

Application Research of Ecological Health in Gerontological Living Space Design

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Abstract:

As the aging of the global population accelerates, the design of gerontological living spaces has increasingly become a focal point in the field of design and a subject of societal concern. This paper aims to explore the application of ecological health concepts in the design of gerontological living spaces, with the objective of providing an environment that is more conducive to the health, safety, and comfort of the elderly. The paper begins by delineating the concepts of ecological health and gerontological living space design, analyzing the relationship between the two, and highlighting the significance of ecological health concepts within the design of gerontological living spaces. Subsequently, it identifies the current issues and status of gerontological living space design, followed by a case study analysis that examines the practical application of ecological health concepts across different cultural and geographical contexts and the insights these cases offer to gerontological living space design. Finally, the paper proposes a series of strategies for integrating and innovating ecological health concepts into gerontological living space design. These strategies include the integration of natural elements with lighting, the flexibility and adaptability of spatial layout, barrier-free design, the incorporation of smart home systems, the introduction of therapeutic landscapes and health monitoring, and customization based on cultural background and individual needs. The aim of these strategies is to meet the physiological, psychological, and social needs of the elderly through a comprehensive design approach, thereby rationally incorporating ecological health into the design of gerontological living spaces.

Keywords:

Ecological Health, Gerontological Living Spaces, Design Principles, Application Strategies

1. Introduction

As the global population continues to age, the living environment and quality of life of the elderly have increasingly become a focal point of societal concern. Ecological health, as an emerging health concept, emphasizes the harmonious coexistence of humans with the natural environment, which holds significant importance for enhancing the quality of life for the elderly. Integrating the principles of ecological

health into the design of gerontological living spaces not only meets the physiological needs of the elderly but also elevates their psychological and emotional satisfaction, thereby achieving holistic well-being for the aging population.

However, the design of gerontological housing in our country still faces numerous challenges. On one hand, many residential designs have not fully considered the specific needs of the elderly, such as barrier-free design, safety, and comfort. On the other hand, the application of ecological health principles in the design of gerontological living spaces is not yet widespread or in-depth [1]. In response to these issues, this paper aims to explore the application of ecological health in the design of gerontological living spaces, analyze its potential value in improving the living environment for the elderly, and propose corresponding design strategies and recommendations.

Through this study, it is hoped to provide new perspectives and methods for the design of gerontological living spaces, promote the physical and mental health of the elderly, and provide reference and insights for addressing the challenges of population aging and promoting sustainable social development.

2. Overview of Ecological Health and Gerontological Living Spaces

2.1. Definition of Ecological Health

Ecology refers to the environmental conditions in which living organisms exist, as well as the relationships among these organisms and between organisms and their environment. It also encompasses the balanced and harmonious state of the internal environment of the organism.

Health and wellness are two aspects of the concept of "health." Traditionally, health has been viewed as the presence of a robust physique and fully functioning capabilities. However, contemporary understandings of health are multifaceted, encompassing various dimensions such as mental and physical well-being, and internal and external health aspects. Health is now considered to include five essential elements and dimensions, with the five dimensions covering psychological and social health. With the increasing pressures of modern life, the importance of psychological health has risen significantly.

Wellness can be categorized into broad and narrow senses. Combining the meanings of health and wellness, the basic definition of wellness is established: It refers to the state and behavior of maintaining an optimal condition of physical and mental health through a series of behaviors and cultivations in a specific environment. Unlike leisure and general health care, wellness is characterized by a continuous state and behavior of health and wellness [2].

In summary, ecological health can be fundamentally defined as a health promotion approach that involves living in a well-lit, temperate, quiet, and clean air environment with comprehensive support facilities. It integrates multidisciplinary concepts from ecology, medicine, psychology, and sociology, and emphasizes harmonious coexistence between humans and the natural environment. By improving the ecological conditions of the living environment, it promotes the physical and psychological health of the residents through a series of leisure and exercise activities.

2.2. Definition of Gerontological Living Spaces

Gerontological living spaces are residential environments designed to accommodate the physiological and psychological characteristics and special needs of the elderly, particularly in response to the intensifying issue of aging [3]. These spaces must also fulfill the physical requirements of the elderly, such as location and floor level. Additionally, gerontological living spaces should cater to the social needs of the elderly, including the presence of a harmonious elderly community and controllable privacy and security when interacting with strangers.

