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Research on Design and Development of Elder-Friendly Furniture in Chinese Residential Situation

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Abstract

Purpose: In order to actively respond to the social pressure brought by the aging of the population in China, to respond to the smooth operation of the national "multi-level elderly care service system based on home, supported by community and supplemented by institutions", to help the elderly with declining physical and mental functions to adapt to current living environment, to extend their time of independent and safe life. ***Methodology:*** Based on characteristics of China's aging situation and the current market of elderly-friendly furniture in China, the article started from the characteristics, behavioral habits and demands of the elderly, ***Conclusion:*** Proposed design ideas and development strategies of elderly-friendly furniture in residential situation, including elderly-friendly design methods for basic furniture such as sitting and lying furniture, storage and operation furniture, as well as emotional, applicable and standardized development strategies. It is suggested that the furniture categories should be refined when the market is mature, so as to activate the elderly-friendly furniture market and promote it step by step, and guide the steady development of the furniture industry.

Keywords: the elderly, elder-friendly furniture (EF), furniture, design

1. Introduction

At present, China is the only country in the world with an elderly population of more than 200 million. It is expected that the elderly population will reach 300 million by 2025 and reach its peak in 2040. China's aging is characterized by fast speed, large base and "getting old before getting rich", accompanied by advanced aging, empty-nest and small family structure. China's elderly care system basically presents "9073 model", which means 90% of the elderly stay at home, 7% enjoy community care services and 3% enjoy nursing institutions (Sohu, 2021). With the improvement of living conditions and concepts upgrading, 80% of the elderly are willing to live separately from their adult children (Shan Luo, 2016). It can be seen that "home care" and "self-care" have become the key words for most of the elderly in China.

Furniture is necessary instrument for home life, the elderly stay at home for long time, furniture and life are more relevant. It is an urgent livelihood issue to deal with and implement elder-friendly furniture from the aspects of policy, design and market, which can help the elderly realize self-care easily, compensate for their gradually declining physiological function, extend their self-care time, and improve their life quality in old age.

Throughout survey of China's elder-friendly furniture (EF) market, there is few professional manufacturers, whose research and development ability are not strong, showing a situation with big market, few products, low level of development. Secondly, the lack of corresponding national standards and norms also restricts the healthy development of elder-friendly furniture. Data show that the elderly are not satisfied with the current furniture they have, as much as 89% of total old people (Deyu Luo, 2014). First, both the elder and designer do not have

comprehensive understanding of EF, which leads to the low degree of suitability for the elderly. Second, a large number of products in present market are concentrated on young and middle-aged groups, EF is almost rare. Aging brings not only social problems but also development opportunities, firstly, most of the elderly have accumulated wealth and stable income without financial burden, coupled with traditional Chinese culture of filial piety, most adult children are willing to support their parents to improve their life quality. Therefore, EF has great potential chance in China (CHARLS, 2018). In the next 50 years, people born from the 1970s to the 1990s will become the new generation of elder people. Their good educational background and economic status will further stimulate the demand for EF for the elderly.

2. Literature Review

In the middle and late last century, Europe, America and Japan took the lead in stepping in aging society, and began to study the elderly, which mainly focused on residence, the research on EF was scattered in research of elder-friendly residence, which proposed to use small scale, simple and variable furniture to improve the quality of elder-friendly residence, but there was no systematic research on EF. There are many kinds of elder-friendly products in western countries, which pay attention to barrier-free and universal design. Among them, Japanese products are more refined and emotional.

China's research on EF started around 2010, mainly consisted by articles of qualitative research, which can be divided into three categories: firstly, overview research on EF without focusing on residential situation. Secondly, research on single type of EF, there are few complete sets of EF. Thirdly, research conducted from a single perspective such as barrier-free design or emotional design, and there is few comprehensive research on residential space. This paper will focus on residential situation, try to put forward a set of suitable design ideas and development strategies for EF.

