ISSN 2616-5783 Vol.8, Issue 9: 65-69, DOI: 10.25236/AJHSS.2025.080910

Research on the Design of Age-Friendly Furniture Products from the Perspective of Active Aging

Linzhi Zhou[1,a], Sufen Liu[1,b,*], Jinchuan He[1,c]

[1]*Creative Design School, Guangzhou Software College, Guangzhou, China*
[a]*184343320@qq.com,* [b]*496830465@qq.com,* [c]*676469078@qq.com*
[*]*Corresponding author*

Abstract: *Addressing the adaptability issues of the elderly's living environment, this study focuses on furniture design for two primary living forms: home-based elderly care and nursing homes. The primary objective is to comprehensively evaluate and improve the design of age-friendly furniture to more effectively meet the needs of the elderly population. Employing a user-centered approach, this study conducts a detailed analysis of the living environment and behaviors of the elderly, revealing the limitations of existing age-friendly furniture in terms of safety and usability. This research further constructs a conceptual model, design path, and theoretical framework for age-friendly furniture design in system design, aiming to optimize furniture planning, behavioral habit analysis, form selection, and situational interaction, ensuring regional adaptability and cultural sensitivity in design outcomes. Age-friendly furniture should facilitate interaction and communication between the elderly and their living environment, enhancing their quality of life. Additionally, the design process must adhere to scientific methods to ensure the feasibility of the scheme.*

Keywords: *Age-Friendly Furniture Design; Behavior Analysis; User-Centered Design*

1. Introduction

By the end of 2024, the population aged 60 and above in China had climbed to 296.97 million, accounting for 21.1% of the total population, while the population aged 65 and above accounted for15.4%[1]. To address this challenge, the World Health Organization (WHO) proposed the core concept of "Active Aging", with "Universal Design" by Goldsmiths, UK, and "Residential Buildings for the Elderly" by the United States as typical representatives [2]. Domestic research on aging mainly focuses on the elderly housing industry [3] and detailed elaboration on spatial planning, furniture layout, and detail design of residential spaces [4]. At the same time, it also explores the residential needs of elderly people at different stages (healthy elderly, assisted elderly, and nursing elderly), as well as design methods and design patterns for elderly housing [5]. In addition, some studies take the main furniture in a certain entrance hall space as the starting point, combining universal design, barrier-free design, elderly care grading, and elderly care models to explore the requirements for aging-friendly renovation of residential spaces [6]. Currently, research on aging-friendly furniture design for home use is mostly spatially concentrated in living rooms, kitchens, bedrooms, and bathrooms [7]. This article will start from the perspective of furniture design, combining the behavioral characteristics of the elderly, to stud

2. User behavior method and application

The "user behavior approach" originated from the interdisciplinary research between psychology and behavioral science in the early 20th century. Its core is to reveal users' underlying needs, motivations, and decision-making processes by observing, recording, and analyzing their behavior patterns during interaction with products or systems, providing a scientific basis for design. Psychologist B.F. Skinner revealed the causal relationship between behavior and incentives through the "Skinner box" experiment: by designing clear feedback mechanisms, users can be guided to act according to preset goals.

Common user research methods include: observing user interactions with products in their natural environment; conducting in-depth interviews to understand user feelings; collecting large-scale data through questionnaires and conducting usability tests to observe user operational issues; and utilizing prototype testing to gather user feedback for iterative product design.

ISSN 2616-5783 Vol.8, Issue 9: 65-69, DOI: 10.25236/AJHSS.2025.080910

3. Analysis of the characteristics of age-friendly furniture

3.1 Physiological and psychological characteristics of the elderly

The physiological functions of the elderly undergo significant changes, specifically manifested as slower responses and organic functional decline. Based on these physiological characteristics, the elderly can be divided into three categories: The first category is self-care elderly, who are physically healthy and energetic, not only capable of independently managing daily life but also having the spare energy to engage in socio-economic activities. After meeting their basic living needs, they have the "capital" to enrich their spiritual world, including "active" elderly who have a high willingness to actively age and enthusiastically participate in various social, cultural, and recreational activities. The second category is assisted-care elderly, whose physiological functions are weaker than those of self-care elderly, with reduced ability to independently participate in social activities. Their social circles are narrowed to the community and they require the company of others. However, even so, they can still choose to actively age with the company of others, actively communicating with others and participating in elderly education and cultural entertainment activities. The third category is disabled elderly, whose physical functions have significantly declined, requiring home-based or institutional care. However, they also have physiological, safety, social, self-esteem, and self-actualization needs. Under the concept of active aging, they can also integrate into active life in their own unique ways through sight, hearing, smell, and other means.

