Research on quasi-social interaction and loneliness between users and smart home from the perspective of media dependence: Postprint

Authors: WANG Haoyu

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Abstract

The development of media technology has given people a new experience of human-computer interaction. Understanding how human-computer conduct quasi-social interaction is of great significance for understanding the deep psychology of individuals and human-computer relationship. Based on the fact that smart home robots are widely used, from the theoretical perspective of quasi-social interaction, through the questionnaire survey of smart home robot users, the research questions and important concepts are extracted on the basis of existing literature, and the survey data are deeply interpreted and analyzed. Finally, on the path of human-machine quasi-social interaction, it is discussed that the quasi-social interaction between users and smart home will have an impact on users ' loneliness.

Full Text

Research on Quasi-Social Interaction and Loneliness Between Users and Smart Home Devices from the Perspective of Media Dependence Theory

WANG Haoyu
School of Foreign Studies, Shanghai Business School, China
Corresponding author E-mail: Howoo.wang@foxmail.com

Abstract: The development of media technology has created new experiences of human-computer interaction. Understanding how quasi-social interaction unfolds between humans and computers is crucial for comprehending the deeper psychological dimensions of individuals and human-computer relationships.

Building on the widespread adoption of smart home robots, this study employs the theoretical lens of quasi-social interaction. Through a questionnaire survey of smart home robot users, research questions and key concepts are extracted from existing literature, and the survey data are subjected to in-depth interpretation and analysis. Finally, the paper explores how quasi-social interaction between users and smart home devices influences user loneliness.

Keywords: Quasi-social interaction, media dependence, smart home, loneliness

1.1 Background Information

At the beginning of 2022, the COVID-19 pandemic in China exhibited a multi-point outbreak pattern, making social distancing and hygiene maintenance essential social practices. In this context, artificial intelligence (AI) agents and smart home technologies have emerged as pioneers of intelligent technology integration into society, becoming increasingly fundamental to our daily lives. Smart speakers and other smart home devices function as fixed media platforms that connect people and objects within specific scenarios or rule-based systems. We observe that these devices not only control household appliances but also engage in conversational interactions as companions, becoming objects of emotional labor. This raises an important question: Does quasi-social interaction between users and smart home devices influence user loneliness?

2.1 Literature Review of Quasi-Social Interaction

Quasi-social interaction (PSI) theory was first proposed by American psychologists Horton and Wohl in their 1956 paper published in *Psychiatry*, titled "Mass Communication and Para-Social Interaction: Observations on Intimacy at a Distance." Specifically, the theory describes a social connection formed between audiences and media characters that resembles relationships established through daily face-to-face communication. This phenomenon is termed quasi-social interaction. Audiences develop a sense of familiarity with media characters, perceiving them as close friends.

Media figures thus serve as a form of "distant companionship." As times have changed and media technology has continuously advanced, the media that people frequently use has also evolved. Consequently, the connotation of this theory has been constantly updated, and it is now employed to explain a range of psychological reactions and behaviors of audiences toward media figures.

By the 1970s, mass media had developed considerably, and people's engagement with media had reached unprecedented levels. Simultaneously, scholarly research on mass media confirmed the existence of quasi-social interaction. McQuail proposed that mass media serves an "interpersonal communication" function in his study of uses and gratifications theory, suggesting that audiences' interpersonal needs can be satisfied through mass media consumption.

This perspective is grounded in quasi-social interaction theory, and since then, specific research on the topic has gradually emerged.

When examining audience media consumption behavior, German scholar Gleich found that three factors—friendship, program content, and psychological empathy—influence the degree of quasi-social interaction, and argued that the characteristics of quasi-social interaction should be understood as multidimensional. This viewpoint has encouraged researchers to move beyond studying single psychological factors affecting quasi-social interaction. In 2006, Klimmt, Schramm, and Hartmann investigated the negative aspects of audience-media figure relationships in quasi-social interaction. They argued that the process of quasi-social interaction changes dynamically according to audience media consumption patterns, and identified three levels of quasi-social interaction: cognitive, emotional, and behavioral, with these factors evolving alongside the development of audience media consumption behavior.

