

Spatial Optimization and Reconstruction of Old Communities under the Background of Aging

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Abstract As aging becomes increasingly serious, how to make the life of the elderly more convenient and comfortable has become one of the social problems to be solved urgently. Old residential areas are one of spaces where the elderly gather. In this paper, the prominent problems in the community space of existing old residential areas that are not conducive to the life of the elderly were analyzed, and corresponding countermeasures to transform the community space were put forward. It is hoped that public space can play its due value and make old residential areas glow with new vitality.

Keywords Aging adaptability, Community public space, Elderly care community, Space transformation

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According to the seventh census data, as of November 2020, China's total population is 1.443 billion, and the population aged 60 and above accounts for 18.70%^[1], about 264 million. Among them, the population aged 65 and above accounted for 13.50%, around 191 million. China has entered an aging society, and it is predicted by the National Bureau of Statistics that China will shift from an aging society to an aging society in 2022.

Presently, land resources are tight, and the cost of demolition is large, so it is difficult to promote it, which hinders the development of a city. In 2020, The State Council issued the *Guiding Opinions on Comprehensively Promoting the Renovation of Old Residential Areas*, pointing out the necessity and urgency of the renovation of old residential areas^[2].

Although traditional old residential areas have been built for a long time, the atmosphere of the market and fireworks are the most valuable elements in the community space and should be continued. Community public space is the most important outdoor activity place for the elderly in old residential areas, which can meet their fitness needs, emotional communication needs and rest needs^[3]. In the China's "12th Five-Year Plan" for the development of the cause of the elderly, it is pointed out that in the next five years, a total of 3.42 million beds for the elderly will be added. China's elderly care community service is still in its infancy, so the age-appropriate design of community space should be based on various characteristics of the elderly, and appropriate renewal and transformation should be conducted to meet the special needs of the elderly^[4].

1 Problems in the community space of old residential areas

1.1 Lacking barrier-free and humane facilities

There is no barrier-free facilities in the public space of old residential areas. There is no barrier-free ramp near the steps, which brings much inconvenience and security risks to the elderly^[5]. In addition, many internal roads, flower beds and grass pools in the residential areas are laid with kerbs with sharp edges, which is not convenient for wheelchairs to pass. If the elderly fall and bump, the consequences will be more serious. The squares of some residential areas will be sunk or elevated, which makes it difficult for the elderly to travel.

1.2 Unreasonable flow line and space layout

Old residential areas have single spatial layout and lacks public activity space. Moreover, the public green space is mainly composed of simple tree pools and grass pools, and the public space lacks hierarchy. The flow lines are mainly vehicular lines, while there are fewer pedestrian lines, and there are pedestrians and cars on roads. Pedestrian roads are narrow and occupied mostly, which poses a great safety hazard for elderly people with degraded mobility and audio-visual ability (Fig.1).

1.3 Lacking suitable outdoor activities facilities for the elderly

Old residential areas lacked eye-catching signs and facilities for leisure activities at the beginning of the design. In addition to communication, the most important activity of the elderly in the community space is fitness activities, but old residential areas often lack

a large area of activity squares. Due to the lack of fitness facilities, older people choose low branches for activities like leg presses and horizontal bars, which can not only cause security risks but also damage the growth of trees to affect the maintenance of landscape. In addition, some outdoor seats in some residential areas are made of stone or concrete, so they are too cold in winter and too hot in summer. Besides, the seats have many sharp corners, and people are easy to bump them (Fig.2).

2 Characteristics of the elderly in public space

As people age, all kinds of physical functions decline, which will have a certain impact on its physiology and psychology. Physiologically speaking, the organs and tissues of the elderly age, and their vision, hearing and reaction ability will decline to a certain degree. At the psychological level, the psychological capacity of the elderly will be greatly reduced. They are easy to have a sense of loneliness, hoping to talk with someone.

2.1 Basic physiological characteristics of the elderly

2.1.1 Degradation of sensory function. Human sensory functions include vision, hearing, touch, taste and smell, etc., and they are the main ways for the human body to receive external signals^[6]. Aging causes these senses to decline, and it appears firstly in hearing and vision, followed by other senses (Fig.3).

2.1.2 Deterioration of motor function. As people age, the motor function and flexibility of the elderly will decline. Firstly, they move slowly and are slow to react. Secondly, due to joint wear,

they will encounter certain difficulties when doing bending, leg lifting and other stretching actions. Thirdly, the loss of calcium causes the bones to become brittle, and a slight collision or wrestling will bring great harm to the elderly.

