionship, social interaction, personal assistance, and emotional simulation services.

As information technology and AI rapidly evolve, virtual intimate relationships in human-computer interaction have become an important topic of academic discussion. Zhang Tiantian suggests that such virtual intimacy arises as a response to social needs.[28] In real life, people may struggle to find suitable partners or meet emotional needs due to various reasons. AI's personalized and customizable characteristics enable users to interact with their idealized partners. Scholar Gao Hanning argues that virtual intimacy in human-computer interaction is characterized by its virtuality, fluidity, and personalization.[21]

Han Li and Renwen Zhang, analyzing screenshots and posts from the Reddit r/replika community, categorize AI social interactions related to human emotions into seven types: intimate behaviors, daily interactions, self-disclosure, games and fantasies, boundary-crossing behaviors, personalized customization, and communication barriers.[29] Scholars such as Jia Mengzhen classify the purposes of young people using AI companions into three types: generating emotional substitutes, cloning relationships, and generating native companions.[12] They believe AI companions, as tools for young people's ideal self-realization, not only promote emotional socialization but also broaden the social significance of intimate relationships, providing strong support for youth emotional development. Zhang Ruijun and Han Lixin argue that "emotional attachment" and "companionship" are the primary emotional expressions in human-machine intimate relationships, with psychological cues being important factors influencing emotional attachment.[30] Iryna Pentina explore why humans become attached to social chatbots like Replika, particularly when individuals suffer from emotional distress or lack companionship. AI can provide emotional support and encouragement,[31] but emotional dependence on AI may also harm human psychological health.[32] Additionally, when AI expresses deep thoughts or emotions, users may experience fear, a phenomenon related to the uncanny valley effect.[29]

As virtual intimate relationships between humans and machines become more common, ethical and societal issues are increasingly being discussed. Many scholars argue that virtual intimacy in human-computer interaction may lead to distancing from real interpersonal relationships or raise concerns regarding privacy and data protection.[33] In the future, as AI technology continues to develop, regulating the relationship between humans and AI in terms of law and ethics will become a crucial issue.[34]

5. Conclusion and Summary

In the atomized digital era, intimate relationships have become scarce. With technological advancements, internet platforms now create virtual companions for consumers that are repeatable

and shareable.[17] From virtual lovers to romance games, and now large language models, humans continuously seek and shape intimate connections.

Falling in love or forming friendships with AI, as an emerging social phenomenon, reflects humanity's increasing dependence on technology and the diverse needs for intimate relationships in the digital age.[35] With the development of AI, particularly in affective computing and generative AI, emotional interactions between humans and AI are becoming more common. Many individuals seek emotional support through virtual companions or AI social robots, which can alleviate loneliness and fulfill emotional needs.[36] However, such relationships remain virtual, with AI's emotional responses generated through algorithms and data processing, lacking authentic emotional resonance. As a result, while people may rely on AI for emotional satisfaction, they face risks of emotional dependency and the loss of genuine emotional connections. This emotional illusion could even lead individuals to lose the ability to form deep emotional bonds in real-world social interactions, further exacerbating social isolation.[29]

Additionally, privacy and data security are crucial challenges. During emotional interactions with AI, the system collects and analyzes user data to generate personalized emotional responses. While such customized services make users feel more understood, the potential risks of privacy breaches and data misuse also increase. Particularly when emotional exchanges involve private content, if users' trust in AI is misused, it may lead to severe legal and social consequences.[37] Therefore, developing effective privacy protection measures and regulatory mechanisms to ensure the security of user data is a critical issue for the future of human-AI relationships.

At present, there are no clear legal or ethical regulations regarding intimate relationships between humans and AI. As AI technology and virtual intimate relationships between humans and machines continue to evolve, it becomes essential to define the legal status and responsibility of AI in these relationships. Furthermore, addressing emotional disputes between humans and AI, and whether AI can be legally recognized as an emotional partner, are challenges that need to be resolved urgently.

This paper focuses solely on the study of virtual intimate relationships between humans and AI, compiling literature from the past five years on human-machine interaction and virtual intimacy. It reviews the relevant research from three perspectives: intimate relationships, virtual intimacy, and virtual intimate relationships in human-machine interaction. Although this review provides valuable insights and contributes to the field, it is clear that exploration in this area is far from complete. Future research needs to adopt more diverse perspectives and study a broader range of subjects for a more in-depth and comprehensive understanding.

References

- [1] Jamieson, L. (1998). *Intimacy: Personal relationships in modern societies*. Cambridge: Polity Press.
- [2] Xie, T., Pentina, I., & Hancock, T. (2023). Friend, mentor, lover: does chatbot engagement lead to psychological dependence?. *Journal of Service Management*, 34(4), 806-828.
- [3] Bigham, J. P., & Richards, J. T. (2013). VUIs need a UI: Improving voice user interfaces with visual feedback. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)*. New York, NY: ACM.
- [4] Cullen, W., Gulati, G., & Kelly, B. D. (2020). Mental health in the COVID-19 pandemic. *QJM: An International Journal of Medicine*, 113(5), 311-312.
- [5] Cao, B. L., & Luo, L. L. (2023). The development characteristics and mechanism of companion Chatbots. *Youth Journalist*, (2), 19-22.
- [6] The New York Times. (2020). Riding out quarantine with a Chatbot friend: 'I feel very connected'. Retrieved from <https://www.nytimes.com/2020/06/16/technology/chatbots-quarantine-coronavirus.html?searchResultPosition=1>
- [7] Giddens, A. (2001). *The transformation of intimacy* (Y. Chen & M. Wang, Trans.). Beijing: Social Sciences Documentation Publishing House.
- [8] Miller, R. S. (2015). *Intimate relationships* (W. Wang, Trans.). Beijing: People's Posts and Telecommunications Publishing House.
- [9] Xu, Y. (2021). *Creating Intimacy: A Study on Emotional Labor on the Internet* (Master's thesis). Jinan University, Guangzhou.

