



# Elderly People's Living Space and Well-Being Design Based on Ergonomic Applications

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**Abstract.** The purpose of this research is to take the well-being of the elderly as the starting point, analyze the research results on ergonomic applications for the elderly as a whole, and analyze the current research status, development status, existing problems and development trends from the perspectives of interior space design (including barrier-free design of kitchens and bathrooms for the elderly) and outdoor environmental space design. The special design of the space will improve the quality of the living space for the elderly, enhance the quality of life of the elderly, make the elderly enjoy equal rights with other people of different age groups in the living space, and make life in old age more meaningful.

**Keywords:** Well-being · Living space · Ergonomic · The elderly · Barrier-free design

## 1 Introduction

The field of welfare culture covers the life welfare, social welfare, demand welfare, spiritual welfare, service welfare, the welfare of young children, the welfare of the elderly, the welfare of people with disabilities, and the welfare of socially disadvantaged groups, etc. The fundamental purpose of welfare design is to improve the existing service experience, service innovation, and service consciousness to realize the greater social role of people, to provide functional and practical products for the disadvantaged, to improve the public environment, and to provide convenience for the disadvantaged.

The social problem of aging due to the increasing population is also driving the development of the design industry. Designers should pay attention to social livelihood and solve social problems with professional standards. At present, China's design in the field of aging is still at a preliminary stage. Although more and more senior housing is emerging, most of the designs do not seriously analyze the physiological factors, psychological factors and behavioral habits of the elderly. Some of the accessibility facilities that can be found everywhere seem to meet the needs of the elderly, but they are not used much in practice. We need to combine the living habits of the elderly and continue to break through and innovate in order to do a good job in the accessibility design of their living space. It will not only bring safety and convenience to the senior citizens' home life, but also bring convenience to their families.

## **2 Design Principles for the Living Spaces of Senior People**

### **2.1 Safety**

Based on the special characteristics of the elderly, the accessible design should analyze the physiological and psychological needs of the elderly, and equip corresponding safety facilities according to the behavioral movement of the elderly to ensure their safety.

### **2.2 Comfort**

Accessible design should also ensure the comfort of the spatial environment. It can be expressed in sound insulation, ventilation, light and the choice of furniture, which could make the elderly feel comfortable.

### **2.3 Practicability**

The elderly group has diminished memory and spatial perception ability. In the accessible design, we shall pay attention to the rationalization of space scale and the aging-appropriateness of space form to ensure the variability and openness of living space. Combined with the special physical structure of the elderly, we analyze the relationship between the accessible facilities and the elderly to make the space more practical.

## **3 The Needs of the Elderly in the Living Space**

How to enable the elderly to enjoy the social welfare of livelihood services is an inevitable trend in the development of the national design industry. Based on the characteristics of diversity and uncertainty of spatial design and the comprehensive consideration of the current situation of aging, when responding to and solving the specific problems that have emerged and will emerge in the living space for the elderly, the design field shall give design a more systematic and specific strategic goal and positioning, and determines and establishes the direction and research focus of the design development of the living space for the elderly.

### **3.1 The Physiological Needs of the Elderly in the Living Space**

The design of living space for the elderly should take the rationality of the space into consideration. In addition to meeting the basic functional requirements of living for the elderly, and ensuring the safety and comfort of the living space, we shall also consider the tactile, visual and auditory functional requirements of the elderly. For the elderly, the growth of bones is closely related to age and different kinds of work. The mobility becomes more and more inconvenient and the range of movement is shrinking, so these details should be taken into consideration when designing the living space for the elderly.

In the functional design of the living space for the elderly, the flow direction of the elderly should be analyzed. In the selection of building materials: the floor should be made of non-slip, wear-resistant, environmentally friendly, non-staining wooden flooring

or carpet, and avoid height differences as much as possible; the walls and roof should be made of warm and moisture-proof environmentally friendly materials; and safety handrails, emergency equipment and alarm equipment should be set in the design of the walls according to the height and activity range of the elderly; The furniture and facilities should be optimally designed according to the life style of the occupants, and rounded corners or soft package materials should be chosen. In terms of space scale: the selection and design of furniture should be based on the human body structure of the occupants. And the ergonomic data should be used as a guide to design the size and scale suitable for the daily activities of the elderly. Considering the changes in the physical condition of the elderly, try to avoid using drawers below the knee or cabinets above the head.