2.2 Literature Review of Media Dependence Theory

To understand media dependence theory, we can examine its conceptual development from multiple perspectives. Gong Xinqiong, in "Relationship, Conflict, Integration: Understanding the Three Dimensions of Media Dependence Theory," argues that from a relational perspective, audiences depend on media for instrumental or utilitarian purposes, forming both instrumental interests and ritualistic non-interests. From a conflict theory perspective, there exists a positive relationship between social conflict and media dependence. From a structural-functional perspective, media system dependence theory maintains social integration through balancing relationships and preserving structure.

Feng Juxiang, in "Characteristics and Performance of Media Dependence," concludes that as media progresses and develops, people increasingly rely on media for information acquisition, with dependence deepening over time. Wang Huaichun, by comparing audience relationships with old and new media, clearly demonstrates that individuals' dependence on new media is gradually intensifying, manifesting as deepening spiritual and practical reliance.

Furthermore, many scholars have expanded the analysis of media dependence from diverse cultural perspectives, enhancing the breadth and depth of research. Huang Juanjuan, in "Phenomenon of Media Dependence of the Audience in the Context of Social Networks: Based on the Perspective of Media Ecology," notes that current understanding of media dependence remains relatively one-sided, focusing primarily on two viewpoints: technological critique and audience obsession with media use, while neglecting human rational thinking. Therefore, she examines the characteristics and development of media dependence theory from a media ecology perspective, which contributes to the harmonious development of the media ecosystem.

Zhang Xi, in "Exploring the Influencing Factors of Audience Media Dependence from the Perspective of Social Environment: Taking Social Media 'Zhihu' as

an Example," investigates the factors shaping media dependence from a social environmental perspective, using Zhihu as a case study. The research indicates that in the new media environment, audience dependence on media results from the interaction of multiple factors.

Zhu Qinghe and Zhang Junhui, in "Media Dependence of Grassroots Culture and Its Social Utility," explain the phenomenon of media dependence from a multidisciplinary perspective. Sun Li, in "Research on Social Media Dependence from the Perspective of Youth Subculture," points out that media enables individuals to gain identity and quickly find groups sharing their youth subcultures, facilitating communication and a sense of belonging. Consequently, youth groups are particularly susceptible to media dependence.

Nie Ying, in "The Phenomenon of Social Media Dependence from the Perspective of Media Ecology," analyzes why audiences rely on social media from a media ecology standpoint, emphasizing that building sound media literacy is key to avoiding media dependence. Liu Zhensheng, in "Social Media Dependence and Media Needs Research: Taking College Students' Weibo Dependence as an Example," employs quantitative investigation to reveal widespread community formation among college students.

2.3 Questions Raised

Through literature review, it is evident that academic research on media dependence has yielded fruitful results with diverse research objects. However, literature on group media dependence specifically focused on smart home devices remains relatively limited. Therefore, this paper selects the phenomenon of "group dependence on smart home" as its research object to make a meaningful contribution in this area.

This study seeks to answer the following questions from the perspective of media dependence: Does quasi-social interaction between users and smart home devices affect user loneliness? Will it intensify user loneliness? Will users develop strong media dependence?

3 Research Methods

This paper employs questionnaire surveys and interviews as research methods. The questionnaire survey analyzes whether users' quasi-social interaction with smart home devices influences their loneliness from the perspective of media dependence. Through quantitative research, this study examines the degree of quasi-social interaction between users and smart home devices and its impact on user loneliness.

3.1.1 Hypothesis Establishment

Based on the research questions, this study proposes the following hypotheses:

H1: The degree of quasi-social interaction between users and smart home devices is positively correlated with their loneliness.

H2: Media dependence has a significant positive impact on loneliness.

To test these hypotheses, this study employed a questionnaire survey method. Through online sampling, researchers obtained 175 valid samples, representing a response rate of 25.5%. The questionnaire was developed using the Wenjuanxing platform, which was also used for data distribution and storage. After removing duplicate IP addresses and responses with extreme durations (too short or too long), a final sample of 175 responses was retained.