- [10] Xu, H., & Zheng, X. (2018). *The generalization of relationships and differential communication: A study on the use of internet language by adolescents and their interpersonal relationships*. *China Youth Study*, (8), 23-31.
- [11] Bauman, Z. (2003). *Liquid love: On the frailty of human bonds*. Cambridge: Polity Press.
- [12] Jia, M. Z., Weng, M. L., & Ma, Y. K. (2024). *Autonomously generated intimate relationships: The interaction experience between youth and AI companions*. *Youth Exploration*, (1), 55-67.
- [13] Wang, N. (2000). *Emotional consumption and the emotional industry: A series of studies on the sociology of consumption*. *Journal of Sun Yatsen University (Social Science Edition)*, (6), 109-113.
- [14] Han, Y. R., & Wang, X. Y. (2020). *An analysis of the origins, types, and models of female-oriented games*. *Modern Communication*, 42(6), 141-146.
- [15] Gao, H. N. (2018). *Virtualized intimacy: The idol industry and fan culture in the internet age*. *Cultural Studies*, (3), 108-122.
- [16] Tian, L. N. (2021). *Between freedom and security: Intimate relationships mediated by social media*. *Social Development Research*, 8(2), 38-53.
- [17] Zheng, G. H., & Zhang, X. Y. (2023). *Emotional connection in the cloud: The intimacy of virtual lovers in the digital age and its instability*. *Social Sciences in Guangdong*, (2), 217-231.
- [18] Chen, L. (2018). *Mobile game consumption and the construction of intimate relationships: A case study of "Love and producer"*. *Shandong Social Sciences*, (10), 48-53.
- [19] Chu, W. W. (2023). *A study on deviant behavior among fans under virtual intimacy relationships (Master's thesis)*. East China University of Science and Technology, Shanghai.
- [20] Wu, W. H. (2020). *Body myth, ethnic carnival, and virtual intimacy relationships: A media sociology investigation of "Girlfriend fans"*. *Journal of East China University of Science and Technology (Social Science Edition)*, 35(3), 32-43.
- [21] Gao, H. N. (2023). *Intimacy in the age of digital reproduction: From live stream to ChatGPT*. *Journal of Guangzhou University (Social Science Edition)*, 22(5), 60-69.
- [22] Song, M. J., & Liu, Y. (2023). *The Adventure of Communication: Human-AI conversational interaction and intimate relationship development*. *Journalism and Writing*, (7), 64-74.
- [23] Nilsson, N. J. (1998). *Artificial intelligence: A new synthesis*. Amsterdam: Morgan Kaufmann.
- [24] Turing, A. M. (1950). *Computing machinery and intelligence*. *Mind*, 59(236), 433-460.
- [25] Weizenbaum, J. (1966). *ELIZA—a computer program for the study of natural language communication between man and machine*. *Communications of the ACM*, 9(1), 36-45.
- [26] Song, X., Xu, B., & Zhao, Z. (2022). *Can people experience romantic love for artificial intelligence? An empirical study of intelligent assistants*. *Information & Management*, 59(2), 103595.
- [27] Xing, J., & Chen, Y. D. (2024). *The Electronic Butterfly of 'Goodbye When Powered Off': Mediated Intimacy, Liquid Emotion, and Cyber Infatuation in Metaverse Social Interactions*. *Radio & TV Journal*, (6), 102-106.
- [28] Zhang, T. T. (2024). *Exploring future technological development paths of "Virtual lovers"*. *Digital Technology and Application*, 42(3), 188-191.
- [29] Li, H., & Zhang, R. (2024). *Finding love in algorithms: deciphering the emotional contexts of close encounters with AI chatbots*. *Journal of Computer-Mediated Communication*, 29(5), zmae015.
- [30] Zhang, R. J., & Han, L. X. (2022). *My AI lover: A study on emotional interaction in Human-AI intimate relationships from the perspective of media equation theory*. *Journalism & Media Studies*, (12), 4-8.
- [31] Pentina, I., Hancock, T., & Xie, T. (2023). *Exploring relationship development with social chatbots: A mixed-method study of replika*. *Computers in Human Behavior*, 140, 107600.
- [32] Laestadius, L., Bishop, A., Gonzalez, M., Illeňčík, D., & Campos-Castillo, C. (2024). *Too human and not human enough: A grounded theory analysis of mental health harms from emotional dependence on the social chatbot Replika*. *New Media & Society*, 26(10), 5923-5941.
- [33] Ghosh, S., Bagai, S., & Westner, M. M. (2023). *Replika: Embodying AI*. Retrieved from <https://www.hbs.edu/faculty/Pages/item.aspx?num=63508>
- [34] Zimmerman, A., Janhonen, J., & Beer, E. (2023). *Human/AI relationships: challenges, downsides, and impacts on human/human relationships*. Retrieved from <https://doi.org/10.1007/s43681-023-00348-8>
- [35] Buick, S. (2024). *In love with a Chatbot: Exploring Human-AI relationships from a fourth wave HCI perspective*. Retrieved from <https://www.diva-portal.org/smash/record.jsf?dsid=498&pid=diva2%3A1882677>
- [36] Maples, B., Cerit, M., Vishwanath, A., & Pea, R. (2024). *Loneliness and suicide mitigation for students using GPT3-enabled chatbots*. *NPJ Mental Health Research*, 3(1), 4.
- [37] Bishop, D. (2022). *A friend within your phone: The benefits and harms of social chatbot Replika*. Retrieved from <https://dc.uwm.edu/uwsurca/2022/poster/22>