3. Discussions (Analysis of Characteristics of the Elderly in Place)

3.1 Classification of the Elderly

Elderly people refer to those aged 60 and above (The Standing Committee of the Chinese People's Congress, 2018). Elder people over 60 in place can be divided into three categories: Self-helping aged people, Device-helping aged people and Nursing-helping aged people (Ministry of Housing and Urban-Rural Development, 2016), which are also the three essential stages for people aging. Different elder people have different demands for furniture. Self-helping aged people can take care of themselves, their main consideration is the appearance, material and comfort of furniture, and auxiliary function needs are not in urgent. Device-helping aged people who with limit living ability, need to rely on auxiliary facilities to complete self-care (Zhenxiang Wang, 2015), so auxiliary function of furniture is their first consideration, followed by the appearance. Nursing-helping aged people have completely lost self-care ability, rely on other people to look after them, and they use furniture lest frequently (Shan Luo, 2016). And he demands of care-giver for furniture should be the main focus of design. Self-helping aged people and Device-helping aged people form the majority of the elderly in paper, and this paper takes these two types of elder people as the research object.

3.2 Physiological Characteristics of the Elderly

The physiological characteristics of the elderly are different from those of ordinary people in the following aspects:

Loss of height. Due to the decrease of bone density and muscle atrophy, height the elderly gradually decreases with increase of age. Data shows that from the age of 30 to 90, the average height of men decreases by 2.25% and that of women by 2.5% (Zhenya Zhong & Liming Shen, 2018).

Decline in movement ability. Due to bone and muscle degeneration, upper and lower limb strength and physical mobility of the elderly are weakened. The control ability of the hand is weakened, and operation of high-precision activities is difficult for them. After squatting, it is difficult to stand up, and even some elder people need to use external support to stand up.

Decreased perception ability. In terms of vision, the elderly's ability to distinguish images is decreased, and their sensitivity to color and light is also decreased. Decreased acuity to sound, decreased auditory recognition and decreased tactile sensitivity are all happened to the elderly. They have to use lighting, color and other auxiliary ways to strengthen their perception.

Weakened cognitive ability. The elderly have poor ability to accept new things and tend to produce resist emotions. Due to decreased memory ability, it takes long time for them to learn new knowledge (Yun Guan, 2016), so products for the elderly should be as simple as possible.

3.3 Psychological Characteristics of the Elderly

Change of social status caused by retirement is likely to make the elderly feel lost, lonely and frustrated (Deyu

Luo, 2018). They hope to be recognized and respected by society, and they hope to have something to rely on and enjoy in old age. Specific to furniture design, with the help of pleasing and balanced appearance, convenient control and the identification of cultural, are all the ways to meet the psychological demands of the elderly, so as to stimulate emotional resonance, sublimate the value of furniture.

3.4 Behavioral Characteristics of the Elderly in Place

By observing and recording the daily behaviors of Self-helping aged people and Device-helping aged people, it is concluded that the home behaviors of the elderly are mainly Necessary Activities such as rest, washing, housework, cooking, etc., with some Recreational Activities such as watching TV, playing cards, etc., Communication Activities like chatting, making phone calls, and a small amount of Self- fulfilling Activities such as studying, writing. Their behavior type changes from the basic type to leisure type, and then enrichment type in sequence, therefore research should firstly focus on basic furniture included sitting and lying furniture, operational furniture and storage furniture, in order to realize Necessary Activities, and on this basis, gradually expand and refine to other furniture categories.

3.5 The Elderly's Demands for Elder-Friendly Furniture

One reason for the lagging development of EF is that the exclusive needs of the elderly are not clearly defined. Through questionnaire survey and interview, the core demands of the elderly in place for furniture are found as follows:

Table 1. Core demands of the elderly for EF (made by author)

Difficulties of current furniture for the elderly	**Demands of the elderly**
Inconvenience caused by loss of height	Increasing height of the seat to make it easier to stand up
	Lower the height of cabinet to facilitate housework
	Reduce activities that require raising hands to complete
	Increase the upper space utilization for furniture
Upper/lower limb strength decreased, movement ability declined	Furniture with auxiliary function to help walking and standing up
Inconvenient storage space	Increase the utilization of furniture end space, visualization for items stored, reduce memory burden
Insufficient illumination	Illumination for getting up at night, internal lighting in storage and operational furniture
Lack of emotional support	Prefer soft and stable shape and structure, warm color, and wood texture
Economic & applicability	Moderate price, durable, easy to operate

