Research on the Design of Elderly Service System from the Perspective of Design Ethics
Taking the Design of Sleep Care Service System as an Example

Mingran Huo[1] Dongjiu Yu[2]

1,2 Nanjing Tech University, Nanjing, China

ABSTRACT
Starting from the background of population aging, this study explores how designers think about the design ethical challenges brought by technological development when designing services for the elderly. Through in-depth discussion and analysis of the user behavior, operational needs, and technical accessibility of the elderly, the study summarizes the ethical issues in the design of services for the elderly, and ultimately summarizes three principles of design ethics for sleep care services for the elderly, i.e., focusing on individual differences and diversity, ensuring product safety and accessibility, and perceptual ease of use from the perspective of aging. The design practice is also based on this foundation, proposing design ethics combined with technological development for the design of elderly service systems, and calling for further research and interdisciplinary cooperation to promote better fulfillment of the needs of the elderly.

Keywords: *Design ethics, Sleep safety, Service system design, Multidisciplinary integration.*

1. INTRODUCTION

The development of the Internet, Internet of Things, big data, and artificial intelligence technologies has led to the widespread application of smart home products, providing users with intelligent and convenient services [1]. Services using cell phones as terminals, such as online shopping, taxi, food ordering, and smart home control, have accelerated the process of digitization and intelligence in daily life. However, in this era of rapid technological development, a portion of the elderly who are unable to update their technological cognition in time are isolated from intelligence, and it is difficult for them to keep up with the development of the times due to the deterioration and lack of physical functions, or the imperfect network infrastructure [2]. For the elderly, what intelligent products bring is not necessarily a convenient life, but more likely to be new barriers and obstacles [3].

As the global aging trend intensifies, the health and well-being of the elderly have become the focus of social attention. Sleep plays a crucial role in the daily lives of older adults, but many older adults face sleep problems and safety hazards, which may negatively impact their health and quality of life: sleep problems may lead to adverse effects such as daytime fatigue, cognitive decline, mood swings, decreased immunity, and even increased health risks such as developing depression, cardiovascular disease, and cognitive impairment. In addition, older adults are more likely to experience nighttime awakenings, insomnia, and apnea during sleep. Therefore, it is of great theoretical and practical significance to study the sleep safety care service system for the elderly. It can not only improve the sleep quality and quality of life of the elderly and reduce the safety risks, but also provide innovative solutions for geriatric care and enhance the health care of the elderly.

2. CONCEPTUAL CONNOTATION OF DESIGN ETHICS AND CURRENT RESEARCH STATUS

Design ethics means that designers must focus on the long-term interests in the process of design behavior, and use ethics to achieve balance and

coordination of the three aspects of people-environment-resources [4]. Victor Babanak pointed out in Designing for the Real World that in the era of mass production of industrial products, design has become the most powerful tool for shaping supplies and the environment, so designers need to have a high sense of social and moral responsibility. In the 21st century, the issue of design ethics has attracted more and more attention, and the "Design Ethics Education Forum" held in Hangzhou in 2007 called for reflection on design in the name of the future, and assuming the responsibility of ethical reflection and value reconstruction in the name of design.

In today's society, the cause of design activities has been expanded to the entire human society and the natural environment, and all kinds of ethical issues related to design have begun to have an impact on human beings and nature and have attracted people's attention and attention [5]. Design ethics is not only a kind of norm, but also an important dimension for designers to reflect humanistic care [6]. As the famous scholar Liu Guanzhong said: design is culture. Chaos and chaos conceal order, uncertainty and contradiction breed opportunities, worry and ideals contain philosophy, and ideas and exploration require the updating of concepts and the science of methodological mechanisms. How to utilize the advantages of technological change, reduce the negative impacts of technology, and enhance the equality of enjoyment of technology are problems that can be solved through design [7].

3. ETHICAL ISSUES IN CONTEMPORARY SERVICE DESIGN FOR OLDER PEOPLE

In the contemporary design of services for older people, there are ethical issues such as neglecting the independence and autonomy of older people and violating the privacy and data of older users, which need to be attended to and addressed by designers.

3.1 The Issue of Respect for Independence and Autonomy

Service design for the elderly has evolved from focusing on physiological changes and assisting people's normal life through technology, to nowadays paying more attention to psychological changes and committing to providing emotional support so that the elderly can live in the digital society with dignity [8]. Independence and autonomy of older people are important considerations in the design of services for older people. Independence and autonomy have a significant impact on the well-being and quality of life of older people as they relate to important aspects of individual dignity, self-determination and personal control.