The completion rate for internet sampling surveys is relatively low, and this study is no exception. Other sampling methods also suffer from low response rates; for instance, the CATI method using PPS sampling similarly yields low response rates. This study adopts non-probability sampling due to its operational convenience, time efficiency, and relatively low cost. Non-probability sampling suffices for this study's purpose of exploring relationships between variables. Given constraints such as budget and implementation difficulty, a balance between scientific rigor and feasibility was necessary.

Therefore, this study collected non-probability samples through online questionnaires.

Demographic Characteristics of Respondents **Table 1** Gender Distribution: The gender distribution is relatively balanced, with females comprising 59.24% and males 40.76% of the sample.

Table 2 Age Distribution: The majority of respondents are young people aged 18-25, accounting for 52.73% of the sample, followed by those under 18 (14.13%). The 26-30 age group represents 12.5%, those aged 41-50 account for 8.7%, the 31-40 group comprises 6.52%, while very small proportions fall in the 51-60 (3.26%) and over 60 (2.17%) age ranges.

Smart Home Device Usage Patterns **Table 3** Device Categories: Usage of mainstream smart home devices is relatively evenly distributed. Siri accounts for 63.59% of users, Xiao Ai for 47.83%, Tmall Genie for 37.5%, and Xiaodu for 36.41%.

Table 4 Duration of Use: 35.33% of users have used smart home devices for 1-3 years, 20.65% for half a year to one year, 18.48% for three months to half a year, 16.85% for one to three months, and 8.7% for over three years.

Table 5 Frequency of Use: 46.74% use devices less than three times per week, 32.61% use them 3-4 times per week, 14.67% use them 5-6 times per week, and 5.98% use them more than six times per week.

4.1 The Dependence on Smart Home Robots Is Significantly Related to Duration of Use

This study employs one-way ANOVA to compare sample means and determine whether significant differences exist in population means. If differences are significant, this demonstrates that various factors influence the dependent variables. Since observed variables such as loneliness and basic smart home device usage are primarily categorical and discontinuous, correlation and regression analyses are inappropriate for verifying their relationship with smart home device dependence. Therefore, this section uses one-way ANOVA to examine the dependence on smart home devices and differences in basic usage patterns.

Loneliness was measured using items from the widely used third edition of Russell's Loneliness Scale. The UCLA Loneliness Scale (University of California, Los Angeles) was originally developed by Russell, Peplau, and Cutrona in 1980 to assess subjective feelings of loneliness.

Table 6 shows the dependence on smart home robots across different usage duration categories, including descriptive statistics and confidence intervals.

Table 7 presents the ANOVA analysis results for smart home robot dependence.

Data analysis reveals that dependence on smart home robots is significantly related to duration of use. As the length of smart home device usage increases, dependence on these devices grows stronger.

ELIZA, the world's first chatbot, could not comprehend the true emotions and meanings behind users' words. It could only process text, match sentences for responses, or repeat the other party's words as interpretation. Nevertheless, people showed far more enthusiasm and trust than designers anticipated (Weizenbaum, 1966). In interactions with smart home robots, users' essentially lonely self-talk becomes a form of being heard. To some extent, users perceive smart home robots as projections for self-expression.

As smart home robots become increasingly sophisticated in personalized features and functions, they perform more emotional labor that aligns with human psychological expectations according to predetermined procedures and rules. Users unconsciously assume that smart home robots genuinely experience sympathy and compassion. As media characters, smart home robots resemble actors using props to present a predetermined image for effective performance.

Human users may forget that smart home robots express emotions only according to rules, leading to deeper dependence on social robots. According to public data released by Microsoft Bing China, the top ten phrases humans say to Xiao Bing include "Do you like me," "I love you," "I'm out of love, comfort me," "How about no girlfriend," and many other emotionally charged expressions. When smart home robots replace humans in emotional labor, users may become overindulged in cheap, easily accessible virtual relationships to alleviate loneliness, resulting in the social consequence of collectively escaping real

relationships.

4.2 Loneliness Was Significantly Correlated with Frequency of Device Use

Table 8 shows the degree of loneliness across different usage frequency categories, including descriptive statistics and confidence intervals.