3.2 Current status of age-friendly furniture design

Significant progress has been made in the field of age-friendly furniture design in recent years, which is attributed to both the precise consideration of the special needs of the elderly and the driving force of increasingly vigorous market demand. As presented in Tab 1, numerous furniture manufacturers and designers have actively participated in this field, leveraging innovative materials and functional design to improve the living environment of the elderly and enhance their quality of life. Currently, although age-friendly furniture design has achieved certain results through the application of innovative materials and functions, further optimization of products requires in-depth insight into the real living conditions and challenges faced by the elderly. This not only relies on quantitative data but also involves qualitative insights obtained through user observation, scenario analysis, and other methods. Qualitative insight analysis can accurately summarize specific problems and needs in the lives of the elderly, providing precise guidance for furniture design optimization and helping to develop furniture products that meet the physiological and psychological needs of the elderly and truly adapt to their lifestyles and expectations.

Table 1 Elderly characteristics and furniture design

	Characteristics of the elderly	Behavioral issues	Furniture design solutions
Physiology	Decreased hand flexibility	Difficult to operate and complex components	Design simple and easy to usehandles and operation interfaces.
	Vision deterioration	Identification is difficult, especially for items with low color contrast.	Use high contrast colors and adequate lighting equipment.
	Muscle strength decline	Moving furniture is difficult.	Made from lightweight materials.
	Decreased balance ability	May fall when standing or sitting down.	Adds wheels or sliding mechanism.
	Move slowly	It takes longer to move from one place to another.	The furniture is highly stable, with auxiliary grips or support devices.
Psychology	The need for independence	Unwilling to ask for help, resulting in injuries caused by using unsuitable furniture.	Design furniture that is easy to operate and accessible.
	Resist change	Resistance to new furniture or changing the furniture layout	Furniture with a traditional appearance and simple operation.
	Emotional fluctuations, feelings of loneliness	Sensitive to the environment, easily feels uneasy, lacks social interaction.	Use warm colors and comfortable materials, designing to promote social interactions.
	Memory is difficult	Forget the location of items or how to use furniture	Design furniture with label prompts.

ISSN 2616-5783 Vol.8, Issue 9: 65-69, DOI: 10.25236/AJHSS.2025.080910

4. Furniture usage behavior of the elderly

4.1 Research Methodology and Process

This study explores the design of age-friendly furniture through a five-stage user research process, as illustrated in Figure 1, to ensure effective satisfaction of the needs of elderly users. Initially, behavioral data from elderly households is systematically collected through observational research, utilizing videos and images to document daily activities in key living spaces. Subsequently, the AEIOU behavioral analysis framework is employed to preliminarily categorize and comprehend the data. Building on this foundation, Noldus Observer XT software is utilized for more in-depth video observation and behavioral coding, accurately capturing and analyzing the interaction patterns of the elderly. Following this, data visualization techniques are integrated to visually present the analysis results, thereby gaining insights into user behaviors and needs. Ultimately, these analysis findings are transformed into specific design improvements and suggestions, shaping innovative furniture design concepts aimed at enhancing the functionality of furniture and accommodating the usage needs of the elderly, ultimately improving their living comfort and quality of life. This process transforms intangible user data into tangible design solutions, effectively bridging theoretical research and practical application.

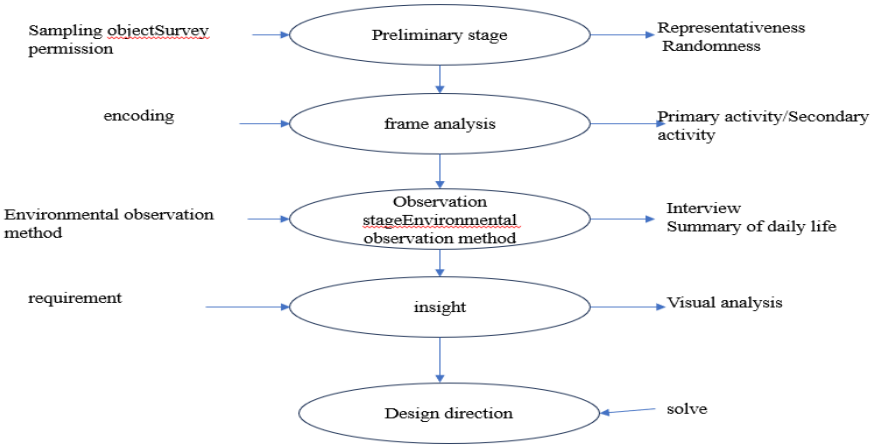

Fig.1 Design process of age-friendly furniture

4.2 Observation method

4.2.1 Sample selection

This study selected six elderly households from seven districts in Guangzhou as observation subjects, with the following sample selection criteria. 1) In terms of age and health status, the participants were aged between 65 and 82, with four in a self-care state, meaning their Activities of Daily Living (ADL) scores were greater than or equal to 90. Two participants had mild functional impairment, with ADL scores ranging from 60 to 89. 2) In terms of family structure, all six households lived with their children or three generations under one roof. The sample selection aimed to verify the universality and differences of elderly users' behavior patterns in an urban multi-generational cohabitation environment, ensuring that the research conclusions are representative of both the characteristics of an aging society and urban family structures.