In summary, the design of gerontological living spaces fully embodies care and respect for the elderly, aiming to provide them with a safe, comfortable, and convenient living environment.

2.3. Relationship Between Ecological Health and Gerontological Living Spaces

There is a close connection between ecological health and gerontological living spaces, with the two complementing and mutually enhancing each other. The integration of the concept of ecological health not only elevates the quality of gerontological living spaces but also supports the comprehensive health of the elderly.

Firstly, in terms of health promotion, ecological health emphasizes harmonious coexistence with the natural environment. The design of gerontological living spaces, by incorporating ecological health principles, can provide a healthier and more comfortable living environment for the elderly, promoting their physical and mental well-being. It offers psychological comfort to the elderly, taking into account their mental health. Ecological health contributes to enhancing the emotional and psychological well-being of the elderly by providing opportunities for contact with nature, such as outdoor gardens and balcony greening.

Secondly, in terms of community integration, ecological health not only focuses on the individual health of the elderly but also emphasizes community and social participation. The design of gerontological living spaces, by providing convenient social spaces and facilities for activities, encourages interaction with the community. It enhances the elderly's adaptability to the environment. The application of ecological health principles allows living space design to better adapt to climate changes and the physiological needs of the elderly, such as natural lighting and ventilation.

Lastly, in terms of rehabilitation and health care, rehabilitation facilities within ecological health, such as therapeutic gardens and treatment areas, are integrated into the design of gerontological living spaces, providing convenience for the elderly in their daily rehabilitation training and health care activities.

3. Current Status and Issues of Gerontological Living Space Design

As society continues to evolve, the needs of the elderly are also changing. However, without considering the psychological needs and diminishing behavioral characteristics of the elderly, it is challenging to meet and adapt to their needs in design. The types of gerontological living spaces are relatively singular, and there are certain deficiencies in detail design. The rationality of the spatial layout in some gerontological living spaces is poor, affecting the normal life of the elderly. Public space activities are becoming increasingly diverse, but the forms of activities are monotonous, and the utilization rate of space also needs to be considered. At the same time, there are issues with the application of lighting design in spaces with special needs. In recent years, the development of intelligence has been very rapid, but in the design of gerontological living spaces, there is a lack of systematization and

refinement, and the overall application is not widespread, with some issues of intelligent equipment not being gerontologically adapted.

4. Strategies and Case Studies of Gerontological Living Space Design

4.1. Overview of Design Strategies

In the design of gerontological living spaces with ecological health concepts, several aspects need to be considered. First is the safety and comfort of the elderly living space, which mainly requires meeting the basic physiological needs of the elderly and the safety of their reasonable flow lines in the living space and functional use. Second is the rational spatial layout. As the elderly age, their needs for spatial layout become more stringent. For example, as the physiological functions of the elderly degenerate, their adaptive capacity also decreases. Therefore, in spatial design, it is necessary to pay more attention to a wide field of view and to avoid designing height differences on the ground, such as thresholds and doorsteps.

In the layout, it is necessary to ensure the rationality of route planning, etc. In summary, the design of gerontological living spaces is a systematic work that starts from the perspective of meeting the physical and psychological needs of the elderly. It aims to ensure the safety of the elderly in the facilities and to improve their comfort in the space. The design strategies are carried out through five aspects: spatial atmosphere creation, moderate selection of materials, spatial color matching design, light environment design, and furniture arrangement [4].

4.2. Case Studies of Gerontological Living Space Design at Home and Abroad

4.2.1. Singapore's Living Space Gerontological Transformation

The Singaporean government has led a series of residential gerontological transformation measures to improve the living environment of the elderly's homes and communities, enhancing the safety and convenience of the elderly's home life and effectively ensuring the implementation of community-based elderly care policies. Compared with China, Singapore has a similar population density and cultural background. Therefore, Singapore's residential building gerontological transformation measures have significant reference value for China.

The current situation of Singapore's residences is mainly multi-generational homes, influenced by traditional culture, which, like China, places great emphasis on the concept of family. The main measures of the Singaporean government for gerontological transformation are to introduce corresponding housing plans, with the main housing layout being three bedrooms and one living room, equipped with independent bathrooms and corresponding garbage disposal systems and water recycling systems, etc. At the same time, combined with the concept of ecological health, more natural lighting and good indoor ventilation are introduced. Typical examples of gerontological living space transformation and design include the Admiralty Village and Hillford Wilkie Residences.