4. Findings (Design Ideas and Development Strategies for Elder-Friendly Furniture)

In addition to the functions of ordinary furniture, EF should also take into account functions of nursing, and need to be different from medical or nursing institution furniture meanwhile, need to highlight their home atmosphere. Design principles should include as below:

Independence. It is difficult for the elderly to change their long-term life habits. Furniture should conform to their daily habits and provide auxiliary functions to make the elderly cope with daily life freely.

Safety. Safety should be considered from two aspects which are risk prevention and risk treatment. Risk prevention is to presuppose the elderly might encounter accidents in advance, so it is necessary to adopt some design measures to prevent accidents happening. Risk treatment refer that the elderly can be dealt with in time in order to avoid getting serious if there is an emergency.

Variability. Furniture is durable goods. The elderly's demand for furniture is constantly changing from self-helping stage to nursing-helping stage, and aging is gradual process. The concept of variability, such as extensibility design and modular design, can be adopted to adjust furniture structure and function according to aging stage of the elderly, so as to adapt to different demands and extend the life cycle of furniture.

Standardization. It refers to do well with design and producing standard of EF, so as to make EF can interchange and connect with general furniture, which also can standardize the market, break through the resource barriers between enterprises, and save social resources.

Economy. The elderly have conservative consumption psychology thus pay more attention on function and price of furniture. The EF should be cost saving on the foundation of meeting function, so that the elderly can afford it.

Although the EF market is big, however considering that limit public awareness for EF, plus weak research foundation and development, it is suggested to cultivate public awareness and research steadily, so it is better to start with basic furniture, and then expand to the overall types and solutions, so as to activate the market step by step. It is suggested to start with basic furniture like storage, sitting & lying and operation furniture as below.

4.1 Storage Elder-Friendly Furniture Design Ideas

According to questionnaires, general storage furniture in market is not friend to the elderly, which mainly reflected in these aspects: hard to reach terminal space, unreasonable space division, insufficient illumination and poor visibility etc., which result in low utilization for storage space, inconvenient access to items, leads to poor using experience. Starting from the shortage, storage EF can be optimized from the following aspects:

Table 2. Design ideas for Storage EF (made by author)

Elder-friendly deficiency	**Optimization design ideas**		
low utilization of terminal space	Expand width	Modular design	Built-in retractable hardware
Unreasonable layout	Layout according type of items	Increase stacking space /reduce hanging space/reserve wheelchair space	Built-in liftable rod or telescopic frame
Insufficient illumination	Install induction light in closet		
Poor visibility	Use open-door or walk-in closet	Visual design such as transparent door, open shelf design	Use color as memory aid

4.2 Sitting & Lying Elder-Friendly Furniture Design Ideas

Sitting & lying furniture mainly includes all kinds of chairs, sofa and bed. With aging of the elderly, the frequency for sitting & lying furniture use is increasing, which proposes higher requirements for it. Due to lower limb strength loss, difficulty in transition between standing up and sitting down is the main problem need to be solved. Ergonomics design can be used to make the elderly transit between sitting and standing up smoothly.

Table 3. Design ideas for Sitting EF (made by author)

Elder-friendly deficiency	**Optimization design ideas**		
Difficulty in transition between standing up and sitting down	Raise height of seat surface Adjust seat depth, back angle Increase hardness of the seat surface	Adjust armrest parameters Reserve crutch place	Adjust seat surface angle
Difficulty in moving furniture	Equipped with self-locking pulley	Set invisible handrails, as grasp point when furniture and people moving	

For the elderly, bed not only undertakes function of sleeping, but also need function of nursing. So it is necessary to improve auxiliary function of bed to meet the possible situation of Device-helping and Nursing helping aged People in future.

