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The Empowerment of the Home-Based Elderly Care Industry Through Interaction Design: An Exploration of Innovation Models and Practices

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Abstract

With the advent of China's aging society, home-based elderly care has become one of the mainstream elderly care models in China. This thesis focuses on the application of interaction design in China's home-based elderly care industry and discusses in depth the innovation model and practice path for the future development of China's home-based elderly care industry. Through desktop research, the author analyzes in depth how interaction design optimizes the living experience of the elderly and improves the quality of elderly care services, reveals its empowering effect on the development of the home-based elderly care industry, and provides theoretical support and practical guidance for continuous progress in this field.

Keywords

aging, interaction design, home care for elderly individuals, innovation; design

1. Introduction

On January 17, 2025, the 2024 population data released by the National Bureau of Statistics of China revealed that the elderly population in China aged 60 and over reached 310.31 million, accounting for 22.0%, exceeding 300 million for the first time. Among them, the population aged 65 and above is 220.23 million, accounting for 15.6% of the total population. The population aging rate has increased by 0.9%, and China has now experienced a moderately aging society. The rapid advancement of China's aging process has made the issue of elderly care the focus of Chinese society. Home-based care for the elderly refers to a model of elderly care in which the elderly choose to live in their own home and spend their later years in the family as the core place. Home-based care for the elderly has been favored for its conformity with traditional Chinese concepts and relatively low economic costs. As a discipline that focuses on improving the interaction experience between people and products, systems and the environment, interaction design has injected a strong impetus into the innovation of the home-based elderly care industry. With the elderly as the core user group, the use of interaction design means to empower China's home-based elderly care industry has broad prospects.

The living needs of the elderly group of home-based care can be summarized as "6 old", that is, "the old have security, the old have medical care, the old have action, the old have learning, the old have education, and the old have pleasure". Among them, the old have security is the core and the basis of the other "5 old". "6 old things" is also built on Maslow's demand level theory, reflecting the needs of the aging group in 5 levels

of physiology, safety, sense of belonging, respect and self realization(Wang et al., 2019). The introduction of interaction design concept into the home-based care industry can provide new ideas and methods to solve the problems existing in the traditional home-based care mode. Through the interaction design method, the designer can better understand the behavior habits, psychological needs and cognitive characteristics of the elderly, and design more suitable pension products, services and environments for the elderly, improve the quality and efficiency of home-based care services, enhance the use experience and satisfaction of the elderly, so that the home-based care model can better adapt to the development needs of the new era.

2. Research Status and Application Areas

2.1 Current Research Status

In some developed countries, such as the United States, Japan, and Germany, the home-based elderly care industry developed early, and the application of interaction design is relatively mature. The smart elderly care equipment market in the United States is relatively developed, and many companies are committed to the research and development of highly interactive elderly care products, such as smart health monitoring bracelets, which can collect the physiological data of the elderly in real time and synchronize the data to relevant medical platforms or family members' mobile phones to achieve remote health management. Japan has focused on humanization and emotional care in the interaction design of elderly care services. Many elderly care institutions have introduced companion robots. They can not only chat and play games with elderly people but also assist them in simple living activities, such as reminding them to take medication on time, helping them get up and wait greatly enrich their spiritual life and relieving their loneliness. Elderly care communities in Germany have performed well in terms of environmental interaction design. Through the rational layout of barrier-free passages, intelligent lighting, emergency call systems and other facilities, they have provided a safe and convenient living environment for elderly individuals.

In China, with the acceleration of the aging process and increasing attention to the issue of elderly care, the home-based elderly care industry has developed rapidly, and research on the application of interaction design has gradually emerged. In recent years, Chinese scholars have explored various interaction designs in home-based elderly care services. In terms of elderly care product design, some studies have used the interaction design concept to optimize the product interface, operation processes, and function settings according to the physiological and psychological characteristics of the elderly to improve the ease of use and applicability of the products. In the design of elderly care service platforms, many scholars have focused on how to improve the interactive experience of the platform to achieve accurate matching of service supply and demand. Through big data analysis, artificial intelligence and other technologies, platforms can recommend suitable elderly care services on the basis of the needs and preferences of elderly individuals.