According to the trend that the vision ability of the elderly tends to be gradually weakened, the vision has a greater impact on the behavior of the elderly, such as: declining near vision, presbyopia, poor dark adaptation ability, astigmatism, reduced field of vision and light adaptation adjustment ability and other physiological characteristics, the design of the light environment of the living space shall try not to use any strong reflective surface materials. It shall try to increase the contrast, provide sufficient lighting, and use bright colors for wall and ceiling colors.

According to the performance of the elderly in their life state, the hearing ability is shown as sensitive and retarded. The hearing sensitive issue mostly performances in their leisure time. The space environment shall try to avoid any noise; the selection of materials shall pay attention to the effect of sound insulation.. For example, use the sound insulation material for the wall; use the hydraulic doors to reduce the noise when opening and closing the door. In the hearing retarded aspect: the sensitivity of the elderly to discern the sound is reduced. The designer in the design process shall try to use sound control equipment to reduce noise interference, and use low-frequency warning for emergency sound, etc.

### **3.2 The Psychological Needs of the Elderly in the Living Space**

With the development of society, more and more senior citizens are living alone. They are called empty nesters. The social retirement system is becoming more and more sound, and people are also more concerned about the life of the elderly, but it does not mean that every family can meet the daily living care, medical care and spiritual comfort of the senior citizens. The adaptive capacity and resistance of the elderly are gradually declining, and many of them suffer from various chronic diseases, which are the main reasons that affect the quality of life of the elderly. With the growth of age, the psychological state of the elderly will also have great changes than before, mainly including changes in the habits and psychological characteristics. In the design of living space for the elderly, it is necessary to meet not only the physiological needs of the elderly, but also the psychological needs of the elderly. With the culture of well-being as the guide, the elderly can feel the social care, and achieve a goal of teaching, learning, establishing, and enjoying in their senior life.

Loneliness, fear, and low self-esteem are all common psychological emotions that the senior people have when they are lack of the sense of security. Many senior people have a hard time accepting the phenomenon of their own aging, which is what we often called not giving in to their old age. But due to the aging of physical functions, senior people

have to accept that they are not as young as they were then. On the other hand, loneliness makes the elderly feel insecure. For example, children are busy at work and have no time to visit the elderly, so over time the elderly will become dependent on their children or people close to them. Based on the analysis of the psychology of the elderly, in the facilities of the living space, we should strengthen the corresponding safety facilities and barrier-free design facilities; pay attention to the size and softness of furniture selection to reduce the sense of fear; in the color of the space, warm colors should be used to reduce the sense of loneliness; on the spiritual level, we should combine the interests of the elderly, so that the elderly can give full play to their own strengths in life and reduce the sense of inferiority.

The requirements of senior citizens for the comfort of living space are often higher than those of other people. It can be reflected in the design of space functions and the choice of furniture. The surrounding environment is also an important factor. Air quality, ventilation and light conditions can also affect the psychological changes of the elderly.

## **4 The Accessibility Design Performance in the Living Space of the Elderly**

### **4.1 The Accessibility Design for the Bedroom**

Try not to arrange the bedroom of the elderly in the corners of the house, but in the center of the house. It will be much convenient for us to take care of them. Besides, it can reduce their sense of loneliness. Due to the physiological reasons of the elderly, they may get up for the bathrooms for many times during the nights, so the distance with the bathroom should not be too far. The area of the bedroom should be slightly larger than that of the regular people. For example, a single bedroom should not less than 7 m<sup>2</sup> and a double bedroom should not less than 10.5 m<sup>2</sup>. Considering that people with behavioral difficulties need wheelchairs and other mobility aids, so the area of the accessible bedroom should be considered no less than 14 m<sup>2</sup>. The wall, doorway and furniture position should meet the requirements of wheelchair passage, stay and rotation. The layout of the bedroom space should be determined by the sleeping habits of the elderly. The placement of the bed should be determined by their sleeping direction.. The side of the bed can be placed against the wall if the senior can take care of himself; if it is for a disabled person, the two sides of the bed should leave space for the activities of the caregiver. The accessibility of the bedroom space should be designed according to the behavioral needs of the elderly. For the elderly who use wheelchairs, the design of mobility aids between the bed and the wheelchair should be considered; for the elderly who are bedridden for a long time, a bed with special functions should be designed.