Admiralty Village integrates home care, community care, medical centers, public community centers, and commercial areas. The main area of each residential unit in the village is about 60 square meters. The village takes the concept of an urban village as its main idea, integrating the design of an "urban complex", allowing elderly residents to actively interact with their surroundings and stimulate their

communication vitality. In this project, a three-in-one family center was also designed, where children and the elderly in need of care can be “trusted” to the center during working hours. The project design meets the needs of social development and effectively solves the worries of working people. The project has set up green places suitable for users at all stages, with vertical greening design, interspersed green spaces in the complex, reducing the urban heat island effect, increasing biodiversity, providing visual enjoyment, and improving the local micro-environment. The facilities of the village start from the humanized design, taking into account the characteristics and needs of the elderly in functional zoning, ventilation, lighting, courtyard layout design, and the equipment of sensory beds, plastic floors, various angle handrails, etc., reflecting meticulous care, consideration, and respect for the elderly.

Hillford Wilkie Residences also adopt a design that integrates home care, community care, medical centers, public community centers, and commercial areas. The application function of the project has some similarities with the aforementioned Admiralty Village. The more prominent design point of this case is the optimized apartment design; Hillford Wilkie Residences has nearly 300 residential units, including one-bedroom, double-locked two-bedroom units, etc., which can meet the living patterns of two or three generations; the apartment design provides a place for residents to move and live comfortably; the double-lock design is a more mature design model used in Singapore, that is, a living unit has two locks, the elderly living space and the young living space are both connected and relatively independent.

4.2.2. China's Living Space Gerontological Transformation

China's gerontological living space design and renovation are still in the initial stage, but there are some design cases that can bring certain design considerations. For example, the design of Zhaoxiang Kangning Nursing Home provides certain ideas for the design and renovation of gerontological living space.

The design of Zhaoxiang Kangning Nursing Home, based on a full understanding and care for the elderly's life and psychological needs, explores the elderly's later life tone and inner pursuit through flexible design techniques and carefully crafted color schemes. While providing a real living environment for the elderly, the design also tries to encourage the elderly to actively contact and accept new things, feel the joy of life, and enjoy their later years. Similar to the Singaporean design cases introduced earlier, it is a comprehensive elderly care building complex that provides functional facilities for the elderly living in the building complex, including living rooms, day care centers, restaurants, activity rooms, reading rooms, medical rooms, psychological counseling centers, fitness rooms, etc., to meet the design of gerontological needs. In terms of color matching, the main color is orange wood color, with a small area of dark gray. In addition to giving a strong sense of design, it also considers the aging of the elderly, the degeneration of organ functions and nervous system diseases, which can lead to visual impairment and spatial cognitive dysfunction. The selection of easily recognizable orange color matching and friendly wood materials can help the elderly to a certain extent to increase their recognition, positioning, and memory of public spaces, avoid difficulty in recognizing positions when engaging in independent activities, and increase the autonomy of elderly activities. At the same time, it also brings a visual feeling of vitality, which helps to dispel the negative emotions brought about by physical discomfort or limited activities of the elderly. The internal environment and interior design continue the fresh and clear design style of the

appearance, and different types of rooms are set according to the needs of the elderly with different physical conditions. The living space has reasonable lighting and functional zoning, with a spacious and transparent layout. The space of the bathroom in the living room is increased to make it more unobstructed for the elderly who need to use therapeutic equipment or the help of others to use the bathroom; public care areas, fitness rooms, hairdressing rooms, and other multi-form care areas provide rich choices for the elderly's ample leisure time.

4.3. Integration and Innovation of Ecological Health Concepts into Gerontological Living Space Design

The integration and innovation of ecological health concepts into gerontological living space design is a multidimensional, interdisciplinary process involving various academic fields. Integrating ecological health concepts into gerontological living space, combining the design cases mentioned above, there are several perspectives for integration.

4.3.1. Integration of Lighting and Natural Elements

When designing, it is necessary to make full use of natural lighting in the relevant living space design, through the position of indoor windows and reflective materials with reflective functions, to maximize the integration of lighting and natural elements into the design of gerontological living spaces. At the same time, good natural lighting provides a good landscape view for the interior, allowing the elderly to enjoy the outdoor natural landscape, making them feel happy and achieving a certain effect of health care, and improving the quality of life in their later years.