Adequate consideration of the individual differences and diversity of older persons is often lacking in the design of services for older persons. Older persons are a diverse group with different values, preferences, abilities and needs. However, in the design process, older persons are often viewed as a homogenous group, ignoring the existence of individual differences, which can lead to problems of standardization and one-size-fits-all in services for older persons, depriving them of autonomy in service selection and decision-making. In addition, inadequate information and communication in the design of services for older persons negatively impacts their independence and autonomy. Older persons may face technological barriers, difficulties in accessing information and communication barriers with service providers. This limits the ability of older persons to obtain the necessary information for service selection and decision-making, as well as to express their wishes and preferences. The lack of open channels of information and communication undermines the autonomy and decision-making power of older persons.

Finally, institutional barriers and social biases in the design of some services for older persons also limit their independence and autonomy. For example, excessive regulations, discriminatory policies and prejudicial perceptions exist in some nursing homes and health-care facilities, negatively affecting the autonomy and autonomous decision-making of older persons. These institutional barriers and social prejudices prevent older persons from exercising their autonomy in services and limit their ability to make autonomous choices and participate in decision-making.

3.2 Privacy and Data Security Protection

Computer system trustworthiness (Dependability) is the level of trust in the services provided by the system [9]. Younger groups have a general basic knowledge of the data and information obtained from smart services while older people lack relevant background knowledge and experience and often cannot find or read the

relevant terms and conditions. They lack informed consent to the data collection and processing process and cannot effectively control and manage their personal information. Some services for older people are designed in such a way that there is a risk of privacy leakage during data collection and processing. Older people's personal information and sensitive data may be accessed, used or misused by unauthorized persons or organizations. For example, in health monitoring devices, smart home systems or remote care services, sensitive data such as older people's bio-information, health status, daily activities, etc. may be involved.

In services for older people, the issue of data security includes security during data storage, transmission and processing. Data security involves confidentiality, integrity and availability of data. For example, a smart health monitoring device may collect physiological data, such as heart rate and blood pressure, from an older person for monitoring and reporting health conditions. However, if this data is not properly encrypted and secured, it may be accessed and used by unauthorized persons, resulting in a breach of the health privacy of older persons.

4. DESIGN PRINCIPLES OF ELDERLY SERVICE SYSTEM BASED ON THE CONCEPT OF DESIGN ETHICS

The principles of designing service systems for the elderly based on the concept of design ethics focus on respecting the dignity, independence and privacy of the elderly and on their emotional needs and humane services.

4.1 Humanized Service Process

Humanized design is a design method that pays attention to and respects users' needs, values and experiences. The users of service design are human beings, and its design should be centered on human beings and conform to human needs and human interests [10]. In service design for the elderly, humanized design becomes particularly important because the elderly often face changes in their physical, cognitive and perceptual abilities, which require special attention to their needs and special contexts. Service processes with humanization aim to create user interfaces, products and services that meet the needs of older people and provide a better user experience and quality of life.

Humanized design focuses on the physical and cognitive abilities of older people. Older people may face problems such as vision and hearing loss, motor function decline, and memory loss. These changes should therefore be taken into account in the design of service processes by providing interfaces with large fonts and high contrast, and using clear and easy-to-understand language to ensure that older persons can easily understand and use products and services. For example, in mobile applications, adjustable font size options can be provided to meet the reading needs of different older persons.

Humanized design focuses on the emotional and psychological needs of older persons. Older people may face emotional challenges such as loneliness, loss of loved ones and friends, and adapting to new life stages. Service design for older groups can help older people make connections, find interests and get emotional support by providing social functions, personalized recommendations and emotional support. For example, easy-to-use social functions can be provided in smart devices to allow older people to stay in touch with family and friends.

Humanized design focuses on social engagement and autonomy for older people. Older people want to stay socially active, continue learning and participate in the community. Convenient socialization platforms, online learning resources and community engagement opportunities should be provided throughout the service process to encourage older persons to actively participate in social life. For example, in older persons' communities, diverse activities can be established to meet the interests and needs of older persons and provide easy-to-engage information and support.

Humanized design emphasizes user experience and user participation. Older persons, as the end-users of design, should have their opinions and feedback taken into full consideration. Designers should encourage older people to participate in the design process by providing easy-to-use interfaces and operations that make older people feel confident and satisfied. For example, during the product testing phase, older people can be invited to participate in user testing to collect their opinions and suggestions to improve the design and functionality of the product.