### **4.2 The Accessibility Design for the Kitchen**

The accessibility design of the kitchen space should not only pay attention its safety, but also shall make sure the kitchen is easy to be operated, cleaned and organized. The area of the kitchen should be slightly larger than the ordinary family kitchen. If for the elderly who need to use wheelchairs to move, the net width of the kitchen should not be

less than 2000 mm in consideration of the wheelchair access. And the net width of the passage should not be less than 1500 mm when the cabinets are arranged in double rows. For the elderly who can take care of themselves, the height of the kitchen console should be 800–850 mm. For the elderly who need to use wheelchairs with limited mobility, the height of the kitchen counter should be between 700–750 mm. Due to the limited range of motion of the hands when people are sitting, the stove, sink and cutting surface should be recessed under the treatment in order to facilitate the operation of cooking action.. Its height is 600–650 mm, width 700–750 mm is appropriate. The height of the bottom of the hanging cabinet should not more than 1200 mm. The floor material should be non-slip and the floor should be flat floor tiles, and auxiliary lights should be set at the bottom of the cabinet. Install alarm equipment around the stove to prevent gas leakage and fire.

### **4.3 The Accessibility Design for Restroom**

Bathrooms are more prone to safety accidents than other spaces, so the key to accessible bathroom design is its safety. The layout of the space should be in a way that separates wet from dry. Make sure it is easy to be cleaned and the elderly will not slip and fall easily in there. Avoid height difference in floor. For senior citizens with limited mobility, the space design should not only consider the layout of the three sanitary: vanity, toilet and shower, but also should place the storage cabinet for daily necessities and emergency medicine. Consideration should also be given to the range of movement of the wheelchairs and caregivers, to make sure the wheelchairs can enter and exit smoothly. The bathroom should be at least 4.5 m<sup>2</sup> in size, and the height of the sink should be 750–850 mm, to make sure leaving a space of 600–650 mm for wheelchairs to approach. Shower, toilet and sink should be set up with the safety grab bars and rounded corners. If a bathtub is installed, a safety grab bar should be installed on the inside side of the bathtub. The floor material of the bathroom should be non-slip tiles. Emergency alarm equipment should be installed on the wall.

### **4.4 The Accessibility Design for Public Space**

For the accessibility design of the aisle, the width of the foyer should be more than 1500 mm; the width of the aisle leading to each room should be more than 1200 mm, and the corner of the wall should be rounded or cut. At least 800 mm–850 mm high handrails should be installed on one side of the aisle wall and rounded corners should be made.

The function of balcony is mostly used for drying clothes, sunbathing, enjoying outdoor scenery, planting some plants and storing things. In addition to meeting the above functional conditions, its depth should not be less than 1500 mm; the ground height difference between the balcony and the living room should not be greater than 15 mm, and should be a sloping transition. The balcony should be equipped with facilities for drying clothes that can be lifted and lowered, etc.

Doors, windows and wall design is also the key to reflect the accessibility design. First of all, the best choose of the doors is the sliding doors, which could increase the use of space. The following choices are folding doors and flush doors. The bathroom

doors should also be equipped with observation windows. So when there are occurrence of dangers, the family and caregivers can detect in time.

## 5 Conclusion

With the rapid development of China's economy and the innovation of the cultural industry, the welfare of the elderly is gradually coming into the public's view, and the living problems of the empty nesters are also the focus of the people's welfare. Based on the psychological and physiological factors of the elderly and combined with their living habits and current social conditions, the designers should design a space environment with safety, comfort and practicality which are suitable for the elderly. Based on the ergonomics theoretical system, humanized design concepts shall run through the entire design, thereby improving the happiness, security and identity of the elderly in life.

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