4.3.2. Flexibility and Adaptability of Spatial Layout

Adopt an open layout, reduce partitions, facilitate the movement of the elderly, and increase the multifunctionality of the space. This layout is mainly achieved by using modular furniture, which is mainly movable and deformable modular furniture. The spatial adaptability of modular furniture is strong to adapt to different usage needs and activities, such as adding handrails and raising seat heights, etc. It meets the needs and activities of the elderly under different spaces, different environments, and different conditions. At the same time, modular furniture usually has multiple functions, such as storage units that can be used as seating functions, which can save a certain amount of space and provide the necessary convenience, satisfying the flexibility of spatial layout. Nowadays, modular furniture is becoming more and more mature, and the elderly can choose and combine modules according to their preferences and needs, making the furniture not only functional but also reflective of personal style and taste.

4.3.3. Adequate Perimeter Greening and Indoor and Outdoor Landscape Design

Adequate perimeter greening and landscape facilities can effectively enhance the sense of well-being: Green plants and natural landscapes can elevate mood and provide a sense of psychological comfort and happiness for the elderly. The rational application of indoor green plants can absorb carbon dioxide and release oxygen, thereby improving air quality to a certain extent, which is beneficial to the respiratory health of the elderly [5]. Encouraging the elderly to venture outdoors, a beautiful outdoor environment motivates them to engage in light physical activities such as walking and gardening, which helps maintain physical vitality and promotes health. Moreover, well-designed landscapes can serve as venues for social activities,

providing opportunities for the elderly to interact with others. Research has shown that interaction with nature is believed to delay cognitive decline, and interactive elements in indoor and outdoor landscape designs, such as gardening activities, can stimulate brain activity and maintain cognitive functions in the elderly. The surrounding greening and the design of indoor and outdoor spaces also have a natural healing effect, reducing stress and anxiety, which positively impacts the mental health of the elderly. At the same time, they stimulate the senses of the elderly, and a diverse range of plants and landscape designs can provide a rich sensory experience, including visual, olfactory, tactile, and auditory sensations, which contribute to enhancing the sensory enjoyment of the elderly.

4.3.4. Reasonable Integration of Rehabilitation and Health Monitoring into Design

Integrating health monitoring and rehabilitation into the design can enhance safety. Rehabilitation facilities typically include handrails, grab bars, and non-slip flooring, which can effectively prevent falls and ensure the daily safety of the elderly. Health monitoring devices can track the health status of the elderly in real-time, such as heart rate, blood pressure, and physical activity levels, aiding in timely awareness and response to health issues. For elderly individuals with rehabilitation needs, gerontological design that incorporates rehabilitation facilities allows them to conduct rehabilitation exercises at home, reducing reliance on external professional rehabilitation services and enhancing their ability to live independently, while also preserving their dignity. In today's rapidly advancing intelligent technology, the rational layout of rehabilitation facilities and health monitoring devices can enhance comfort and improve the living comfort of the elderly. For example, health sensors placed in the bedroom can monitor sleep quality and adjust the indoor environment to improve sleep quality. A significant function of health monitoring systems is their emergency response capability; they can promptly notify family members or medical service personnel when abnormal conditions are detected, allowing for a rapid response to emergencies and creating more critical time for treatment.

4.3.5. Integration of the Elderly's Cultural Background and Personalized Customization to Meet Their Specific Needs and Preferences into Gerontological Living Space Design

Enhancing a sense of belonging and emotional connection, familiar cultural elements from the elderly's background are integrated into the living space design, thereby improving the quality of life. Providing personalized customization that takes into account the living habits and aesthetic preferences of the elderly can better meet their living needs, thereby increasing life satisfaction and happiness. Customized gerontological living space design can consider the physical condition and mobility of the elderly, enhancing the safety and convenience of use through barrier-free design and assistive devices [6].

The multi-generational cohabitation needs of the elderly are also one of the reasons for integrating cultural backgrounds and customized requirements. Gerontological design needs to consider the needs of different generations, achieving multifunctionality of space through personalized customization to adapt to the lifestyles and routines of different family members.

5. Conclusions

As the global trend of population aging intensifies, the contradictions of population aging issues become more pronounced, and gerontological living space design faces unprecedented challenges and opportunities. The integration of ecological health concepts into design provides us with a new perspective and methodology to better meet the living needs of the elderly. Future gerontological living space design will place greater emphasis on ecology, health, and sustainability, which will not only improve the quality of life for the elderly but also promote social harmony and progress.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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