Discussion on the Design of Elderly-oriented Human Settlement from the Perspective of Universal Design

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ABSTRACT

With the acceleration of the aging of the population in China, elderly-oriented human settlement design has emerged as a critical strategy to address the challenges of an aging society. This paper explores the connotation, principles, and methods of elderly-oriented human settlement design from the perspective of universal design. It first elucidates the concept of universal design and its relationship with elderly-oriented design, analyzing the physiological, psychological, and social needs of the elderly. Subsequently, based on universal design principles, it examines design priorities in spatial planning, physical environment, and facility equipment across residential spaces, outdoor public spaces, circulation spaces, and color/lighting. Finally, this paper discusses how to promote the engagement of the elderly in the design process to ensure that the design scheme meets the real needs of the elderly, and puts forward some strategies to promote the design of elderly-oriented human settlements from the aspects of policy, education and public awareness.

Keywords: Universal Design, Elderly-oriented Design, Human Settlement, The Aging of the Population, Barrier-free Design

1.Introduction

(1) Research Background

According to data from the Ministry of Civil Affairs of China, by the end of 2022, the population aged 60 and above reached 280.04 million (19.8% of the total population), and those aged 65 and above accounted for 209.78 million (14.9%). Based on the United Nations' "World Population Outlook 2022," China has transitioned from an aging society to a "super-aged society",i which shift exacerbates labor shortages and healthcare pressures.

As life expectancy increases and living standards improve, the elderly's demands for residential environments are rising. The core objective of elderly-oriented human settlement design is to address future challenges through sustainable development perspectives, offering effective solutions to the aging of the population crises. Universal design concepts provide innovative ideas and feasible pathways for realizing elderly-oriented human settlement.

(2)Research Objectives and Significance

Compared to traditional barrier-free design, universal design concepts exhibit greater inclusivity and adaptability, reducing physical and psychological isolation of the elderly as "vulnerable groups." This approach not only enhances quality of life and reduces the possibility of accidents, but also fosters social interactions across age groups, raising societal attention to the elderly and the construction of barrier-free environment..

2.Overview of Universal Design and Elderly-oriented Human Settlement Design

(1) Concept and Principles of Universal Design

The concept of Universal Design (UD) was introduced in the early 1970s by Ron.Mace of North Carolina State University, defining products or

environments usable by all people without modification or special design, regardless of age, gender, or physical ability. The North Carolina State University Universal Design Center, led by Mace, has made significant contributions to UD evaluation, development, and promotion in housing, public spaces, and commercial facilities.

Roberta.L.Null and Kenneth.F.Cherry of the University of Michigan identified four fundamental UD principles:

Supportive Design: means that a product or environment must provide necessary functions to make it fully effective, and this function should be easily accessible. For example, compared with the spherical door handle, the lever door handle can provide better support and open the door more easily even when the hand is slippery.

Adaptable Design: means that a product or environment can meet the changing needs over time. For example, a chair that can be lifted can better meet the requirements of different users for seat height.

Accessible Design: refers to providing all special users with equal comfort and convenience, and solving the inconvenience caused by physical obstacles. For example, compared with stairs, ramps can provide more comfortable and convenient access conditions for disabled people using wheelchairs or elderly people using crutches.

Safety-oriented Design: means not only providing users with a suitable environment or facilities, but also preventing dangers and interference during actual use or operation, and minimizing damage in case of accidents. For example, fillet the protruding corners or sharp corners of furniture to avoid collision accidents.

Universal design starts with barrier-free design, but there are many differences between them. The main difference between universal design and barrier-free design is that it is not only aimed at the disabled, the elderly and other vulnerable groups, but also at serving all people. Elevator can not only facilitate the disabled, the elderly, pregnant women and other vulnerable groups, but also be used by healthy normal people. This design will not be treated differently because of the users' age, gender and physical condition. In contrast, it will not make users feel psychologically alienated due to physical isolation.

(2) Relationship Between Elderly-oriented Human Settlement Design and Universal Design

The "Elderly-oriented" concept, as defined in the "General Technical Requirements for Elderly-oriented Furniture" by China Building Materials Market Association and Beijing Furniture Industry Association in April 2022, emphasizes designing products that "consider the physiological and psychological characteristics of the elderly, ensuring safety, convenience, and comfort."

