

Research on the Modular Design Strategy of Old Community Facilities for the Elderly based on "Gerontology"

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Abstract. With the intensification of the aging of the population, the adaptation of community space to the elderly has become an important issue that needs urgent attention in the renewal of community space. In view of the contradiction between the current public space facilities in old communities that are difficult to meet the growing needs of the elderly, this paper takes the old communities in Beijing as the research object, studies the modular design of the facilities suitable for the elderly in the old communities based on the behavioral needs of the elderly, analyzes the existing space problems and the needs of the elderly through site research and questionnaires, and finally puts forward design strategies and design schemes to provide ideas for the renewal of old community spaces.

Keywords: Geriatric Behavior; Age-appropriate Facilities; Modularization; Design Strategy.

1. Introduction

As early as 2000, China has entered an aging society[1]. At present, the aging of the population has become the basic national condition of our country. Among them, the aging degree of China's cities continues to deepen, and re-examining and responding to the needs of the growing elderly group has become an urgent problem to be solved, which should attract universal attention in all fields of society.

In the early days, the focus of community development and construction in China was to increase the number and density of housing buildings[2], which led to the widespread neglect of facilities for the elderly in the community, which posed a potential threat to the elderly group who care for the elderly at home. In recent years, the focus of China's urban construction is shifting from incremental development to stock optimization, and refined micro-renewal has become the main mode of renewal. As an important object of renovation and upgrading at this stage, the government and residents have higher requirements for the quality and scale of renovation and renewal[3].

In the face of China's unique national conditions in terms of aging, the academic community needs to make specific research and analysis on the specific situation of aging. In terms of the renovation of old communities, Chen Ye et al. took an old community on Changning Road in Shanghai as an example and used questionnaire surveys and other methods to explore the renewal route and governance path of old communities from the perspective of behavioral methods[4], while Sun Le made a specific classification of community facilities for the elderly according to Maslow's hierarchy of needs, and proposed design strategies for community cultural facilities, medical care facilities, educational facilities, and fitness facilities[5]. It is worth mentioning that Yao Zhihao et al. pointed out that the current research focus of facilities for the elderly in China has shifted from the transformation of physical space to more attention to the behavioral characteristics of the elderly and the needs of the community, and the concept of community life circle has promoted the transformation of age-appropriate renewal from engineering-oriented to human-oriented[6]. At the same time, Liu et al. used bibliometric methods to find that few scholars analyzed the types, characteristics, and design methods of elderly care facilities from a holistic perspective[7]. It can be seen that the old community has become the primary object of age-appropriate renewal, and the starting point of renewal needs to fall more on the behavioral characteristics of the elderly group itself. At the same time, the specific classification of facilities for the elderly needs to be further clarified,

and the overall design methods and concepts of facilities for the elderly that are more suitable for the elderly communities need to be put forward urgently.

Based on the current situation of aging in China, this study analyzes the research status of facilities suitable for the elderly. Taking "gerontology behavior" as the starting point, this paper understands the current situation of old community facilities through site investigation and questionnaire, and finally classifies the community facilities for the elderly, and puts forward the overall design strategy of using modular method for the design of facilities for the elderly. This study provides an ideal facility design scheme for the elderly group who are engaged in community elderly care, which is of great significance for community elderly care and active aging.

2. Analysis of the Characteristics of the Elderly Group in the Old Community

In today's society, the elderly are facing the aging of their physical functions, and they also have to cope with the rapid update and iteration of technology and conceptual changes. In this study, based on the observation and analysis of the middle-aged and elderly groups in the old community, the "geriatric behavior" in the context of geriatric behavior is specifically divided into the behavioral characteristics and psychological characteristics of the elderly group.

2.1. Behavioral Traits

2.1.1. Regularization of Activity Time

The elderly generally pay attention to their own physical health and pay attention to the regularity of their daily life[8]. In daily life, this regularity is manifested in regular routines, regular outings, etc. This means that their use of community facilities is often regular, so fully functional and fixed facilities for the elderly bring life security and increase happiness, and are more likely to be welcomed by the elderly group.

