The Design of Sustainable Living Space for the Elderly in China: A Case Study of Nanchang Zhonghuaqing Nursing Homes

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Abstract. China gradually enters an aging society, and how to provide a safe, comfortable, convenient, and sustainable living environment for the elderly is the purpose and goal of the study. Based on analyzing the pension living space environment in China, this paper explored the behavior and psychological needs of the Chinese elderly through the field research of local nursing homes, literature study, and case analysis in China. Furthermore, the study pointed out the shortcomings of the existing pension space design and put forward four spatial transformation schemes. From the perspective of sustainability, creating more possibilities for the living space of the elderly has a certain guiding significance for the design of pension space in China.

Keywords: Sustainable design · Space design · Living environment · Humanized design

1 Introduction

1.1 Background

Currently, China has entered the aging era, and the pension problem has become the focus of today's society. According to the National Bureau of Statistics, China's elderly population will be over 300 million. China will move from a mild elderly society to a moderate elderly society. According to the seventh National census, the population aged 60 and above accounts for 18.70%, and those aged 65 and above account for 13.50% (Ruiqing & Danlin, 2022). With the acceleration of population aging, the breakthrough and innovation of the pension model have gradually begun to be a concern. Although there are many studies on the design of the living space of the elderly at home and abroad, the space suitable for the elderly in China is still in the primary theoretical stage (Wang & Wei, 2022), and the actual construction is still being explored. Although there are a lot of "Elderly residential" in the Chinese market, "Nursing homes", the surface is set up in line with the environment of the elderly. The scale also meets the needs of the elderly, but the actual space design is not a significant breakthrough. Some facilities are even just decorations and not for the elderly physical, psychological, and special

behavioral needs thinking (Hui & Zhe, 2017). By transforming the living space of the elderly, we should consider safety and the psychological problems and social needs of the elderly (Yu, Xiaoyue, & Weiling, 2022). Improving the happiness of the elderly in their later life and designing a sustainable living space for the elderly is a vital pension problem to be solved.

1.2 Significance of the Problem

This paper is based on the characteristics of the Chinese elderly living space design, from the elderly physiological, psychological, and behavioral characteristics as the starting point to explore the fundamental needs of the elderly. The fundamental need of the elderly center for space design and transformation (Tingwei, Qian, & Gaoyang, 2020) make the living environment more suitable for the elderly to improve the quality of life the elderly and to ensure the comfort and safety of the elderly living environment. At the same time, the Internet and big data will be applied to better integrate intelligent home design into the living space of the elderly, facilitate the life of the elderly, and create a sustainable living space environment. Through the needs analysis of the elderly, the living space of the elderly is transformed to create a more suitable home for the elderly to improve their sense of existence and happiness (Wang & Wei, 2022).

1.3 Objective of the Research

The average retirement age of Chinese people is around 60, and according to the survey, many retirees suffer from depression due to a psychological gap or lack of care. From the physiological needs: with the growth of age, the visual, auditory, smell, taste, and tactile functions are slowly degraded, some old people will have hair loss problems, tooth loss problems, and even dementia; some old people will be dazzled, becoming weak and even blind; some old people will have walking disorder even become paralysis, some old people will have hearing loss, even becoming deaf. From the perspective of psychological needs: the elders are afraid of being forgotten by The Times and neglected by society. They look forward to receiving social care, understanding, and environmental support. The elders are eager to communicate with each other and get equal opportunities to participate in society. From the behavioral needs: in the living environment, the elderly like quiet but are also afraid of loneliness. The elderly prefer to bask in the sun and dislike dark and damp. At the same time, the elderly have strong self-esteem and pay attention to the privacy of the living space. In terms of space design, different schemes should be adopted for the elderly with behavioral capacity and inability so that the living space of the elderly can be more perfect and comprehensive.

This study aims to analyze the sense of security, belonging, and intelligence brought by space from the perspective of green, environmental protection, and ecological and energy saving by analyzing the physical, psychological, and behavioral needs of the elderly. Finally, to create a safe, warm, and convenient sustainable living space environment for the elderly and to realize a sustainable space environment suitable for the living activities of the elderly.