The design of elderly-oriented human settlement refers to the environmental design concept that takes the living needs of the elderly as the core, and creates a safe, convenient, healthy and dignified living space through scientific planning and humanized design to address declining physical functions, mobility limitations, and changing social needs.Its goal is not only to solve the basic living problems of the elderly, but also to improve their quality of life and social participation. Its core is people-centered, focusing on the physical, psychological and social needs of the elderly. The key point of the design of elderly-oriented human settlement is not only to serve the groups who have entered the old age, but also to consider all the people who may be aging in the future.

The design of elderly-oriented human settlement should follow five principles: safety, convenience, health, sociality and dignity. Safety means that the personal safety of the elderly in the environment is guaranteed, such as fall prevention design, emergency rescue system, furniture stability. Convenience includes not only the barrier-free physical space constructed by perfect auxiliary facilities such as handrails and high-contrast signs, but also the digital barrier-free environment such as smart devices that simplify operation. Health means providing good natural lighting and ventilation conditions, detecting the physical health of the elderly through intelligent equipment, and building rehabilitation training space. Sociality refers to attaching importance to family interaction design, providing space for family and community public activities, and providing space and

platform for the elderly to communicate with all ages. Dignity means paying attention to protecting the privacy of the elderly, paying attention to humanistic care, and alleviating loneliness through color design and natural landscape elements. Dignity means to protect the privacy of the elderly, paying attention to humanistic care, and alleviating loneliness through color design and natural landscape elements.

Elderly-oriented human settlement design can be seen as a specific application of universal design in elderly housing, addressing not only physiological needs due to declining physical functions but also psychological inclusivity for diverse health statuses and lifestyles. And, universal design emphasizes serving all people, including but not limited to the elderly, and is also conducive to the use of other age groups, which can effectively improve the utilization rate of the entire living environment.

(3) Needs Characteristics of the Elderly

① Physiological Needs

With the growth of age, the physical functions of the elderly gradually decline, and their perception ability and sports ability are degraded, and they are faced with the decline of vision, hearing and muscle strength, which leads to the slow movement, poor balance and easy fatigue of the elderly. Therefore, elderly-oriented human settlement design has higher requirements for the spatial layout, scale and lighting of the living environment. For example, handrails should be provided for the elderly to hold in bathrooms and other spaces to prevent them from falling, and sufficient traffic width should be designed in public spaces where the elderly walk to facilitate the use of wheelchairs and crutches.

② Psychological Needs

With the aging of the body, the psychological state of the elderly will also change. Affected by physical condition, it will produce negative emotions such as loneliness, loss, attachment, inferiority, fear, etc., and it is eager for attention.Familiarity, comfort and communication with family members can enhance their sense of security and reduce the adverse effects of negative emotions. The elderly are also eager to maintain independence and autonomy, and a living environment that can provide convenient living security will help them take care of themselves and safeguard their self-esteem.

③ Social Needs

The social communication of the elderly has the characteristics of aggregation, timeliness and regionality. The elderly want to keep communication and interaction with family, friends and neighbors, and tend to get along with familiar people when participating in social activities, and the time and place are relatively regular. An elderly-oriented human settlement should by provided with courtyards and community rooms to facilitate the social activities of the elderly, so as to meet their social needs.

3. Key Points of Elderly-oriented Human Settlements Design Based on Universal Design Concept

(1) Residential Space Design

① Entrance and Foyer

A barrier-free ramp should be intalled at the entrance or a threshold should be avoided to facilitate wheelchair access. If a ramp is provided, it should meet the general design standards, generally between 1:12 and 1:16. Continuous handrails shall be provided on both sides of the ramp. Sufficient activity space should be reserved at the entrance to facilitate changing shoes and hanging clothes. The height setting of shoe cabinets and clothes hangers should be suitable for the physical condition of the elderly, which is convenient for the elderly to operate easily. For example, the depth of the shoe cabinet should be 30-40 cm, and the height should be 80-100 cm, and inductive lighting should be provided to provide sufficient lighting to facilitate the search for items.