Table 4. Design ideas for bed (made by author)

Elder-friendly deficiency	**Optimization design ideas**		
Lack of grip equipment	Set detachable handrail at side of bed.		
Difficulty in getting up at	Adjustable design in head	Set night illumination.	Reserve crutches

night	and end of bed	placement place
Unsuitable angle of bed head	Adjustable head of bed	

4.3 Operational Elder-Friendly Furniture Design Ideas

Operational furniture refers to cabinetry and washing cabinet that help the elderly complete housework in daily life. Kitchen is basically filled with cabinetry, and bathroom furniture mainly refers to washing cabinet. Self-helping aged people and Device-helping aged people can do housework, whereas they have difficulty in using Furniture because of decline of physical condition, so operational EF need optimal design as well.

Table 5. Design ideas for Operational EF (made by author)

Elder-friendly deficiency	**Optimization design ideas**		
Inconvenient to put out/in items	Modify dimension according to parameters of the elder	Built-in retractable hardware	Cabinetry layout matches operating procedures
Standing posture	Reserved seat place under lower cabinet	Reserve wheelchair space	
Inappropriate cabinet surface height	Decrease cabinet surface height	Set different height according to different operational areas	
Memory difficulty for inner items	Visual design such as transparent door, open shelf design	Use color as memory aid	Install induction light in cabinet

4.4 Emotional Design for Elder-Friendly Furniture

Accompany the elderly day and night, furniture not only need to guarantee their function, but also should use design language to meet the psychological demands of the elderly, to achieve emotional support. The elderly are easy to feel lonely, hope to obtain recognition from others, have nostalgic psychology, so designer can choose nostalgic wood, warm colors, use wood, bamboo, rattan and other simple materials to calm mood of the elderly. Steady and simple modeling are suggested to create sense of security, and beautiful elements can be used to create sense of identity. Pursuit for novelty and complexity should be avoided as these might cause pressure on the elderly. Form of medical furniture should be avoided, on the contrary a sense of home should be the consideration. It is suggested to use natural design language to express care for the elderly and avoid EF being labeled.

Table 6. Emotional design for EF (made by author)

Psychological and emotional characteristics of the elderly	**Emotional design strategies**		
Psychology of nostalgia	Low brightness/ low purity/warm tone/natural color	Natural and simple materials	Traditional elements
Prone to feel lonely, lack of security	Steady and pleasing shape	Avoid medical forms	Increase interactivity
Hope to be recognized	Adopt element of harmony	Adopt cultural connotation	
Resistance and stress to learn new stuff	Simple and convenient design	Avoid design need more memory	Reduce complex high-tech design
Dislike to be labeled	Universal design, Natural and relax design language		

4.5 Economy and Applicability of Elder-Friendly Furniture

EF does not mean improving cost, on the contrary, simple and moderate design are better. In addition, consumption concept of majority old people is still economical and practical, so better to reduce cost through centralized purchasing of materials, standardized design and other ways. It is suggested to pre-calculate price of EF and maintain it at medium even low level in market, so as to decrease entry threshold for the elderly and activate mainstream users for EF. For temporary non-essential auxiliary functions, it can be achieved by gradually increasing or replacement via variability design.

4.6 Issue National Standards and Norms

At present, there is no national standard for design and producing of EF in China. To ensure the sustainable development of EF, design standards should be introduced from the perspectives of ergonomics, mechanical performance, safety of raw materials, and equip with corresponding producing standards, so that government have laws to check, manufacturers have laws to rely on, and the elderly have laws to sue, so as to guide the healthy development of the industry.

5. Conclusion

Ageing in place is the mainstream elderly care model in China. With the acceleration of aging in China, and absence of EF in market, safe and comfortable EF has become necessary condition to realize ageing in place. Considering psychological, physiological and emotional characteristics of the elderly, it is suggested to start research from basic furniture such as storage, sitting and lying, and operational furniture, propose optimization design ideas, and make consideration on emotional and standardized design for EF. After the market is getting mature, research can be expanded and refined to other furniture types, so as to promote development of the EF market steadily.

Conflict of Interest

No potential conflict and interest were reported by the authors.

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