2.1.3 Deterioration of immune function. Compared with sensory and motor functions, the deterioration of immune function of the elderly is less noticeable. They are less resistant to

changes in temperature and humidity, and their health is easily affected by external factors.

2.2 Basic psychological characteristics of the elderly

After entering the old age stage, the role and function of the elderly in the society and the family have undergone significant changes, which has brought psychological ups and downs. At such times, it is necessary to create a good public

space for their emotional communication and physical exercise. The psychological changes of the elderly will have the following characteristics.

2.2.1 Being afraid of being alone and easy to feel lonely. At present, China's family structure is changing, and the pension problem caused by the huge proportion of only children is that more and more elderly people live alone. More and more life time of people is occupied by



Fig.1 Motor vehicles parking indiscriminately



Fig.2 Simple supporting facilities in old residential areas

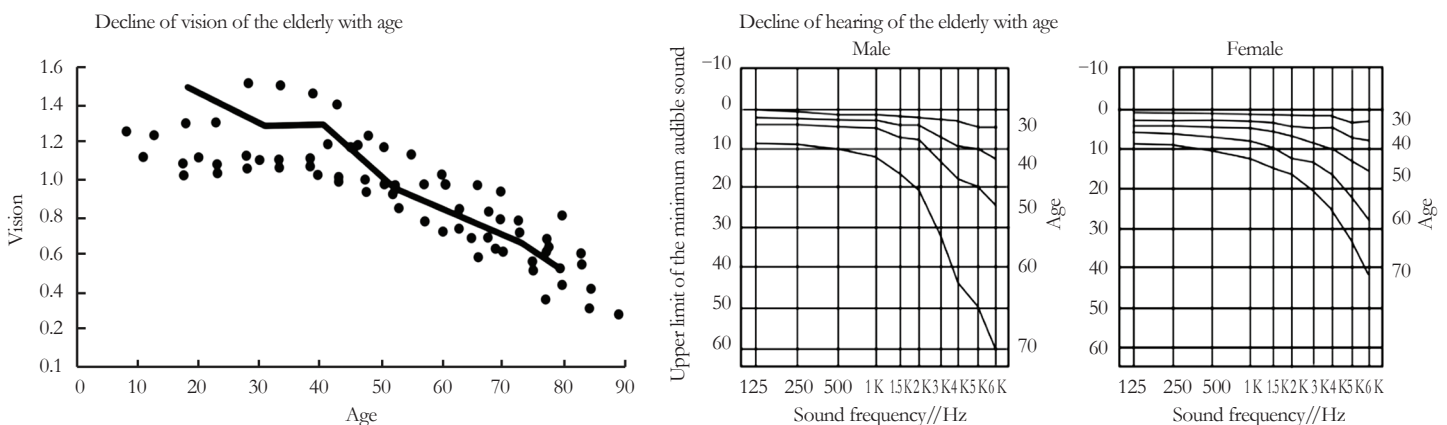


Fig.3 Decline curves of vision and hearing of the elderly

work, and there is less time to talk with parents and take walks. Most young people live closer to their workplaces, but they are far from their parents' homes. In the long run, the mental state of the elderly will have problems, and affect their physical health.

2.2.2 The aggregate demand becomes stronger. The elderly have more time to spend on their own. In order to avoid loneliness, they like to gather together to spend their leisure time. According to the main data brief of China's Urban and Rural Elderly Population Tracking Survey in 2010, only 4.1% of the elderly are willing to take turns living in their children's homes, and most of the elderly want to have their own living space because they are worried about getting along well with each other (Table 1).

3 Renovation of public space in old communities for the elderly

As the main user group of old communities, the elderly should be given more consideration in the transformation. Therefore, in the process of the transformation, various characteristics of the elderly should be respected, and the psychological and physiological needs of the elderly should be met through facilities and services, reflecting the humanized design of public space^[7].

3.1 Optimizing traffic flow and providing a safe travel environment

At present, the most serious threat to the safety of the elderly in old residential areas is the vehicles, and the roads with pedestrians and vehicles not only endanger the safety of the elderly, but also affects the smooth passage of vehicles in old residential areas. Hence, in the renewal of public space in the residential areas, the road network structure should first be transformed, and pedestrians and vehicles should be divided as far as possible. Moreover, several routes for the elderly should be designed. The distance of the routes should be shortened as much as possible. The accessibility of the main activity space in communities should be high, and the crossing between these routes

and motor vehicles should be reduced. Electric vehicles, as the same large number of vehicles in communities, also need to be distinguished from the routes of the elderly.