Although international research on the interaction design of the home-based elderly care industry has achieved some results, there are still some research gaps and deficiencies. On the one hand, interdisciplinary research is not in depth, and the integration of interaction design and elderly care services, geriatric psychology, sociology and other disciplines is not close enough; as a result, the complex needs of elderly people are not comprehensively considered in the design process. For example, in the design of some smart elderly care products, although the realization of technical functions was emphasized, the cognitive characteristics and emotional needs of the elderly were ignored, making it difficult for the products to achieve the expected effects in actual use. On the other hand, most current studies focus on the interaction design of a single product or service, and there is a lack of interaction design research on the overall ecosystem of home-based elderly care. Home-based elderly care is a complex system involving multiple links and roles, including elderly individuals, family members, service providers, the community, medical institutions, etc. How to build an efficient and synergetic interactive ecosystem to achieve good interaction between various elements and information sharing remains to be further explored. In addition, relatively few studies exist on personalized interaction design for elderly people from different regions, different economic statuses and cultural backgrounds, making it difficult to meet the diverse needs of elderly people.

2.2 Application Areas

Health management: The health of the elderly is undoubtedly the top priority of home-based care, and interaction design is extensively used in this field. As a common health monitoring tool, the interface design of the smart bracelet abandons complicated graphics and numerous buttons and uses large fonts to clearly present key data such as heart rate, blood pressure, and sleep monitoring. High-contrast color matching ensures that elderly individuals can easily read them under different light conditions. In terms of operation, simple touch and swipe gestures are used to reduce the memory burden of elderly individuals, which is in line with the characteristics of the elderly's cognitive decline and weakened fine motor control of the hand, reduces the learning cost, and improves device acceptance. Moreover, this type of device is seamlessly connected with mobile apps or medical institution systems. Once abnormal health data are monitored, an early warning mechanism is immediately triggered so that medical personnel receive information in real time and intervene in time, comprehensively improving the level of health security for the elderly at home.

Safety protection: Safety in the home environment is the cornerstone of elderly people's peace of mind. The interaction design uses the smart home security system to build this line of defense. The smart door lock integrates a variety of unlocking methods. In addition to the traditional key, the fingerprint recognition and facial recognition functions provide convenience for daily entry and exit. On the basis of the fingerprint characteristics of elderly individuals, the design of the identification area is optimized, the contact area is increased, and the sensing sensitivity is increased to ensure the accuracy of fingerprint identification. The facial recognition module has the ability to capture and adapt quickly to light changes, whether it is direct, strong light or dim light, can be accurately identified, allowing the elderly to enter and exit the house without barriers. Once the system monitors the abnormal door opening status, such as when the door is not closed for a long time, a stranger breaks in, etc., it immediately pushes an alarm message to the children of the elderly or community security personnel to inform the elderly of the potential danger with clear and clear messages and guide them in reasonable responses. The entire interaction design process should fully consider the psychological stress response and information processing ability of the elderly in emergency situations to ensure the personal and property safety of the elderly in the home environment and create a secure living atmosphere.

Social entertainment: Loneliness is a prominent issue that affects elderly people at home. Interaction design can effectively alleviate this dilemma by optimizing the social entertainment function. The interface layout of the social networking APP customized for the elderly is designed like a traditional phone book. The avatars of the contacts are enlarged and clear. The operational functions focus on core social needs such as video calling and voice chat, and one-click communication starts and lowers the operational threshold. Some social networking platforms for the elderly tapped the interests and hobbies of the elderly and formed online communication groups for calligraphy, painting, and photography to stimulate the enthusiasm of the elderly for interaction by virtue of easy-to-operate work upload and comment functions. Through an interaction design that adapts to operational ability, space limitations are broken, and the social circle is reshaped so that the elderly can integrate into a rich and colorful social entertainment life without going out, which can enhance the happiness of living at home and provide care and attention to the elderly at the psychological level. Nourishes and improves overall life satisfaction.