4.2 Data Privacy and Security Design

Data privacy security design is crucial in service design for the elderly. With the advancement of technology and digitalization, many services for the elderly involve the collection, processing and storage of personal information and sensitive data. In order to protect the privacy and data security of older people, the design of services for older people should follow the data minimization principle and only collect and use necessary personal information and data. The data collected should be closely related to the services provided and over-collection of sensitive information should be avoided. By minimizing data collection, privacy leakage and data security risks can be reduced.

Strict data security measures should be implemented on this basis to protect the confidentiality, integrity and availability of personal data. This includes the use of strong encryption technology to ensure data security during storage and transmission; the establishment of access control mechanisms to restrict access to data; and the conduct of regular security audits and risk assessments to identify and rectify potential security breaches. Older people should be informed of the purposes for which personal data are collected, how they are used and how they are shared. Clear privacy policies and user agreements should be provided in the design so that older persons understand how their personal data will be used and protected. Informed consent is key to ensuring that older people have control and choice over their personal data.

Data privacy and security design in the design of services for older people is key to protecting older people's privacy and data security. By following the principle of data minimization, strengthening data security measures, providing transparency and informed consent, older people's personal data can be protected from intrusion and misuse, and older people can be empowered to have control over and trust in their personal data. This will help to build sustainable services for older persons and improve their quality of life and well-being.

5. DESIGN PRACTICE OF SLEEP CARE SERVICE SYSTEM FOR THE ELDERLY BASED ON THE CONCEPT OF DESIGN ETHICS

Design practice through the above design strategies can better meet the needs of older people, provide safe, reliable and welcoming sleep care services, and make a positive contribution to the health and well-being of older people.

5.1 User Research and Demand Analysis of Sleep Monitoring System for the Elderly

User behavior observation is to observe the testers in a planned and purposeful manner and record the basic psychological characteristics of the testers' behaviors, and to establish a user behavior observation record sheet to facilitate the researchers to clarify the purpose of observation and record the observation data of each tester in a timely manner. The target users in the service system are surveyed and researched, so as to understand the various problems encountered by the elderly group in the sleep state, and to dig out the pain points and opportunity points of the elderly, so as to provide reference for the subsequent design of the sleep monitoring service system.

In the demand research phase, the sleep problems faced by the elderly are first analyzed through desktop research and question cards. The survey research shows that the elderly may face a variety of problems during sleep, including insomnia, frequent nocturia, sleep apnea, irregular sleep-wake rhythms, venous thrombosis, noise and environmental disturbances, as well as sleep-related movement disorders. According to data published by the Alzheimer's Association of America, seniors who sleep seven hours or less per night can delay brain aging by up to two years, making it important for the senior population to improve the quality of their sleep and maintain good sleep health.

5.2 Analysis of Existing Sleep Monitoring Products in the Market

Currently, a variety of elderly sleep monitoring products exist in the market, and each product and service has its own characteristics and advantages, and these systems are designed to help the elderly monitor and improve sleep quality. The largest share is accounted for by smart wearable devices such as smart bracelets, smart watches, and sleep caps. These devices usually monitor the user's sleep time, sleep quality, heart rate and other metrics through built-in sensors and provide appropriate reports and analysis. There is also a category of devices placed underneath the mattress that monitor the user's sleep activity through sensing technology. These sensors measure the user's body movements,

breathing rate, sleep position, etc. to assess sleep quality and provide corresponding reports and recommendations.

5.3 User Journey Mapping Analysis

Explore the stages, behaviors, emotions, pain points, and opportunity points that need to be involved in the age of older adults when they receive sleep monitoring services to support subsequent service system design.

Based on the pain point analysis, the opportunity points for optimizing the design of the sleep monitoring service system for the elderly are derived, firstly, the use of care products to monitor the physical health of the elderly and to provide door-to-door assistance and medical services. Secondly, as many elderly people live alone, there may be accidents at night, so the sleep monitoring APP should monitor the sleep quality of the elderly in real time, show no one's sleep report and visualization analysis and synchronously uploaded to the system of children and doctors, so that they can keep abreast of the elderly's health status and take timely action when there are emergencies. In addition, based on big data and the Internet of Things to realize the interconnection of everything, provide online expert one-on-one diagnosis, give personalized conditioning programs, and build a multi-party service platform to jointly protect the sleep safety of the elderly.

5.4 Elderly Sleep Monitoring Service System Model Construction

Based on the comprehensive analysis of the above user needs, a complete sleep monitoring service system for the elderly is constructed, the monitoring process is improved, and the service blueprint of the sleep monitoring system is drawn, so as to bring a better sleep experience to the elderly group.

