



Optimized Design of Outdoor Symbiotic Environments for the Elderly and Children in Urban Housing

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Abstract. Demographic structure is one of the important factors affecting residential patterns. Accompanied by the implementation of the comprehensive two-child policy and under the current specific national conditions of China, the demographic structure at this stage presents two obvious characteristics: population aging and the continuous increase of newborns. In view of the psychological and physiological similarities between the elderly and children, this paper first analyses the commonality of their outdoor environment needs, and then discusses the hybrid spatial layout and design methods of outdoor environment adapted to the two different groups, combining with the design principles of public outdoor environments for the elderly and children. The proposed design concepts and experience summarization will provide a valuable reference for the creation of outdoor symbiotic environment for the elderly and children in the near future.

Keywords: Urban housing; outdoor environment; elderly; children; optimized design

1 INTRODUCTION

Outdoor environment is an indispensable part of the whole urban residential project, and good outdoor environment design can help to improve people's living quality, and at the same time benefit people's physical and mental health. On one hand, the physical condition and mobility of the elderly tend to decline with age, and the scope of activities is also reduced accordingly, so the outdoor environment in urban housing becomes the main place for them to contact and feel the natural environment. On the other hand, playfulness is the nature of children and people, and children are more likely to be influenced in acquiring and developing their cognitive abilities in the outdoor environment when they carry out recreational activities [1]. At the same time, a good outdoor environment also helps to cultivate children's ability to explore and discover, the spirit of mutual help and love, and the quality of respect for the elderly and the young [2]. Considering the common and complementary characteristics of the two groups, it is of great practical significance to study the design of outdoor environments for the common life of the elderly and children.

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2 ANALYSIS OF THE NEEDS OF THE ELDERLY AND CHILDREN FOR OUTDOOR ENVIRONMENT

The elderly as "old children" and children in many features have greater similarity. The design of outdoor functional areas of residential environments suitable for the elderly and children is different from the design for other age groups, and should be more inclined to actively adapt to the physiological and psychological characteristics of these two special groups.

2.1 Common Physiological Needs

Elderly people are in a period of physical decline and children are in a period of physical development. Although the two groups are at different stages of life, they have great similarity. At the same time, compared with young adults, their physical functions are relatively weak. Thus, the physiological similarities between older persons and children dictate that they share a large degree of common needs in terms of their living environments, as shown in Fig. 1, and that they need to be treated differently from young adults. Specifically, this feature is reflected in the following two points [3].



Fig. 1. Common physiological needs of the elderly and children in outdoor environment.

Sound, light, color and temperature design needs in outdoor environment.

Sound: For the elderly and children, sleep is very important, noise from outside will form a stimulus, resulting in they are not easy to fall asleep or easy to wake up, effective noise isolation measures are necessary. Reasonable use of sound-absorbing materials on the ground, walls and other acoustic treatment or through the planting of coral trees, cedars, cypresses, sequoias, rowan, pittosporum tobira, osmanthus, ailanthus, ligustrum lucidum and other plants that have sound-absorbing and noise-reducing functions and ornamental plants, in order to reduce the impact of environmental noise.

Light: Sufficient natural light exposure can help the elderly and children promote calcium absorption, enhance body functions and resistance. The environment can be

designed to ensure sufficient and effective natural lighting in the activity area through the sunny lawns and sparse grasslands. Artificial lighting, as an important supplement, should provide obvious light reminders at corners of corridors, height differences, etc., and create different environmental atmospheres through the strength of the brightness, the warm and cold tones of the colors, and the different ways of placing the lamps.

Color: Elderly people's visual function declines to the extent that short band colors are difficult to recognize, and children's visual function still needs appropriate color stimulation to help vision development. Consequently, they are more willing to choose bright colors such as red, yellow, orange and so on. It should be noted that warm colors tend to excite people and should be used wisely. They can be used appropriately on light-colored walls in activity areas to serve as a warning reminder and to enliven the atmosphere.