2.1.2. Singularization of Social Objects

When it comes to choosing who to do, older people usually tend to be familiar with things, such as neighbors, relatives, etc. Different groups of activities will also form their own social circles, such as square dancing, playing chess, tai chi, etc., this social landscape is a medium that makes it easy for the elderly group to feel a sense of belonging, and they are extremely stable and determined.

2.1.3. Centralization of the Scope of Activities

Older people often have a fixed place to live and are generally not far away, which makes it difficult for them to choose new activities and facilities. For individual activities, their behaviors such as dining and exercising often have a strong sense of purpose, and the range of activities they choose remains basically the same, while for group activities, such as square dancing and chess and cards, most of the time they choose to be in a fixed location[9]. As a result, the range of activities of the elderly group is very fixed and concentrated. The installation of appropriate age-appropriate facilities in the vacant land of the old community ensures the demand and frequency of use.

2.2. Psychological Characteristics

2.2.1. The Need for Good Health

According to Wang's research, retirees will go through three stages: "independence", "mediation" and "dementia" [10], with the first two periods lasting longer. When work is no longer the center of life, retirees often focus on the maintenance of physical health, which is manifested in regular work and rest, balanced diet, appropriate exercise, etc., and the interest and rhythm of life have become the center of this group of people. Therefore, health-conscious recreation facilities are more likely to be welcomed by the elderly.

2.2.2. The Need for Lifelong Learning

There are quite a lot of elderly people who are "left behind" in the development process of the intelligent information age. For example, when unwell, older people are unable to use smartphones proficiently[11] resulting in a blockage in the process of medical treatment and medical denial. In fact, a significant number of older people still have a high learning ability and a strong desire to learn new things. Promotional panels and knowledge modules are considered to be welcome elements of the facility among the elderly, which helps them to keep up to date with cutting-edge information in their spare time.

2.2.3. The Need for Interpersonal Communication

The vast majority of the elderly still follow a simple lifestyle, emphasizing offline, person-to-person intimacy and authenticity. Therefore, the general desire of the elderly group for old things, especially for interpersonal communication, is something that we need to pay special attention to[12]. The elderly group has accumulated a lot of life experience and life experience, and is no less than young people in terms of skills and psychology, and a considerable number of elderly people are willing to talk to young people and pass on their own experience, because this allows them to obtain the information that they are "needed" and prove that they are still integrated into society, and this sense of achievement can bring great energy to the elderly group.

3. Community Research

3.1. Community Space Research

Through visits and research, it was found that the overall layout of old communities in Beijing is basically similar, and many infrastructures such as sanitation facilities (garbage cans, etc.) and sports facilities (fitness equipment) have been popularized and supported, and can meet the basic living needs of residents. But correspondingly, the problems existing in the community in terms of facilities for the elderly are basically the same. The specific manifestations are that the facilities themselves fail to fully consider the needs of the elderly, the placement of facilities is unreasonable, the resources of open space are not fully utilized, the utilization rate of facilities is generally not high, and there is a general lack of maintenance. A total of six old communities were visited, and relevant research pictures, texts, and data information were collected as follows Table 1.

3.2. Community Population Surveys

3.2.1. Temporal Distribution of Crowd Activities

Through the investigation and investigation, it was found that the temporal distribution of the types and main behaviors in the community was regular, which was mainly manifested in the flow of people and behaviors in the community in one day. In the morning (before 12:00pm), the flow of people in the community gradually flattens, and the elderly usually appear and carry out activities during the school hours of children, during the lunch hours (12:00pm-15:00pm), the elderly tend to cook and rest at home, and in the afternoon (after 15:00pm), the elderly tend to gather to chat and play, and such activities usually end before the time when the children return home. The table of the main groups of people in the community and their behaviors in a day is as follows Table 2.

3.2.2. Surveys

Through the preliminary visit and research of the old community population, a total of 20 questionnaire questions were designed, and a total of 200 questionnaires were distributed, which were distributed to the middle-aged and elderly groups, of which 180 valid questionnaires were recovered. The questionnaire counted the basic information of the respondents, i.e., age and gender, and also investigated the participants' activities and living habits, as well as their thoughts and preferences about the details of the design of facilities for the elderly.