2 Literature Review

With the CNKI database as the primary data source, the search conditions are elderly space design: elderly + elderly apartment + nursing home + suitable for aging + living space design. There is no limit to the publication time of the articles. As of August 31, 2022, 1,348 records were retrieved, including 443 journal papers, 888 dissertations, and 17 conference papers. From the perspective of literature sources, the academic papers on the theme of "elderly space design" are mainly distributed in journals majoring in architectural science and engineering. Moreover, other documents are distributed in other journals (mainly in journals related to Chinese politics and international politics, national theory and.

In the early 1990s, China began to enter an aging society. At the same time, many monographs were published on the living environment of the elderly. The first was the National Natural Science Foundation of Urban Elderly Residential Building Environment Research hosted by Professor Hu Renlu of Southeast University. The Design of the Living Environment for the Elderly, written by Hu Renlu, Ma Guang, and others, expounds on problems and causes of the living environment of the Chinese elderly and puts forward the design countermeasures suitable for the living environment of the elderly. In 1999, the first architectural Design Code for the elderly made more detailed provisions for the design and assembly of functional space and indoor facilities. As a result, in the living space, the requirements of functional space, the design, and the assembly of indoor facilities all have more precise requirements. Since entering the 21st century, the relevant works and research on pension housing in China have increased (Yu, Xiaoyue, & Weiling, 2022).

Since entering the 21st century, the relevant works and related research on pension housing in China have increased. Gu Tingwei, Zhang Qian, and Qin Gaoyang published research and suggestions in the Background of Aging in 2020 and proposed a reasonable size suitable for designing and transforming. Wang Dong, Chen Shuo, and Li Hongda suggested that the living space of the elderly apartment should be designed in a modular way according to its function according to Masno's demand principle (Dong, Shuo, & Hongda, 2021). Wang Yayuan summarized the types of activities of the elderly and the characteristics of the activity space and put forward reasonable suggestions for designing the activity site space for the elderly (Yayuan, Huang, & Jie, 2013). By combing the theoretical literature related to the indoor environment design of the elderly in the past 20 years, Liu Qian studies the psychological and physiological particularity of the elderly group from the perspective of epistemology. It puts forward the research direction of the interior design of the elderly from different design perspectives. It shows the practice of interior design research for the elderly group in China from the application's perspective. However, the article does not propose measures and methods to improve the living environment of the elderly, which belongs to the review paper (Qian, 2016).

Zhang Yuanyuan, in Wuhan's "home endowment" residential construction as an example, discusses the aging society coming residential buildings inside and outside space barrier-free design, combined with the elderly physiological and psychological needs, from ergonomics, the elderly building inside and outside space design specification, and the elderly residential living space comfort, sustainability, in order to the aging society coming residential building inside and outside space barrier-free design play a role in promoting. This is consistent with discussing the study of sustainable living space design for the Chinese elderly through the actual case of "Chinese sentiment" nursing homes (Yuanyuan, 2017). Based on the analysis of the basic characteristics of the elderly, Gong Feifei proposed a design strategy for apartments for the elderly. The article provides the reference size data for each space in the nursing home, but it does not consider the residential psychological and behavioral needs of the elderly (Feifei, 2021). Zheng Jing describes the design of the public space in the living environment of the elderly by hand (Jing, 2020).

This study has an additional reference value. Zhang Zhimin believes that the topic of supporting the elderly of the elderly should be re-examined by analyzing the psychological and physiological characteristics of the elderly, which is similar to the perspective of proposing five spatial designs by analyzing the physiological, psychological, and behavioral needs of the elderly (Zhimin, 2016). Wu Guorong thinks the bathroom space is the activity space where the elderly have the safest hidden danger. The interactive design concept is used in the design of the elderly bathroom space. Through the facility transformation of the bathroom space, achieve an environment that suits the old people living (Guorong & Chang, 2013). Zhao Wenjing proposed to pay attention to the barrier-free design of the living space organization of the elderly group. From the perspective of the physiological and psychological living environment, the humanized design of furnishings and the sense of space scale design discussed the importance of barrier-free design for the living space of the elderly (Wenjing, 2021).