4.2.2 Methodological objectives

The following objectives are achieved through observation methods. 1) The researcher comprehensively extracts high-frequency behavioral patterns and spatiotemporal distribution characteristics of elderly people in household scenarios through systematic observation and recording. Focusing on typical life scenarios such as kitchen diet and daily activities, the researcher accurately captures the patterns of elderly people's daily activities, including activity time, frequency, sequence, and spatial movement paths, through long-term continuous observation, providing a detailed data foundation for subsequent design. 2) The researcher conducts an in-depth analysis of potential safety hazards that elderly people may encounter during the use of furniture. Through careful observation, specific issues are identified, such as the risk of imbalance caused by insufficient support when getting up and

ISSN 2616-5783 Vol.8, Issue 9: 65-69, DOI: 10.25236/AJHSS.2025.080910

operational difficulties caused by unreasonable height for item retrieval and placement. These observations will help us accurately identify the core pain points of elderly users when using furniture, providing direction for designing safer and more convenient furniture products. 3) Based on the collected behavioral data, we will conduct a comprehensive verification of existing design schemes, revealing their limitations in practical use. Through comparative analysis, we will identify deficiencies and improvement spaces in the design, providing solid empirical support for subsequent design optimization and ensuring that the design scheme can better meet the actual needs of elderly users.

4.2.3 Data collection and coding

Using Noldus Observer XT software, 64,705 behavioral data points were recorded in real-time over a 14-day period from six elderly households. The coding rules are as follows:

1) Behavior category: As shown in Figure 2, the behaviors of the elderly in their living spaces are classified and characterized to better understand their behavioral patterns in different spaces.

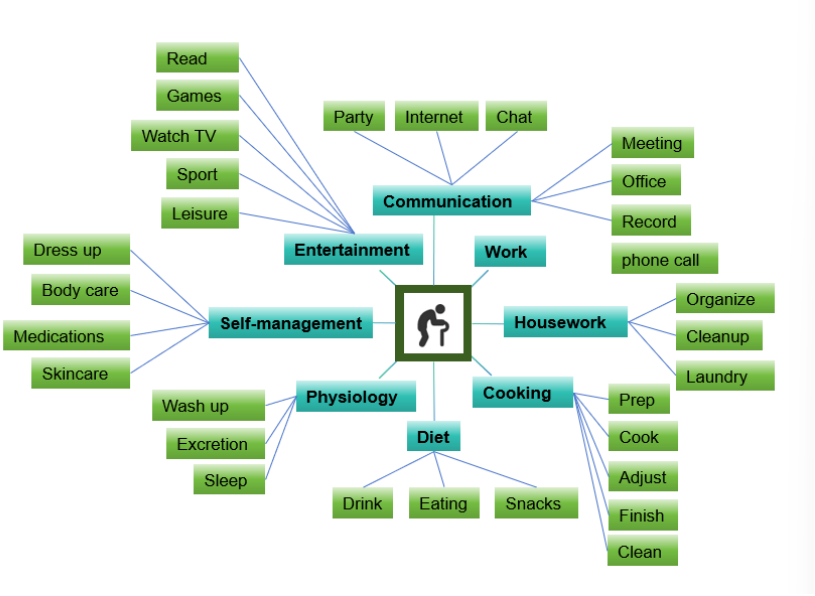

Fig.2 Classification of elderly furniture usage behavior

2) Spatial correlation: Marking of areas such as the kitchen, living room, and dining room. 3) Temporal parameters: Behavior duration, instantaneous time, frequency, and interval. This video shows the elderly engaging in cleaning activities in the kitchen. Observing the video, analysis of the observed video can capture the start and end moments of specific user behaviors. This recording method accurately captures the duration, frequency, and related context of each behavior. after the observation, the video data recorded by Noldus Observer XT can be transformed into a timeline visualization for a day. The data shows that the elderly need to complete an average of 7.2 bending and reaching actions per day in the kitchen scene, with 63% of these bending behaviors relying on external supports, such as holding onto countertops or cabinet edges to maintain balance. In addition, the average time taken to stand up from a sitting position is 4.5 seconds, and 76% of these standing up actions are accompanied by supporting behaviors such as holding onto furniture or walls. This high frequency of assistance needs indicates that elderly users have a high physical dependence on furniture.