Table 1. Survey of the current situation of public facilities













| The name of the community | Fuqiang Xili | Zaoyuan Dongli | Guanyinsi Nanli | Xinghua Zhongli | Nan Sanlitun | Changchunli Xiaoqu |
|---|--|--|---|---|--|--|
| The area of the open space of the community |  |  |  |  |  |  |
| Photos from the scene |  |  |  |  |  |  |
| Total area (m2) | 112918 | 47265 | 94179 | 6397 | 7283 | 25706 |
| The area of the base of the building (m2) | 29293 | 14397 | 24295 | 1805 | 4456 | 9906 |
| Green area (m2) | 83625 | 32867 | 69883 | 4592 | 2827 | 15800 |
| Number of facilities | <ul style="list-style-type: none"> 1 group of public fitness facilities 1 takeaway cabinet 1 garbage collection station 1 kiosk | <ul style="list-style-type: none"> 1 group of public fitness facilities 2 groups of public rest facilities 1 garbage collection station 1 group of drying racks | <ul style="list-style-type: none"> Several garbage sorting facilities 4 groups of bulletin boards 1 shared tailwater recovery device | <ul style="list-style-type: none"> 1 set of fitness equipment 1 set of shared take-out and charging facilities 1 garbage station 2 sets of drying racks | <ul style="list-style-type: none"> 1 set of public rest facilities 1 set of fitness facilities 1 set of shared facilities 2sets of garbage sorting facilities along the road | <ul style="list-style-type: none"> Public rest facilities along the road 1 group of garbage sorting facilities 2 bulletin boards Several barrier-free facilities for the elderly |
| Facility maintenance | <p>There is no follow-up maintenance of the fitness facilities</p> <p>The facilities are old</p> <p>The garbage station is maintained by special personnel</p> <p>The rest facilities such as pavilions are well maintained by the residents</p> | <p>The facilities are relatively intact</p> <p>A small number of facilities are damaged, but they do not affect their use.</p> <p>However, there are many facilities that are idle and not well utilized</p> | <p>Some facilities are under maintenance, but the maintenance materials are stranded, affecting the normal living environment of residents</p> | <p>There is no property management, the damaged facilities are not repaired</p> <p>Some of the newly installed facilities are shelved without maintenance</p> | <p>The use and maintenance of the facilities are in good condition</p> <p>There are special personnel responsible for cleaning up</p> | <p>Some facilities were damaged but could not be repaired in time</p> <p>Barrier-free facilities and bulletin boards were well maintained</p> |

Table 2. Temporal distribution of crowd activities in old communities

| Period | Main population | Crowd main behavior |
|----------------|---|---|
| 7:00am-8:00am | Older people and young people | Shop for fruits and vegetables and go to work |
| 8:00am-9:00am | School-age children and the elderly | Older people send their children to school |
| 9:00am-12:00pm | The number of people is small, and most of them are elderly | Rest, chat, and prepare lunch |
| 12:00pm-4:00pm | Elderly, mostly in groups | Exercise, get together to chat, bask in the sun, etc. |
| 4:00pm | School-age children and adolescents, the elderly | Elderly people pick up children and teenagers from school |

According to the results of the valid questionnaire, more than half of the respondents' communities have been equipped with facilities for the elderly. In terms of facility materials, the most desired material is wood, followed by steel, the third is board, and finally plastic. It shows that there is a gap between the existing design of age-appropriate facilities and the user's wishes, and the existing design does not take into account that steel facilities are not suitable for sports in winter, and the use of wood in the design of age-appropriate facilities should be the biggest voice of the public.

Nearly half of the middle-aged and elderly people use the existing facilities in the community at least once a week, followed by at least once a day. Explain the necessity and feasibility of the research question. 50% of the respondents said that they only knew more than 10 middle-aged and elderly people in the same community, reflecting that the reason for knowing them was the same interests and hobbies. Therefore, the design of facilities for the elderly should provide a place for middle-aged and elderly people to communicate with their hobbies, and social functions cannot be ignored in the design.

3.3. Analysis of Spatial Problems and Needs

3.3.1. Space Issues

Through the investigation of community space, it is found that there are the following problems in the old community public facilities.