Then, through China's current pension mode, combined with the four principles for the elderly living space design, namely the people-core principle, safety principle, comfort principle, and barrier-free design principle, comprehensively discusses the suitability for the elderly living building design requirements. Explore suitable for the elderly living building, the study of this paper provides certain reference values (Wen Wen, 2021). Dai Hongqin put forward five key points of space design, which are analyzed from the color design, sound design, decoration design, storage design, and barrier-free design of the elderly living space, respectively, which has certain reference value for the research of this paper (Hongqin, 2017). Sun Guang believes that only by having a deep understanding of the special physiological and psychological characteristics, behavioral characteristics, and living habits of the elderly, can a comprehensive, reasonable, and targeted design and research be carried out (Guang, 2017). Wang Yi discussed the public design of aging social residential areas in China and proposed the creation of public ecological space (Yi, 2021).

Li Zhuodi put forward the concept of a "green" indoor public activity space for the elderly and analyzed the design of indoor public activities for the elderly (Zhuodye & Shixiong, 2018). This is consistent with the concept of sustainable space advocated in this paper. Wu Chengjun and Wang Weidi started with the residential design of the elderly and analyzed the residential design principles in line with the physiological and psychological characteristics of the elderly. Furthermore, they proposed that the sustainable use of residential functions can be flexibly adjusted with the needs of life to meet the needs of the elderly home environment at different stages. This is similar to the concept of variability space proposed in this paper and has some reference value (Chengjun & Weidi, 2011). Liu Yang came up with an idea to combine the ergonomics of the elderly, from the furniture, color, materials, lighting, greening, and exquisite design aspects, paying attention to humanized design to provide a safe and comfortable home to the elderly (Yang, 2019).

Zhang Wei, Guo Shuqi, and others took the design of aging living spaces as the starting point and discussed the demand for elderly living space and interior furniture design (Wei, Shuqi, Zhenting, Jian, & Wenran, 2017). Zhi Qing believed that it is of great significance to deeply study emotional design in living spaces to improve the quality of life with the help of emotional design methods (Zhiqing, 2020) This has some reference value for this study. Tao Ruifeng and Yang He detailedly analyzed the living situation of elderly people, listed the design principles of barrier-free living spaces for the elderly, and illustrated some designs in practical application. Providing a research direction for the relevant barrier-free and suitable for the age (Ruifeng & He, 2020). Zhang blueprinted, and Zhu Shengwen believed that the construction of the elderly space in China should be fully combined with the characteristics of the elderly. In designing the living space of the apartments for the elderly, the personalized space design should be combined with the characteristics of different elderly people (Blueprint & Zhu, 2021).

Peng Hongkun and Shi Hang focused on the application ideas and development of smart homes in the design of living spaces for the elderly. They believed that using intelligent technology to serve the elderly is of great significance to the design of living spaces for the elderly (Jinghua & Zhu, 2014). Dai Jinghua and Wang Zhu proposed to combine the design essence of respecting the old and supporting the elderly in traditional architecture with modern architectural design, analyze the mutual relationship between the residential building layout, the house type design, and the pension model in the evolution, and explored the pension model that is adapted to the modern Chinese society while maintaining the wonderful cultural tradition (Zhijie, 2021). Some discussions of the above journals provided important references for the basic research of this topic.

3   Methodology

3.1   Scope of the Research

The Nursing Home is located at 1699 Wenjiao Road, Xinjian County, Nanchang City, Jiangxi Province, China. It was the first systematic social welfare institution in Jiangxi province to serve the elderly at home and abroad professionally. There were three types of rooms, love room, VIP room, and luxury suite. Services and paramedics were arranged on each floor. In addition, there were also places for the elderly, such as gyms, reading

rooms, chess, and card rooms. Furthermore, there was a health center in the apartment for regular health examinations for the elderly. Through interviews and surveys, as of September 2022, there were currently 200 elderly people, including 85 men, 115 women, and 67 elderly people with dementia.
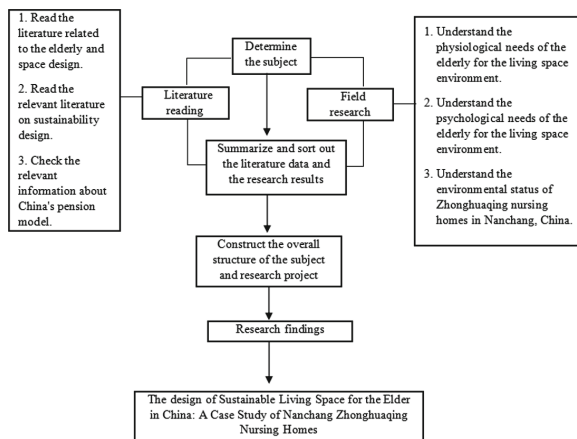
3.2   Population/Sample