Secondly, for places in which the elderly are mostly active, walking paths should be designed for them, and the use of flat and non-slip hard paving should be used. Meanwhile, the use of steps should be reduced or canceled, and a gentle slope should be adopted. For the design of motor vehicle roads, there should be a clear identification, and they should be separated from special footpaths for the elderly in space to avoid cars' random turns to make them injured. Finally, it is also necessary to ensure the smooth drainage system of roads to avoid the accumulation of water on roads to affect their traveling.

3.2 Appropriately increasing the space for exchanges

The activity time and place of the elderly have certain rules. For instance, they like to get up early and exercise in the morning, chat in the afternoon, and walk together in the evening. Therefore, the elderly need a lot of space for outdoor activities. When the public space of old residential areas is transformed, it is necessary to carry out targeted design according to the living habits of the elderly and increase some communication space.

There are many spaces that are not properly managed in old residential areas, and it is needed to make full use of idle space, fully tap this function, and give it new functions according to the actual situation of communities, such as community parking lot, public green space and community activity center, etc. They should be transformed into positive spaces that can be used. The maintenance and management of this part of the space should be strengthened to reshape the spatial vitality of communities.

3.3 Improving supporting facilities

Public rest seats are an essential infrastructure for outdoor activities of the elderly. According to the physiological and behavioral characteristics of the elderly, seats with ergonomic characteristics of the elderly should be

arranged in the concentrated activity areas. At the same time, only the allocation of public seats is far from enough. The leisure and entertainment facilities in some old residential areas are not complete enough, and the unreasonable site selection results in their low efficiency^[8]. In the renovation, site planning should be conducted. Pergolas and pavilions should be set up in a square to create shade and rain shelter spaces and provide leisure and entertainment places for the elderly. In areas with heavy traffic such as community open spaces and main roads, lighting facilities should be supplemented according to the spacing requirement of 10 m^[9], and lawn ground lights should be supplemented in areas with material changes such as green spaces and grass pools to improve the nighttime lighting system.

3.4 Improving landscape system

Due to physiological and psychological changes, the increasing frequency of emotional anxiety, and high mental pressure of the elderly, natural vegetation, water, air and other elements should be used to build "healing parks" through horticultural therapy and forest therapy in the planning and design, and retreating gardens and vertical greening should be added to residential buildings in the form of point-like and linear distribution. Tall trees are planted to create enclosed or semi-enclosed space, create a seasonal and growing landscape of changing scenery, and form a green landscape system friendly to the elderly.

4 Brief summary

The aging society is a necessary stage for the development of a country's civilization, and the problem of "getting old before getting rich" has become increasingly prominent in China. As the most important and ideal activity place for the elderly, old residential areas are the most important space carrier for social old-age care, and carry the functions of social communication, leisure and entertainment for the elderly. The suitability for aging plays an important role in improving the aging community and enhancing

Table 1 Survey of residence intention of the elderly

Old-age and residential characteristics	No		Yes		Total	
	Number	Proportion//%	Number	Proportion//%	Number	Proportion//%
Living in the nursing institution for the aged	8,660	87.49	1,238	12.51	9,898	100
Taking turns staying with the children	8,883	95.49	420	4.51	9,303	100
Living and eating with their son	7,095	71.68	2,803	28.32	9,898	100
Living and eating with their grandchildren	7,109	71.82	2,789	28.18	9,898	100
Living and eating with their daughter-in-law	7,749	78.29	2,149	21.71	9,898	100
Living and eating with their daughter	8,919	90.11	979	9.89	9,898	100
Living and eating with their son-in-law	9,430	95.27	468	4.73	9,898	100

(To be continued in P60)

enterprise co-construction, and ensure that the curriculum site case teaching engineering projects and laboratory platform resources are abundant, and effectively promote the employment of students based on the social demand and industry development. The specialty will reinforce the construction of the course ideology and professional trend learning, continually optimize and enrich the course content, enhance the practical abilities of students, stimulate their interest in learning, and implement the "student-centered" education and teaching concept. Furthermore, the specialty will facilitate the cross-fertilization of disciplines, the formation of a unified approach to teaching and research, the timely synthesis and refinement of theoretical achievements, the dissemination of successful experiences, and the propagation of advanced practices to other professional courses within this and related disciplines. This will effectively promote the construction of an application-oriented "new engineering" and cultivate talents who can serve the country's high-quality development^[9-10].

References

[1] Ministry of Education of the People's Republic

of China. (2022, January 10). *Building a high-quality higher education system*. Retrieved from http://www.moe.gov.cn/jyb_xwfb/s5148/202201/t20220110_593495.html.