② Living Room and Dining Area

The living room should minimize obstacles and use an open layout to facilitate the elderly to move indoors. Sofas, chairs and other furniture should be suitable in height to facilitate the elderly to stand up and sit down easily. Generally, the height of sofa heights should be 40-45cm, and its stability should be considered. Sufficient space should be reserved around the dining table for

wheelchair access. Its table dimensions is generally 70-75 cm. Dining chairs should be equipped with armrests and backrest to ensure the comfort and stability of the elderly when eating.

③ Bedroom

Beds and other furniture in the bedroom should be convenient for the elderly to use. The height of the bed is generally 40-50 cm, and the height of the bedside table should be close to the wound, which is convenient for placing and taking articles. The bedroom window should provide good lighting and ventilation, and it should be convenient to open and close. Curtains should be easy to open and close, such as push-pull curtains or simple hook curtains. In addition, the bedroom can be equipped with an emergency call device, so that the elderly can seek help in time in case of emergency.

④ Bathroom

Bathroom is a space with high safety risk in the living environment of the elderly. Non-slip floor tiles should be installed here, toilets with handrails should be set up or fixed handrails should be installed on the wall. Handrails should be firm and appropriate in scale, suitable for the elderly to grasp. Generally, the armrest should be 7-15 cm from the front of the toilet, and the height should be 65-70 cm. Non-slip seats, continuous handrails and hand-held shower heads should be installed in the shower area to ensure the safety of the elderly in the shower and avoid slipping.

(2) Outdoor Public Space Design

① Community Entrances and Roads

Barrier-free ramps should be set at the community entrance. The width of the ramp and the entrance passage shall not be less than 1.2m to meet the needs of wheelchair and pedestrian traffic at the same time. The road should be flat and free of obstacles, and the ground should be made of non-slip and wear-resistant materials, and the height difference of more than 2 cm should be avoided. Clear signs should be set near the entrance, such as signs and house numbers, to facilitate the identification of the elderly.

② Leisure Plazas and Green Spaces

Community spaces such as leisure squares and green spaces should be equipped with benches to facilitate the rest of the elderly. The bench should be 40-50 cm in height and 1.2-1.5 m in length, and be equipped with handrails and backrest. The layout of squares and green spaces should take into account the needs of wheelchair access, and the surrounding plant landscape design should not affect the sight and mental safety of the elderly. It is suggested to adopt an open planting method to avoid using plants with thorns, poison or dense branches and leaves that may affect traffic.

(3) Passage Spaces

① Vertical Transportation

Elevator or barrier-free stairs should be installed inside the building. Sufficient activity space should be reserved in the elevator room to facilitate wheelchair steering. The car shall be sized to accommodate wheelchair and stretcher access. The height of the elevator operation panel should be 90-110 cm to facilitate the operation of the elderly in wheelchairs. The step height of barrier-free stairs should not be higher than 15 cm and the depth should not be less than 30 cm. Continuous handrails should be set on both sides of the stairs, and the diameter of the handrails should be 3-4 cm, which is convenient for grasping.

② Hallway and Internal Space Entrance

The width of corridors and hallways in buildings should be 1.2-1.8m to meet the needs of wheelchair access. The width of the door of the room is not less than 80 cm, and the installation of a threshold is avoided to facilitate wheelchair access. When conditions permit, doors in public spaces should use automatic doors or sliding doors as far as possible, and revolving doors and spring doors should be avoided.

③ Walkways

Walkways in the community should be convenient, continuous and easy to identify, avoid interruption and remove obstacles. The width of the walkways should meet the needs of two people in parallel, generally between 1.5 and 2 meters. Continuous handrails should be set on both sides of the road, and the height and lighting intensity of street lamps along the road should avoid glare to ensure the safety of walking at night.

(4) Color and Lighting Design

① Color

The choice of color is of great significance in the design of elderly-oriented human settlements. In order to enhance the visual recognition ability to adapt to the declining visual ability of the elderly, bright, soft and high contrast colors should be adopted. For example, the bedroom walls and furniture should be white and beige in soft colors, with dark lines or patterns as decorations to increase the visual layering. The logo of the bathroom should be bright color, for example, the emergency call button should be eye-catching red.