First of all, as a public facility for the special needs of the elderly, the popularity of facilities for the elderly is still not high in the old community, and there is a general lack of them. Due to the age of development, the public facilities in the old community still only meet the basic requirements, and cannot provide exclusive and safe guarantees for the elderly as the main residents.

Secondly, the facility itself does not take into account the unique needs of the elderly population, and fails to match the behavioral and psychological characteristics of the elderly group in terms of scale, material, and color. The physical characteristics of the elderly group have changed, the details that need to be paid attention to in life have increased, and the willingness to act and behavioral characteristics have obvious preferences, which can bring guidance for the design of facilities for the elderly.

At the same time, the combination and placement of the facilities are not elegant, and there are problems such as low seats placed in the lawn, and the placement of combined seats does not match the shape of the open space. Unreasonable seats cannot meet the social needs of the elderly group gathering activities, so it is not uncommon for residents to bring their own seats in open spaces and public facilities seats to be left out in the cold.

Finally, there was a general lack of maintenance and renewal of the facilities, and most of them showed obvious wear and tear, and vague scales and instructions affected the use of the community.

3.3.2. Requirements Analysis

Through the survey of community space, it is found that there are the following problems in the needs of the old community.

First of all, among the results of the questionnaire collected, the preference of the elderly for warm, soft materials and bright, bright colors is particularly obvious. The majority of respondents expressed a desire for more diverse materials, such as wood, which became a major inspiration for the material design of age-friendly facilities.

Secondly, many older people said that their social activities in the morning, noon and afternoon are different and focused, and most of them have their own social circles and often hold group activities. In addition to basic leisure facilities, the elderly group hopes to have more group entertainment facilities with high availability rate, such as chess and card tables, to improve the current inconvenience of bringing their own entertainment tools. At the same time, under special circumstances such as high sun shine or sudden rainfall, sheltering facilities in community open

spaces can well cope with the sudden needs of the elderly, but unfortunately, the current penetration rate of sheltering facilities in the community is still very low.

Finally, respondents generally expressed a desire to learn more about the times and keep up with the times. The content of the popular science display of physical health and interesting knowledge is the help that the facilities for the elderly can provide, and also contribute to the increase in the frequency and popularity of the facilities themselves.

The study summarized the special preferences of the elderly for daily activities and the general needs for facilities, which were used to guide the next design process.

4. Design Strategies and Solutions

4.1. Classification of Age-appropriate Facilities

According to the previous literature retrieval and summary, the survey of the old community, and the analysis of the behavioral characteristics of the elderly group, the facilities for the elderly in the old community were divided into five basic types: sports facilities, leisure facilities, shelter facilities, recreational facilities, and barrier-free facilities. At present, the types of community sports facilities are basically saturated, and the types are diverse and unified in terms of appearance and material, and are more regarded as a complete set of products for design, and at the same time, the barrier-free facilities in public places are mostly in the form of barrier-free ramps and handrails, which are regarded as design elements applied to rest, shelter and recreation facilities in this study.

Table 3. Classification of facilities for the elderly

| Type of facility | Facility function |
|-------------------------|---|
| Athletic facilities | Facilities that provide basic sports and fitness programs are mostly designed and manufactured as complete products |
| Leisure facilities | Most of them are facilities for solo rest and group socialization |
| Sheltering facilities | It mostly exists in the form of pavilions and platforms, which are used for shelter from the wind and rain and temporary rest |
| Recreational facilities | It is mostly used for social functions, such as chess and card tables |
| Accessibility | It is mostly in the form of barrier-free handrails, ramps, non-slip pavement, etc |

4.2. Modular Design Strategy for Facilities for the Elderly in Old Neighborhoods

4.2.1. According to the Type of Facility and the Needs of the Elderly, The Design of Individual Facilities is Carried Out

As an integral part of the module, the single facility is of great significance to the visual presentation and use effect of the final facility design. For a single facility, the use of a common design language is a top priority, which determines that the facility is able to respond to age-appropriate needs in terms of scale. At the same time, careful consideration of the needs of the elderly is also a consideration for facility design. Compared to other age groups, the physical conditions that older people may have and what they need to carry need to be fully considered in order to respond to the design results. Finally, a single facility needs to provide space and structure for the combination of facilities, fully consider the various problems that may arise when combining multiple facilities, and design the combination method and structure for various situations to make the modular combination feasible.