Table 9 presents the ANOVA analysis results for loneliness.

Data analysis indicates that loneliness increases with device usage frequency. Users project their desire for conversation onto smart home robots that provide timely feedback, yet simultaneously recognize that these robots are emotionless machines, gradually intensifying feelings of loneliness.

Sherry Turkle, a social psychologist at the Massachusetts Institute of Technology, has long examined the relationship between people and technology. Turkle argues that all socialized robots will learn to perform caring behaviors toward humans. The social robots created by humans are becoming counterparts for equal interaction, playing the roles of friends, family members, and even lovers. However, social robots that express emotions according to rules and perform emotional labor cannot provide genuine friendship to humans. According to Professor Turkle, the warmth, care, and listening demonstrated by social robots become particularly valuable and seemingly authentic as human relationships grow increasingly alienated. This warmth, care, and listening may even lead human users to selectively ignore that social robots lack consciousness and do not truly understand our fundamental vulnerabilities. As users' quasi-social interaction with social robots increases, their media dependence deepens further. With rapid technological development, as smart home robots replace humans in the realm of emotional labor, human emotional communication itself becomes the object of robot emotional labor. How to prevent genuine emotions from being subsumed into digital and algorithmic production platforms, and how to avoid transforming calculated human emotions into raw materials for capital proliferation, are questions worth pondering.

4.3 The Degree of Quasi-Social Interaction Between Users and Smart Home Devices Is Proportional to Their Loneliness

The results demonstrate that both research hypotheses are supported. First, the degree of quasi-social interaction between users and smart home robots has a significant negative impact on loneliness, confirming H1. Second, users' media dependence has a significant positive impact on loneliness, confirming H2. The data reveal a clear masking effect in the model: the positive coefficient of quasi-social interaction on loneliness through the mediating path of media dependence substantially outweighs the direct negative coefficient. In other words, quasi-social interaction between users and social robots exerts a significant positive

impact on loneliness through the masking effect of media dependence.

The masking effect originally refers to the phenomenon where people's senses are weakened by external environmental interference. In academic research, a "masking variable" weakens the main effect between two variables. According to MacKinnon et al.'s (Mackinnon, Krull & Lockwood, 2000) criteria for distinguishing mediating and suppressing effects, this study's results indicate that while users' quasi-social interaction has a weakening effect on loneliness, media dependence masks this negative effect, resulting in an overall positive effect. Specifically, higher degrees of quasi-social interaction between users and smart home robots lead to greater media dependence on social robots, which in turn deepens users' loneliness.

5 Conclusion

This paper presents a cross-sectional study of quasi-social interaction between users and smart home robots using questionnaires. Although the survey's immediacy positions quasi-social interaction as the theoretical starting point, long-term smart home robot users have largely established relatively stable quasi-social relationships with their devices. The media dependence fostered by smart home robots affects human social practices and interaction behaviors, raising several issues worthy of further attention.

First, the widespread application of smart home robots has expanded the theoretical development space for quasi-social interaction theory. Two paradigms exist in quasi-social interaction research: the deficiency paradigm and the general-use paradigm. The deficiency paradigm proposes that quasi-social interaction between media figures and audiences can compensate for and replace deficiencies in real-life interpersonal communication. The general-use paradigm emphasizes that quasi-social interaction is a universal experience; audiences may engage in quasi-social interaction with media figures regardless of their satisfaction with real social relationships. Research has shown that individual quasi-social interaction levels are not proportional to loneliness (Schiappa, Allen & Gregg, 2007). Such findings have made the general-use paradigm more widely accepted in subsequent research.

Second, deepening media dependence on smart home robots may lead to commercial and political manipulation of user emotions. This study's findings demonstrate that media dependence on smart home robots significantly and positively affects user loneliness. In her book *Group Loneliness*, Turkle highlights a concerning phenomenon: "Today we have seen that people insist on returning the original robot they sent for repair, rather than accepting a replacement copy." This attachment reveals how human loneliness drives emotional investment in these devices.

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Note: Figure translations are in progress. See original paper for figures.