A total of 200 elderly people from the "Zhonghua Qing" nursing home in Nanchang were the sample respondents in this study. Information collection and data analysis found that the elderly with lost partners and those living alone accounted for 70% of the total number. For the living environment, women have a higher need to talk than men, and men have a stronger sense of professional belief than women. For the space environment, the living space of the elderly lacks humanized consideration, the facilities are old, and there are safety risks. The living space of the elderly with behavior is too monotonous and lacks interest. Overall, the nursing home is single-furnished and lacks sustainable living.
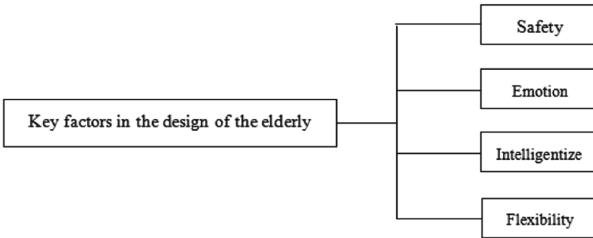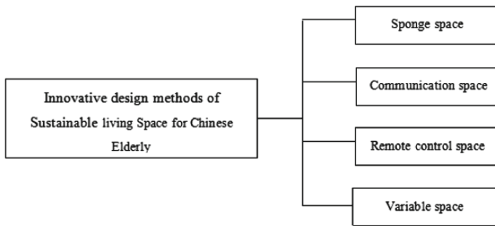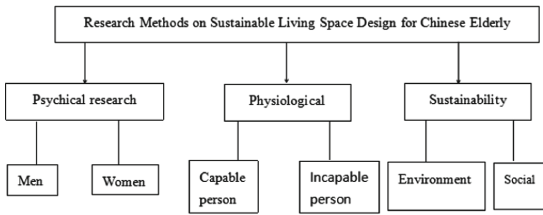
3.3   Conceptual Framework

The research on this topic was carried out from the following aspects:

① Overall design flow chart:

② Research methods

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┌─────────────────────────────────────────────────────────────┐
│ Research Methods on Sustainable Living Space Design for Chinese Elderly │
└─────────────────────────────────────────────────────────────┘
        │                      │                      │
┌───────────────┐      ┌───────────────┐      ┌───────────────┐
│ Psychical research │   │ Physiological │      │ Sustainability │
└───────────────┘      └───────────────┘      └───────────────┘
    │        │            │          │            │          │
┌─────┐  ┌───────┐  ┌─────────┐ ┌─────────┐ ┌───────────┐ ┌──────┐
│ Men │  │ Women │  │ Capable │ │ Incapable│ │Environment│ │Social│
└─────┘  └───────┘  │ person  │ │ person  │ └───────────┘ └──────┘
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                                    ┌──────────────────────┐
                                    │    Sponge space      │
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┌──────────────────────────┐        ┌──────────────────────┐
│ Innovative design methods of │     │ Communication space  │
│ Sustainable living Space for Chinese │ └──────────────────────┘
│         Elderly          │         ┌──────────────────────┐
└──────────────────────────┘        │ Remote control space │
                                    └──────────────────────┘
                                    ┌──────────────────────┐
                                    │    Variable space    │
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                                            ┌──────────────┐
                                            │   Safety     │
                                            └──────────────┘
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                                            │   Emotion    │
┌──────────────────────────────────┐        └──────────────┘
│ Key factors in the design of the elderly │ ┌──────────────┐
└──────────────────────────────────┘        │ Intelligentize│
                                            └──────────────┘
                                            ┌──────────────┐
                                            │  Flexibility │
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3.4 Hypothesis

How should the living space of the elderly be designed? How to solve the loneliness of the elderly in space design? How make the living space designed to facilitate the life of the elderly? What kind of space can achieve continuous living? Through a comprehensive and in-depth understanding of the elderly living habits and physiological and psychological needs, combined with sociology, psychology, ecology, materials, aesthetics, and other disciplines of an advanced concept, study suitable for the elderly needs, safety, health, intelligence, ecology, beauty, economy, practicality, sustainability as one of the elderly activity space design guiding ideology and evaluation criteria.