3. Collaborative Innovation And Personalized Customization

3.1 Interdisciplinary Collaborative Innovation

The empowerment of the home-based elderly care industry through interaction design is inseparable from the close collaboration of multiple disciplines. In the research and development of rehabilitation assistive devices, in-depth integration with medicine is key. Taking a rehabilitation training robot as an example, medical experts precisely design action trajectories on the basis of the rehabilitation needs of elderly individuals, the characteristics of body function decline and the requirements of rehabilitation courses to ensure scientific and effective training actions. Interaction designers focus on creating the control panel, use simple and easy-to-understand icons, and provide step-by-step guidance so that the elderly clearly understand the purpose and operation method of each training link and reduce the difficulty of use.

Psychology is also indispensable. If elderly people cannot correctly address their emotions, this can easily lead to depression, and elderly people with depression may have suicidal tendencies. According to a survey by Yanwu Liu, the suicide phenomenon of the rural elderly "has become shockingly serious". A psychological counseling module is incorporated into the design of intelligent companion equipment to monitor the emotional state of elderly people in real time. When negative emotions such as depression and anxiety are detected, the device automatically plays soothing music to soothe emotions on the basis of psychological principles and sends warm words to provide psychological comfort to accompany the elderly through the emotional trough. This interdisciplinary integration breaks the knowledge boundary of a single discipline and integrates professional advantages such as medicine and psychology to provide all-round and in-depth support for the innovation of home-based elderly care products and services and precisely meet the diverse needs of elderly individuals.

3.2 Personalized Customization Service

In view of the significant individual differences among elderly people, interaction design is leading the home-based elderly care industry into the era of personalization. Big data technology is used to collect comprehensive data on the daily life of elderly individuals, covering activity trajectories, consumption preferences, medical records, interests and hobbies, to construct detailed user portraits. On the basis of this portrait, the intelligent elderly care system customizes exclusive healthy recipes for each elderly person, reasonably matches the ingredients according to nutritional needs and dietary taboos, and generates a personalized home exercise program to adapt to the physical condition and exercise ability of the individual, prevent disease and promote recovery.

At the interactive terminal level, the elderly have the authority to independently adjust the interface layout and the order of the functional modules. For example, elderly people who love reading can set the e-book reading function to the top and optimize the text display to adapt to their vision conditions; for elderly people with chronic diseases, the health management module can highlight the display of disease monitoring data, rehabilitation suggestions and reminders for return visits. This type of personalized service deeply fits the individual needs of the elderly and can greatly improve the quality and degree of satisfaction of elderly care services.

4. Practical Challenges and Coping Strategies

4.1 Technology Acceptance

Although the interaction design strives to optimize the usability of elderly care products, some elderly people still have difficulty accepting new technologies. On the one hand, the long-term solidified living habits and traditional thinking modes have caused elderly people to have instinctive resistance to smart devices, as they believe that the devices are complicated, difficult to learn and unreliable; on the other hand, when they first contact smart elderly care products, the tedious initial settings and complicated operation process frustrate their ability to learn and dilute their enthusiasm for use.

To address the above problems, community and elderly care institutions should jointly build a complete training system and organize regular and targeted training courses. The teaching method follows the step-by-step principle, starting with the most basic turning on and off and the demonstration of simple functions, combined with practical drills to allow the elderly to become familiar with complex functions in practice. Moreover, the concept of "peer education" is introduced to encourage fast learners to share their experiences and enhance the learning atmosphere and confidence. In the early stage of product design, the elderly were fully recruited to participate in the trial test, the interaction process was optimized in a timely manner, and the operation steps were simplified on the basis of the feedback to ensure that the products fit the cognitive habits of elderly individuals, to increase the initial acceptance from the source, and to lay a solid foundation for subsequent promotion and application.

4.2 Potential Privacy and Security Risks

The interactive home-based elderly care system carries a large amount of personal health and living privacy data of elderly individuals, and the risk of data leakage is similar to the sword of Damocles, arousing

widespread concern. At the technical level, investment in the research and development of cybersecurity protection technology should increase, advanced encryption algorithms should be used to encrypt the entire process of data transmission and storage, and a strong firewall should be built to resist external threats such as hacker attacks and malicious theft.