- [2] Cyberspace Administration of China. (2023, October 18). *Global artificial intelligence governance initiative*. Retrieved from <https://www.jiemian.com/article/10245439.html>.
- [3] Ministry of Education, National Development and Reform Commission and Ministry of Finance, CPC (2015, October 23). *Guiding opinions on guiding some local ordinary undergraduate colleges and universities to become application-oriented*. Retrieved from <https://www.chinanews.com.cn/gn/2015/11-16/7624837.shtml>.
- [4] Cheng, J. B. (2023). The value and implementation of project-based teaching under the background of industry-education integration: A case study of the courses related to computer graphic design course. *Theory and Practice of Education*, 43(33), 58-61.
- [5] Sui, R. D. (2023). Research on the innovative mechanism of vocational-general education integration and skilled-society construction under the strategy of empowering the nation with education. *Theory and Practice of Education*,

43(30), 19-24.

- [6] Zheng, H. S. (2023). Innovation and practice based on the integration of industry and education in colleges and universities. *Industrial Innovation*, (18), 184-186.
- [7] Lu, X. Q., Liu, Y. G. & Xu, Y. et al. (2023). Research on curriculum practice teaching reform under the background of industry-teaching integration: A case study of big Data thinking and decision making. *Educational Informatization Forum*, (9), 108-110.
- [8] Ning, Q. M., Tang, H. & Zeng, Z. W. (2020). Exploration on the teaching reform of urban and rural planning specialty in application-oriented universities based on the integration of production and education. *Shanxi Architecture*, 46(24), 174-175, 198.
- [9] Liu, W. F., Qi, X. H. (2023). Path of research classroom teaching reform of industry-education integration in "emerging engineering education". *Education and Teaching Forum*, (6), 145-148.
- [10] Xu, B., Du, J. & Lin, Y. Y. (2023). Research and practice of landscape engineering teaching reform driven by project. *Education and Teaching Forum*, (17), 105-108.

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the quality of life of the elderly. Under the background of aging society and urban renewal, the transformation of old residential areas has become an inevitable trend. Paying attention to care for the elderly is the embodiment of people-oriented. The transformation of old residential areas can not only improve the living environment and living quality of the elderly, but also create a good and dynamic community atmosphere^[10], which is of pivotal significance to both the elderly and the society.

Through the investigation of Wenxinyuan Community in Jining City, the method of aging and sustainable renewal and design of old residential areas was explored, and the understanding of aging renewal of old residential areas was further deepened on the basis of understanding, analysis and interpretation of actual cases. Starting from the current situation, the physiological and psychological characteristics of the elderly were analyzed, and a more universal renewal strategy was obtained finally, which provides an empirical basis for the research and further strengthens the theoretical

basis and practical value of the research. Therefore, corresponding improvement measures and design strategies can be put forward to improve the elderly friendliness of the outdoor environment in communities, effectively improve the quality of life of the elderly, and realize active aging.

References

- [1] Jiao, C. H., Liu M. & Wang S. Y. (2022). Research on the planning and design of elderly oriented community based on architectural programming method. *Housing Science*, (8), 27-33.
- [2] Wang, J. (2022). Research on aging renovation of public space in old communities in Taiyuan under the background of aging. *Future City Design & Management*, (10), 60-62.
- [3] Zhang, M. (2023). Research on countermeasures of cultural landscape renewal in old urban communities. *Beauty & Times*, (4), 82-84.
- [4] Zhang, Q. Y. (2021). Study on the strategy of the old age adaptability reconstruction of the public space in existing communities. *Urbanism and Architecture*, 18(23), 35-37.
- [5] Wang, Q. (2021). *Research on spatial design*

strategies of elderly buildings in areas with hot summer and cold winter from the perspective of microclimate (Master's thesis). Retrieved from China National Knowledge Infrastructure.

- [6] Wang, H. J. (2020). *Study on the living environment of rural elderly in Pucheng County, Weinan* (Master's thesis). Retrieved from China National Knowledge Infrastructure.
- [7] Wu, S. S., Wu, P. (2019). Reviews and prospects from multi-entities viewpoint about urban old community public space in China on the background of aging society. *Architecture & Culture*, (5), 69-71.
- [8] Dou, Y. J. (2018). *Research on aging renewal methods for public space in existing residential areas* (Master's thesis). Retrieved from China National Knowledge Infrastructure.
- [9] Tan, G. H. (2017). *Research on community outdoor environment design based on the concept of "old age friendly"* (Master's thesis). Retrieved from China National Knowledge Infrastructure.
- [10] Zhou, Y. M., Lin, J. Y. (2012). Analysis on the development and planning principles of senior living community. *City Planning Review*, 36(1), 46-51.