4 Results

Sponge space. A sponge is soft and elastic, giving people a safe and comfortable feeling. Make the indoor activity space of the elderly into "sponge space", that is, "breathing

space". In the space design, we should choose soft texture, safety and environmental protection, and breathable materials, such as latex, cork, silicone, and cotton. Ensure the safety of the activities of older people. The high softness of materials can not only guarantee the physical safety of the elderly but also give the elderly a comfortable and warm feeling psychologically (Zhijie, 2021).

Communication space. Old people are afraid of loneliness and often feel lonely. Psychologically, they need more emotional sustenance. The so-called communication space is to set up a simulated dialogue in the environment where the elderly live so that the elderly can have a space to talk and chat with their relatives or friends (Zhan, 2021). For example, many GPS systems use "celebrity benefits" to simulate the voice of stars in software. If the technology is used in their living space, set up the voices they want to hear and communicate. Emotionally, this will give excellent care and comfort to the elderly.

Remote control space. It can also be called a "smart space." Intelligence is the mainstream of today's society. "With the advent of the 5G era and the rapid development of information technology, artificial intelligence is also getting higher and higher." Applying the concept of intelligent design to the living Spaces of the elderly can not only provide convenience for their lives but also maintain their self-esteem so that they can take good care of themselves independently. For example, for the elderly with mobility difficulties, the concept of "Auto walk" can be applied in the living space of the elderly, and the elderly can operate through remote control. It not only facilitates the daily life of the elderly but also ensures the safety of the elderly in the process of action. It can also improve the living space for the elderly from multiple perspectives, such as sound control, touch control, and remote control (Hongkun & Hang, 2020). Remote control space is crucial for improving and developing China's pension system.

Flexible space. The demand for indoor living space in the elderly groups will show new changes with increasing age. In the design of the elderly living space, the principle of "variability" should be followed. According to the characteristics of the elderly activities, the spatial structure can be flexibly changed to create a new environment. For example, in the space partition design, we should prioritize choosing a light partition or using furniture to form a specific space. When the elderly change their space needs, it is convenient to adjust their living space and living space to meet the living space needs of the elderly of different ages (Xinyi & Yang, 2020). We can also combine occupation and space. For example, VR technology is used to create virtual space scenes according to our career needs so that the elderly can have professional experience and add to their life interest.

The four spatial models proposed above are all explored and studied based on sustainable living.

5 Discussions

The literature on the relevant elderly residential space design provided a favorable theoretical reference for this study. In previous data, some discussed the physical, psychological, and behavioral needs of the elderly, proposed to change the pension model, and proposed to change the living space environment needs according to the characteristics

of the elderly. However, the four spatial forms proposed in this topic are not mentioned in previous topic studies. Furthermore, although some studies have also mentioned the concept of intelligent, emotional, and changeable design, the discussion direction is not consistent with my research, and the sustainable use of the living space of the elderly has not been discussed. Therefore, this paper adopted the qualitative analysis method to investigate and study the elderly groups in China and proposed to adopt the transformation of their living space (sponge space, communication space, remote control space, variable space) to create a living space environment for the elderly in line with the development of The Times, with humanistic care and sustainable living.

6   Conclusions

China has been building a sustainable society. In the face of the increasingly severe aging society, the pension problem of the elderly can be solved by the construction of nursing homes and the humanized design of the pension space. Thus, it is the mainstream of the future pension model. The four spatial models proposed in this study can provide a new pension living environment for the elderly. In terms of spatial design, we should respect the individual differences of the elderly group, fully consider the physical and psychological needs of the elderly, and pay attention to the sustainability of living space. Improving the quality of life of the elderly, improving their living environment, promoting their sense of family belonging, and increasing their interest in life are not only the inheritance of traditional Chinese filial piety culture but also can contribute to the sustainable development of Chinese society.

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