In the interaction design link, the data access authority was carefully regulated, the scope of data acquisition was strictly limited on the basis of the different roles and responsibilities of medical personnel, offspring, and community service personnel, and a detailed record was retained for each visit to achieve traceability of the data flow. More importantly, it is important to explain data usage rules and privacy protection measures to the elderly in an easy to understand and illustrated form, such as displaying privacy policy points intuitively on the app login page and device initial settings interface, to ensure that the elderly have a clear understanding of the destination and protection methods of their personal data, eliminate concerns, and safeguard the stable development of the home-based elderly care industry under interactive design empowerment.

5. Conclusions

5.1 Summary of the Current Status

This study focused on the in-depth application of interaction design in the home care industry and systematically described the current research status and future innovation and development direction of interaction design in the home care industry.

Current research shows that China has a moderately aging society, and interaction design, as an innovative force, has been strongly involved, with remarkable results in core areas such as health management, safety protection, and social entertainment. In terms of health management, the smart bracelet is a typical representative. Its interface and operation are carefully designed on the basis of the cognitive characteristics of elderly individuals, with large fonts, high contrast, easy gesture operation, and seamless connection with the medical system to achieve independent health monitoring and professional cooperation. Organic and unified medical support provides all-round protection for home health. In terms of safety protection, the smart home security system uses devices such as smart door locks to fully consider the changes in the body functions of elderly individuals, optimize the accuracy of identification, and promptly alarm and guide the response to abnormalities to effectively protect home safety. In the field of social entertainment, exclusive social networking apps and platforms for the elderly meet their psychological needs, imitate the traditional layout, focus on core functions, and tap interest groups to overcome social loneliness and restore spiritual vitality in elderly individuals.

In terms of the construction of the innovation model, interdisciplinary collaborative innovation integrated medicine, psychology and other disciplines. Experts and designers in the research and development of rehabilitation equipment have joined hands to integrate intelligent companionship into psychological comfort; personalized customization services rely on big data portraits to customize exclusive recipes and exercise for the elderly plan; and the interactive terminal independently regulates and deeply fits individual differences, thereby improving the quality of elderly care services and injecting a surge impetus into the home-based elderly care industry.

5.2 Suggestions for Future Prospects

Although the integration design into China's home-based elderly care industry has achieved some results, there are still some deficiencies. On the one hand, although there are coping strategies for the issue of technology acceptance, the difficulty of promoting smart elderly care products and increasing technology acceptance among elderly people in remote areas or with low education levels should not be underestimated. Moreover, the elderly care model needs to consider adapting to the local economic foundation (Jin et al., 2018). On the other hand, the R&D investment costs of privacy and safety hazard prevention and control technologies are high, the existing normative documents lack systemicity (Sui & Peng, 2016), continuous upgrades face funding and technology bottlenecks, and there is still room for improvement in explaining the effectiveness of complex safety policies to the elderly.

For follow-up research, the research can be conducted in depth from multiple dimensions. For example, in the direction of technology research and development, we will actively explore interaction technologies that are more suitable for the physical and cognitive degradation trends of elderly people, such as the enhancement of tactile feedback and the fusion of multimodal interactions to improve the usability of products; expanding the interdisciplinary scope; and introducing sociology and gerontology. We will comprehensively analyze the needs of elderly people and optimize the design of products and services. At the marketing level, the government, enterprises and social organizations were united to develop differentiated promotion strategies targeting elderly groups in different regions and strata and to strengthen the popularization of training. In terms of policies and regulations, we call for improvements in pension data security laws, standardized industrial development, and protection of the rights and interests of elderly individuals. In terms of talent training, owing to the strong operational characteristics of the industry, elderly care design is characterized by large operation spans, many disciplines involved, and long design cycles, which puts forward greater requirements for designing talent in abilities such as comprehensive planning, logical thinking, and interdisciplinary coherence (Cai, 2019). In summary, continued in-depth research on the empowerment of the home-based elderly care industry through interaction design is expected to lead to a more complete and humanized elderly care ecology, help the elderly enjoy a happy old age, and push the social elderly care undertaking to a new peak.

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Conflicts of Interest

The authors declare no conflict of interest.

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