4.2.2. Combine the Modules of the Single Facilities to Form a Multi-Functional Module

The modular combination of individual facilities can play its own role more fully and take into account the multi-faceted needs of the elderly group more comprehensively. The preset combination parts in the single facility reserve sufficient assembly space, which is easy to operate and can be

flexibly combined to meet the convenience and flexibility required by modular facilities. Clustered and socially oriented elderly groups often have diverse needs in fixed community open spaces, and this is where the multi-functional and diverse group of age-appropriate facilities plays a good role. The combination of facilities and modules meets the diverse psychological characteristics and functional needs of the population.

4.2.3. According to the Hierarchical Distribution of Public Space in the Old Community, the Module Combination is Reasonably Allocated

Good and appropriate placement is the key to give full play to the function of the facility combination, so it is necessary to carry out a reasonable combination of facility modules according to the composition and distribution of the public space of the old community. The area, shape and service radius of the public open space in the community are different, and users need to conduct specific analysis for specific problems when assembling. According to the size of the service radius of the site, the higher the level, the more people and more people served by the vacant space, the more abundant needs, and the need for more and more diverse module combinations. By analogy, the service level of the open space needs to be taken into account when the space layout of the facilities module for the elderly, so as to form a reasonable distribution system of facilities for the elderly in the community space.

4.3. Modular Design Scheme for Facilities Suitable for the Elderly

4.3.1. Leisure Facilities

Rest is one of the important outdoor space behaviors of the elderly, and leisure facilities are of primary significance to the comfort of space. The modular design of leisure facilities first needs to consider the flexibility and combinability of seats, and the leisure facilities are easy to combine and change according to the different needs of scenes and functions, so as to improve the adaptability of leisure facilities. Secondly, it is necessary to fully consider the physiological characteristics of the elderly for styling design, such as avoiding the seat being too low, causing inconvenience for the elderly to sit up, and adding armrests of appropriate height to provide assistance for the elderly to sit up. In addition, leisure facilities need to integrate more humanized functions, such as the shape of seat armrests, which can integrate detailed functions such as leaning on crutches and placing water cups, so as to further improve the rest experience of the elderly and reflect the humanized care of leisure facilities.

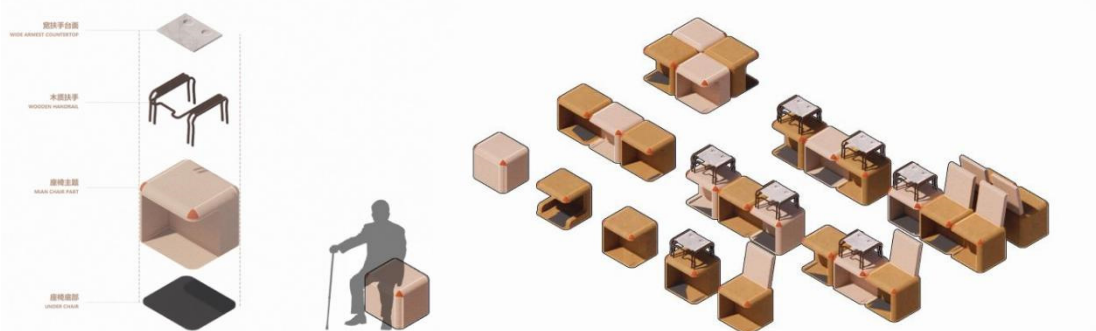


Fig 1. Exploding diagram and type diagram of leisure facilities

4.3.2. Sheltering Facilities

In the process of conducting interviews, the lack of shelter from the wind and rain is a common problem in the community. The shelter facilities will meet the basic needs of residents for sun protection and rain protection, which is of great significance for improving the happiness of community public space. Considering the different shapes and sizes of the community open space, the study proposed the idea of a square pavilion steel frame, which can be freely placed into various shapes of open space such as square and long. At the same time, the designer proposed a variety of

types of plates of the same size, with the slide rails inside the square steel frame, the plates can be freely combined to any side of the pavilion, so that the design adapts to a variety of sites, circulation lines, and personnel needs of the community, so that the pavilion can play a proper role under any community conditions.