Temperature: Temperature regulation is a problem that needs to be considered in combination with humidity, ventilation and other conditions. It is necessary to organize the functional spatial relationship of each area through appropriate design according to local conditions in order to form a good convection effect. At the same time, the reasonable use of sunshade, cane corridor and heat preservation wall can make the local thermal environment comfortable and pleasant.

Accessibility design needs in outdoor environments.

Accessibility design in outdoor environment mainly includes two aspects: accessibility of physical environment and accessibility of information. The accessibility of physical environment refers to taking appropriate measures in landscape design, such as path layout, to facilitate the smooth passage of users whose physical functions are gradually declining or not yet fully developed. The accessibility of information acquisition is aimed at users who have lost their physiological functions, such as hearing and vision, due to aging or lesions in their sensory organs, and who are able to access external information through the use of reasonable instruction systems or auxiliary facilities [4].

First of all, high-frequency activity areas in outdoor environments should be kept at an appropriate distance from complex behavioral areas (e.g., motorways, etc.). When there is a difference in height and terrain, ramps are preferred to steps, and solid, non-slip materials should be used to avoid accidental slipping for the elderly and children, so as to realize barrier-free access to the whole area as much as possible. Secondly, different colors or tactile building materials can be used on the ground in different spaces to divide different regional spaces, which can help the elderly and children to orient themselves and clarify the direction of the route. Finally, proper signage plays an important role in the humanization of project functions. The design of signage system in the common living area of the elderly and children should not only consider the children with limited cognitive ability, but also consider the elderly with declining visual function or even intellectual decline, and the design of the signage should be graphic-based, simple and friendly [5-7].

2.2 Common Psychological Needs

Psychological studies have shown that along with changes in physical functioning and social roles, the elderly tend to be more sensitive and prone to negative emotions such as loneliness, low self-esteem and depression. In addition to the positive characteristics of imitation, curiosity and imagination, children, similar to the elderly, are often characterized by negative emotions such as anxiety, isolation, aggression and fear [8, 9]. The common reason for the negative psychological characteristics of these two groups can be summarized as the lack of security due to the lack of family and friends. Due to this similarity, the common needs in terms of living environment, as shown in Fig. 2, are reflected in the following two points.



Fig. 2. Common psychological needs of the elderly and children in outdoor environment.

Demand for security design in outdoor environment.

The design of security in outdoor environment mainly includes two aspects: the security brought by the environment itself to the users and the security of emotional interaction between users. The former can be considered in terms of convenience, safety, recognizability, and accessibility of the environment design, while the latter can be strengthened in terms of the design of communication sites set up between the elderly, between children, and between the elderly and children. For example, benches under the shade of trees, seats arranged face-to-face around small tables under umbrellas, and recreational areas for the elderly should be arranged as close as possible to recreational areas for children. All the designs serve to make communication happen naturally and provide a spatial basis for the mutual needs of the elderly and children.

Demand for recreational design in outdoor environment.

The elderly not only need to go outdoors to breathe fresh air, sunshine, physical activity, but also needs enough space to meet the requirements to carry out outdoor recreational activities, such as fitness, chess, reading the newspaper and so on. In the meantime, outdoor activity space can be used for children to play games, participate in interpersonal communication, exercise activities, etc., and it is also an important place for them to contact with nature. Hence, the landscape design of the outdoor environment should give full consideration to the children's experiential perception process, and the setup of recreational facilities should help stimulate the imagination,

perception, and practical ability, and enhance their aesthetic level, creativity, and moral literacy. For example, landscape walls with special tactile materials, non-slip rubber pavement with rich color patterns, non-toxic and non-irritating odor plants, etc. can be used as the preferred choice for the landscape of recreational facilities for the elderly and children.

3 DESIGN PRINCIPLES OF OUTDOOR SYMBIOTIC ENVIRONMENT FOR THE ELDERLY AND CHILDREN

The design of the outdoor symbiotic environment for the elderly and children should be centered on the core elements of humanization, such as safety, coordination and nature, as shown in Fig. 3, with the aim of conveying the concept of positive life to them through the all-round arrangement of the spatial environment. Specifically, the following principles should be followed.