② Lighting

Lighting design suitable for elderly-oriented human settlements should also fully consider the eyesight characteristics of the elderly. The illuminance in the living space should be higher than that in the ordinary residence, and the illuminance in the bedroom or living room should be between 150 and 200 lux, and the illuminance in the bathroom should be between 200 and 300 lux. Lighting should be in the form of multiple light sources to avoid shadows. At the same time, in order to avoid discomfort, we should avoid using too bright or flashing lights in an aging living environment. In addition, convenient switch forms such as inductive switch and voice control switch can be used.

4. Elderly Participation in Design Process

(1) Importance of Understanding Needs

Functional requirements stem from needs. The needs of the elderly are the core basis for designing elderly-oriented human settlements. Only by truly involving the elderly in the design process can we gain a deeper understanding and comprehension of their difficulties and needs in daily life, and thus solve practical problems.

(2) Methods and Approaches of Engagement

① Questionnaire Survey

Develop a questionnaire for the living needs of the elderly, including satisfaction and demand suggestions on living environment, facilities and equipment, outdoor activities, etc. Only by collecting the feedbacks of different types of elderly people through questionnaire survey and making reasonable analysis can we really sum up the real thoughts of the elderly.

② Focus Groups

Organize the elderly and related experts and scholars to participate in the focus groups and conduct face-to-face exchanges and discussions. Through communication, we can have a more comprehensive understanding of the life experience and existing problems of the elderly, and put forward suggestions and methods to solve the problems in the discussion.

③ Field Research

Conducting in-depth field research on the living environment of the elderly and understanding their behavior habits in daily life can better find and analyze the existing problems. For example, observe the activity time and route of the elderly in outdoor public space, and the inconvenience when using equipment and facilities.

5. Strategies to Promote Elderly-oriented Human Settlement Design

(1) Policy Support

① Formulation of Relevant Regulations and Standards

The government should formulate regulations and standards for the design of elderly-oriented human settlements, clarify the general design standards in building planning, design and construction, and ensure the aging-resistant construction and transformation of the living environment for the elderly from the legal level. For example, ttdefine and implement the minimum standards for barrier-free facilities and the minimum scale requirements for elderly-oriented living space.

② Economic Incentive Policies

Incentive policies such as special subsidies and tax incentives will be introduced to encourage real estate developers and builders to actively participate in the construction of an elderly-oriented human settlement. For example, tax relief is given to enterprises that develop elderly-oriented housing projects, and financial subsidies are provided to households that undergo elderly-oriented renovation.

(2) Education and Training

① College Education

In order to cultivate students' understanding of related concepts and design practice ability, the contents of universal design and elderly-oriented human settlement design are added to the courses of environmental design, architectural design, decoration design and other related majors in colleges and universities. By setting up specialized courses, elective courses or practical teaching, we can guide college students to deeply understand the needs of the elderly and improve their professional ability in practice.

② Vocational Training

Centering on the universal design and the design of elderly-oriented human settlement, organize employees in environmental design, architectural design, decoration design and construction to carry out vocational training to improve their awareness and ability of elderly-oriented design. The training content may include but not limited to barrier-free design specifications, health care and rehabilitation knowledge of the elderly, ergonomics and other related knowledge.

(3) Raising of Social Awareness

① Publicity of Education Activities

Launch publicity of education activities, publicize the universal design concept through official media, self-media and public service advertisements, and popularize the importance and basic knowledge of aging design. For example, the production of promotional films to improve the elderly-oriented living environment is broadcast on TV programs and online platforms, and exhibitions of elderly-oriented design are held to show excellent aging design cases.

② Advocation of Social Inclusion

Advocate the concept of social inclusion, encourage people of different ages to pay attention to the needs of the elderly together, and create a social atmosphere of respecting, revering and loving the elderly. For example, organize activities involving all ages to promote exchanges and understanding between different ages.

6.Conclusion

From the perspective of universal design, the elderly-oriented human settlement design is a comprehensive and complex subject, integrating design elements from living space to outdoor public environment, from functional planning to color lighting, from economic investment to humanistic care. Through in-depth understanding of the physiological, psychological and social needs of the elderly, guiding and organizing the elderly to actively participate in the design process, and promoting the development of universal design of elderly-oriented human settlement from multiple dimensions such as policy, education and social awareness, we can create a safer, more comfortable and inclusive living environment for the elderly, improve their quality of life, and make contributions to building a harmonious society. Future research and practice should continue to explore and innovate solutions to actively face and address the evolving crisis of the aging of the population.

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