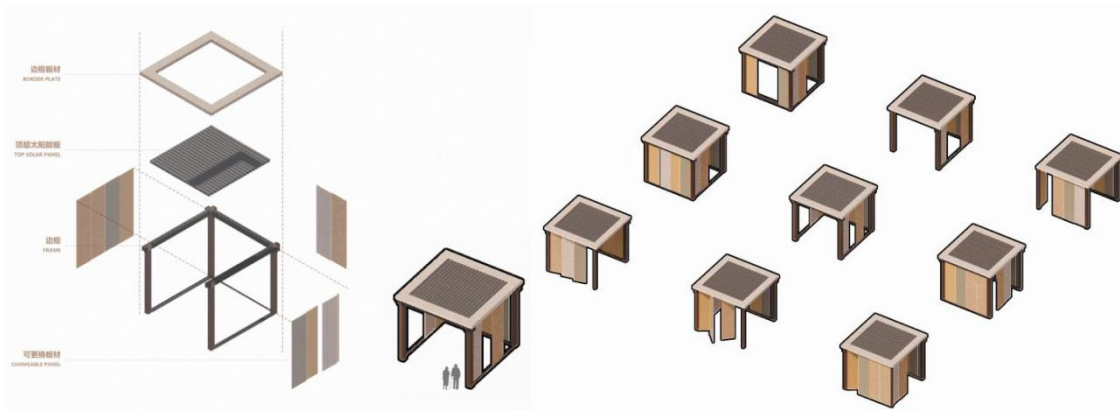


Fig 2. Explosion and type diagram of masking facilities

4.3.3. Recreational Facilities

Board games (mahjong, Go, chess, etc.) are one of the collective activities that the elderly are keen on, and the iron chess tables provided by the community currently have problems such as inability to move, wear and tear of the chessboard, and cold materials, and the research has improved them according to the current situation. First of all, the material of the chess table has been improved, and the cold and sharp iron material has been replaced with a warm and gentle wood material, which has increased the affinity of the facility. Secondly, the support structure at the bottom of the chess table is improved, and the angle of the support column is changed to facilitate the placement and extension of the user's legs. Finally, the design offers three different types of boards, allowing it to boast four different modes, increasing the playability of the facility.

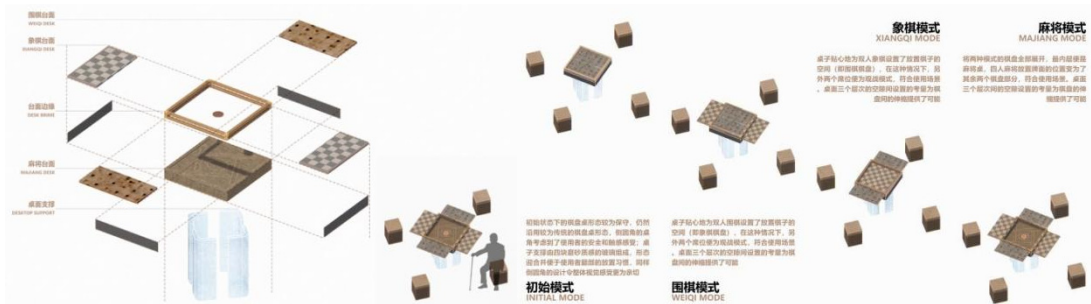


Fig 3. Exploding diagram and type diagram of amusement facilities

5. Summary

Taking geriatric behavior as the starting point, this study gradually analyzes the behavior and psychological characteristics of the elderly group, takes some old communities in Beijing as the research object, sorts out and summarizes the basic situation of the community and its facilities, constructs the basic portrait of the population by means of visit and observation, questionnaire survey, etc., and summarizes the design basis. Finally, the basic classification of age-appropriate facilities is obtained, and the design strategies of community facilities focusing on "modularity" are accumulated. However, the selection of subjects within the scope of Beijing cannot ensure the universality and scientificity of the research results, so further in-depth exploration is needed. Aging will gradually become a global population issue that needs to be paid attention to, and in this context, research is of great significance for the improvement of the quality of life of China's elderly group, the happiness of later life, and the formation of active pension methods.

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