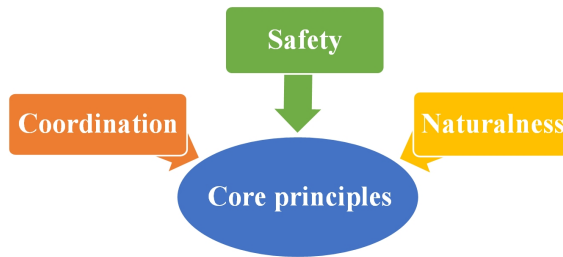


Fig. 3. Design principles of outdoor symbiotic environment for the elderly and children.

3.1 Safety Principle

Elderly people and children are physically weak people, safety design should be carefully implemented according to their physical conditions and behavioral characteristics. This includes the improvement of barrier-free design, the consideration of scale space and the arrangement of space sequence. Specifically, for example, whether the materials used in the relevant equipment are safe and non-toxic, whether the fitness facilities for the elderly are designed for safety, whether there are buffer settings for children's climbing, slides and other game facilities, whether the rubber field road surface has been made non-slip treatment, and whether landscape flowers and wood seedlings try to use non-thorned and non-irritating odors of the plant, and so on.

3.2 Coordination Principle

The outdoor environment, while satisfying the functionality of the space, should also take into account the global harmonization of the elderly area and children's area. The design of the elderly or children's area should be simple and comfortable, but also distinctive and lively. From the whole to realize the coordination of landscape design.

Specifically, for different groups of activities in the space of the various regions of the division, it is necessary to comprehensively consider the location of the interval, occupying the scope of the situation, according to the actual activities carried out by the demand for scientific planning. The landscape design of the outdoor activity space must echo with the overall building, and the style needs to be compatible.

3.3 Naturalness Principle

The natural characteristics of the outdoor symbiotic environment for the elderly and children are greatly influenced by the differences in geography, climate and customs, and different outdoor environments have corresponding design requirements. The design needs to fully consider the above factors, while retaining the naturalness of the environmental ecology and the naturalness of symbiotic integration. Elderly people need a beautiful outdoor environment, a quiet and comfortable place for recreational activities and entertainment, and they also need to relieve their loneliness and emotions, and regularly participate in socialization activities. A humanized design will help establish a sense of familiarity and belonging between the elderly and children. In addition, children have an innate desire to be close to nature and are filled with curiosity and a desire to explore it. Thus, children's contact with nature should also be promoted as much as possible. Specifically, attention should be paid to the choice of plant species when designing landscapes, and varieties can be increased appropriately. For road paving, conventional materials such as cement should be avoided as much as possible, and relatively soft sand or smooth stones should be used instead.

4 SPATIAL LAYOUT OF OUTDOOR SYMBIOTIC ENVIRONMENT FOR THE ELDERLY AND CHILDREN

The spatial layout of the outdoor symbiotic environment for the elderly and children needs to take into full consideration the aforementioned three principles of safety, coordination and naturalness, and complete the relevant functional design using them as a guide. Specifically, the relationship between the activity space for the elderly, the activity space for children and the public activity space should be coordinated globally, with the aim of facilitating the communication among the elderly, among the children and among the elderly and children, and also ensuring the harmonious integration of the independent spaces of each group. The spatial layout forms are generally categorized into the following two main types.

4.1 Freestanding Style

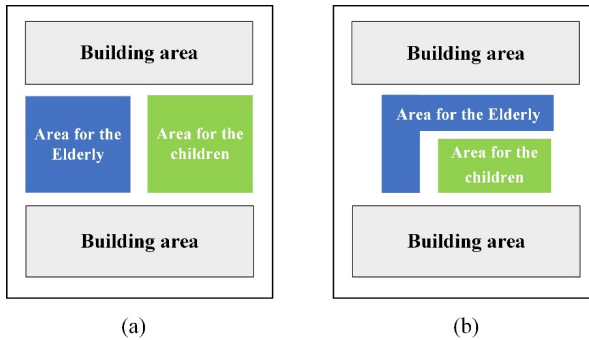


Fig. 4. Freestanding layout of the outdoor symbiotic environment.