5. Design suggestions for age-friendly furniture

From the perspective of active aging, age-friendly furniture design needs to fully cater to the physical and psychological characteristics of the elderly, assisting them in leading an active life.

1) In terms of functional design, practicality and convenience should be emphasized. Taking seats as an example, adjustable backrests and armrests can be equipped to flexibly adjust according to different sitting postures of the elderly, alleviating physical fatigue. At the same time, hidden storage spaces can be set up to facilitate the storage of commonly used items such as reading glasses and medications, making them easily accessible at any time.

2) In terms of dimensions and specifications, it is essential to cater to the physical functions of the

ISSN 2616-5783 Vol.8, Issue 9: 65-69, DOI: 10.25236/AJHSS.2025.080910

elderly. The height of tables and chairs should be scientifically reasonable, ensuring that when the elderly sit or stand, their legs can naturally hang down and their feet can rest flat on the ground, thereby reducing pressure on their legs. The height of beds should facilitate the elderly to get up and lie down, avoiding being too high or too low, which could cause difficulty in getting up or the risk of falling.

3) The selection of materials prioritizes safety and comfort. Environmentally friendly and odorless natural materials, such as solid wood and bamboo, are preferred to minimize potential health hazards posed by chemicals to the elderly. The surface treatment should be smooth, avoiding burrs and sharp edges to prevent scratching the elderly. Cushions and backrests should be made of soft, breathable, and highly elastic sponges to provide excellent support and comfort.

4) Color matching creates a warm atmosphere. Soft and warm hues such as beige and light yellow are used, giving a sense of tranquility and comfort. This helps alleviate the psychological stress of the elderly, enhance their sense of happiness in life, and make age-friendly furniture a close companion for their active lifestyle.

6. Conclusion

In the context of active aging, this study focuses on the design of age-friendly furniture products under two main living forms: home-based care and nursing homes. It holds profound practical significance and forward-looking value. Through in-depth user-centered research, we have clearly identified numerous limitations in the safety and applicability of existing age-friendly furniture, which points the way for subsequent optimization design. The conceptual model, design path, and theoretical framework of system design constructed provide a comprehensive and scientific guidance system for age-friendly furniture design. From precise positioning in the planning stage, to meticulous analysis of behavioral habits, to aesthetic considerations in form selection, and dynamic optimization of situational interaction, it ensures that the design outcomes closely align with the actual needs of the elderly, taking into account regional adaptability and cultural sensitivity. Age-friendly furniture is not just a functional object, but also an important medium for interaction and communication between the elderly and their living environment, playing a crucial role in enhancing the quality of life for the elderly. In future design practices, we should continue to follow scientific methods, continuously explore and innovate, fully consider the diversity and variability of the elderly population, and make age-friendly furniture design more humanized and intelligent. At the same time, we should strengthen interdisciplinary cooperation, integrate resources from all parties, promote the vigorous development of the age-friendly furniture industry, create a more comfortable, safe, and welcoming living environment for the elderly, and assist them in achieving active aging and enjoying a happy and fulfilling later life.

Acknowledgments

Guangzhou Software College School-level Project (KY202336)

References

[1] National Bureau of Statistics. Statistical Communique on the National Economic and Social Development of the People's Republic of China in 2024 [EB/OL]. [2024-02-29].
[2] Tang Lei. Research on Interactive Design of Furniture Products [D]. Beijing: Beijing Forestry University, 2016.
[3] Li Na, Xie Qi, Tian Fei. Research on the Design of Age-Friendly Co-Living Environments Based on Intergenerational Mutual Assistance - Taking Changsha as an Example [J]. Furniture and Interior Decoration, 2021(05):133-137.
[4] Liu Dongwei, Jia Li, Wang Shanshan. Research on Universal Design for Aging-Friendly Housing under Home-Based Elderly Care Mode [J]. Architectural Journal, 2015(06):1-8.
[5] Hao Xue. Research and Practice of Aging-Friendly Design Standards under Home-Based Elderly Care Mode [D]. Beijing: Beijing Jianzhu University, 2017.
[6] Zhu Jie, Zhang Fan, Zhang Yachi, et al. Research and Practice of Elderly Furniture Design Based on Observational Research Method [J]. Furniture and Interior Decoration, 2018(06):26-29.
[7] Yan Shuang, Wang Chenxi, Deng Jiangang, Zhang Liutao. Research and Application of Elderly Indoor Design Based on Humanization Concept [J]. Furniture and Interior Decoration, 2020(11):114-116.