5.4.1 Constructing the Sleep Monitoring Service System

The service system diagram in the service design tool can help people analyze and sort out complex information and show the global relationship of services. A service system is an interactive and collaborative network of service providers, service recipients, and other relevant stakeholders designed to deliver a specific service. It consists of a series of interrelated activities, processes, resources and information flows. Therefore, it is necessary to sort out the interrelationships between older adults-children-physicians in using the health monitoring service system and linking these service scenarios to form a systematic service flow.

5.4.2 Drawing the Service Blueprint of Sleep Monitoring System for the Elderly

Based on the above user requirements to optimize the service system and accurately describe it in a visual way, the sleep monitoring service system for the elderly is divided into seven stages: purchasing products, sleep report, expert care, monitoring sleep, doctor's visit to rescue and treatment, data uploading and feedback.

5.4.3 Interface Design of Sleep Monitoring Service System for the Elderly

The sleep monitoring service system mainly includes three main sections: 1) data visualization for elderly users, which mainly displays sleep curves and visual data, and users can view their own sleep data through the APP, such as the length of snoring, the length of teeth grinding, normal respiration, deep sleep, normal sleep, etc., and automatically record the number of times of getting up in the night, so that the users can have a clearer sense of the quality of their own sleep; 2) a physician service platform, doctors can view patient data in the system and give timely treatment advice, when there is an emergency situation, it will automatically issue an early warning to remind doctors and their children to take timely first aid measures; 3) doctor-patient contact platform, patients can view the doctor's treatment area and the number of appointments on the platform, according to their actual situation to book a doctor, when the symptoms are mild and do not need to go to the hospital, you can also contact the doctor for advice through the platform. When the symptoms are mild and do not need to go to the hospital, they can also contact the doctor for consultation through the platform.

6. CONCLUSION

From a design ethics perspective, this study focuses on the respect of the independence, autonomy and privacy of older people, as well as the protection of data privacy security. By analyzing the existing problems and challenges, it is recognized that there are still some ethical issues

in the design of services for the elderly that need our attention and solutions. By paying due attention to the independence, autonomy and privacy of older persons, we can create more humane, respectful and secure service systems that enhance the quality of life and well-being of older persons

REFERENCES

[1] DU Jinhua, QI Ruoxuan. Research on voice user interface design strategy for aging-appropriate smart home products based on contextual analysis[J]. Packaging Engineering, 2021, 42(16): 202-210. DOI:10.19554/j.cnki.1001-3563.2021.16.028.

[2] Li Zhihong. Innovative strategies for China's aging policy in the new era[J]. Scientific Research on Aging, 2018, 6(03): 3-13.

[3] ZHANG Wei-Wei,LIU Ming-Hui,WANG Susanna. Inclusiveness in the digital age: a study of smart product design for aging from the perspective of design ethics[J]. Decoration, 2022(05): 46-51. DOI:10.16272/j.cnki.cn11-1392/j.2022.05.025.

[4] YANG Xianyi,LIU Yang,WANG Jun. Analyzing the connotation of design ethics[J]. Beauty and Era(First Half),2009(03):15-18.DOI:10.16129/j.cnki.mysds.2009.03.018.

[5] XIONG Xingfu, ZHAO Yiyi. Exploration of public service facilities based on the concept of design ethics[J]. Packaging Engineering, 2018, 39(06):240-244.DOI:10.19554/j.cnki.1001-3563.2018.06.046.

[6] Lu Xiaobo. A Little Thought on Design Ethics[J]. Art Observation, 2003(06):11.

[7] Wu Qiong. Design ethics in the information age[J]. Decoration, 2012(10):32-36.DOI:10.16272/j.cnki.cn11-1392/j.2012.10.006.

[8] HU Fei, ZHANG Xi. Designing for Aging: The Birth and Flux of Design Concepts Involving the Elderly since 1945[J]. Journal of Nanjing Arts Institute (Art and Design),2017(06):33-44+235.

[9] Kza B, Jq C, Pza B, etal. The Mortality Trends of Falls Among the Elderly Adults in the Mainland of China, 2013—2020: A Population-Based Study Through the National Disease Surveillance Points System [J]. The Lancet Regional Health - Western Pacific, 19.

[10] Zhang Gang. Reflections on humanized design of urban public facilities[J]. Packaging Engineering, 2022, 43(20):332-335. DOI:10.19554/j.cnki.1001-3563.2022.20.038.