As shown in Fig. 4, the freestanding spatial layout form is to separate the activity venues for the elderly, children's activity areas and public activity areas in a side-by-side or semi-enclosed manner, with each of the three as a whole being independent. The functional boundaries of the layout are clearer for each group, and a certain degree of privacy is retained within their respective activity areas. Among them, the semi-enclosed spatial layout shown in Fig. 1b strengthens the connection between the elderly area and the children's area, which is convenient for the elderly to take care of children, and the children feel safer with the all-around care of the elderly when they are playing.

4.2 Distributed Style

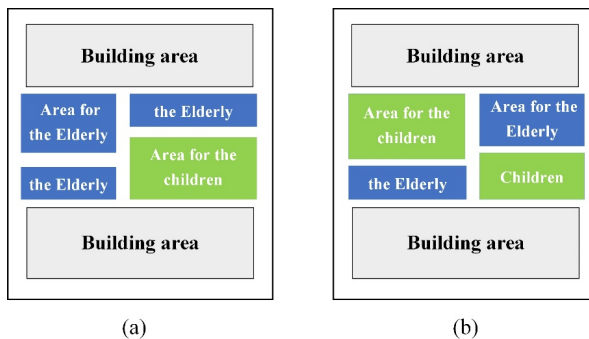


Fig. 5. Distributed layout of the outdoor symbiotic environment.

As shown in Fig. 5, the distributed spatial layout form, is to discrete the elderly activity areas or children's activity areas into a number of blocks, where the discrete format can be changed according to the actual needs. In the locally distributed layout shown in Fig. 2a, the children's activity area retains its integrity, which is conducive

to centralized care, while the elderly activity area can be distributed according to its function, and the children's activity area is generally surrounded. This layout form serves as a transitional layout form between the freestanding and the fully distributed (as shown in Fig. 2b).

5 CONCLUSIONS

Elderly people and children are two vulnerable groups that cannot be ignored among current community residents and that require focused attention. With the accelerated aging of China's population, the traditional way of old-age care is no longer fully compatible with the needs of the elderly for a better life. At the same time, considering the continuous increase of newborns brought about by the liberalization of the national two-child policy, from the perspective of urban residential outdoor environment design, this paper studies how to let the elderly and children, two groups with many similarities, live together in high quality, and humanely analyzes the needs of the elderly and children for outdoor environment design in terms of sound, light, color and temperature and barrier free from a physiological perspective. This paper discusses the needs of the elderly and children for the outdoor environment design in terms of security and recreational from the perspective of psychology. In addition, it also summarizes the three principles of safety, coordination and naturalness for outdoor symbiotic environment design and its freestanding and the distributed layouts. The relevant results and viewpoints will provide some reference and methodological guidance for the engineering design of this type of outdoor symbiotic environment.

However, the design of symbiotic environment for nursing homes and kindergartens, as a new model of social service, has some shortcomings. Elderly people and young children have big differences in their behaviors and interests. For example, the elderly may have mobility problems and poor eyesight, while children are active and prone to accidents. Elderly people may need a quiet environment for rest and recreation, while children need an open space for play and learning. Thus, how to satisfy both needs in the same limited environment while ensuring safety is an important issue. Meanwhile, the management mode and service content of nursing homes and kindergartens are quite different. For example, nursing homes need to provide medical services and life care, while kindergartens need to provide educational and recreational services. As a result, it is a challenge to realize effective management and services in the same environment. By continuously exploring and improving the design of symbiotic environments for nursing homes and kindergartens, we believe that in the future we can find better ways to highlight the advantages of this design while solving its problems.

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