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Research on Optimization Strategies for Outdoor Activity Spaces in Old Residential Communities Based on the Interaction Behaviors of the Elderly

— A Case Study of the Residential Community at Tsinghua University

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Abstract: With the continuous population aging in China, increasing attention has been paid to a series of aging-related social issues. These concerns extend beyond basic living security for the elderly to include the fulfillment of their psychological needs. Outdoor activity spaces in residential communities serve as the primary venues for daily social interaction among older adults. Although elderly residents frequently engage in outdoor activities, the spaces available for leisure and social interaction are relatively limited. Most older adults perceive these spaces merely as places for rest rather than as emotionally meaningful environments that foster a sense of belonging. Based on established theories such as communication and spatial theory, place theory, behavior theory, and environmental psychology of aging, this study combines field investigations and observations conducted in the residential community of Tsinghua University in Beijing. Through methods including on-site surveys, behavioral observations, and interviews, the research explores the spatial preferences and patterns of aggregation associated with different types of interaction behaviors among older adults. It further summarizes the relationship between elderly social interaction activities in community public spaces and the spatial elements and characteristics of their settings. Ultimately, this study seeks to propose optimization strategies for outdoor activity spaces in residential communities that can better meet the psychological needs of elderly social interaction, thereby helping to construct socially engaging environments with a strong sense of belonging and fostering a positive neighborhood atmosphere.

1. Introduction

Against the backdrop of rapid urbanization and population aging in China, the quality of older adults' living environments has become a significant social concern. Outdoor spaces in residential communities, as primary settings for daily activities, not only support mobility, rest, and social interaction, but also serve as key carriers of social relationships, emotional identity, and psychological well-being [1]. High-quality spaces can promote interaction, reduce loneliness, and enhance well-being and belonging, making the construction of age-friendly environments a critical issue in urban planning and architecture.

This study focuses on the relationship between elderly interaction behaviors and outdoor spatial environments in residential communities. It draws on interdisciplinary theories, including communication and spatial theory, place theory, behavior setting theory, and environmental psychology of aging. In Life Between Buildings, Danish architect Jan Gehl classifies social activities into necessary, optional, and social activities, highlighting the relationship between activity types and spatial environments [1]. Place theory further emphasizes spatial meaning: Christian Norberg-Schulz's concept of genius loci links space to orientation and identification [2], while Yi-Fu Tuan associates sense of belonging with these same processes [3]. Roger Barker's behavior setting theory reveals stable relationships between behavior patterns and environmental settings [4], and environmental psychology of aging shows that physiological, cognitive, and social changes influence spatial preferences. Together, these perspectives provide a foundation for understanding elderly behavior in space.

For empirical analysis, the study considers factors such as the proportion of elderly residents, group composition, activity space types, and facility provision. The sample includes older adults aged 60 to over 80 with diverse living arrangements, ensuring representativeness [5]. The selected community offers varied outdoor spaces and relatively complete medical and care facilities. Combining theoretical analysis with field observation, the study examines the distribution and characteristics of elderly interaction behaviors across spatial types and proposes optimization strategies for residential outdoor spaces, contributing to age-friendly community development [6].

The paper is structured as follows: Chapter 1 presents case selection and methods; Chapter 2 classifies elderly interaction behaviors and spaces; Chapter 3 reports interview findings; Chapter 4 analyzes spatiotemporal characteristics and mechanisms; and Chapter 5 proposes optimization strategies for outdoor spaces.

2. Study Area Selection and Methodology

Based on the above selection criteria and field investigations of residential communities in Haidian and Xicheng Districts of Beijing, this study selects the Tsinghua University residential community in Haidian District as the case study. As a typical university-affiliated community, it has a relatively high proportion of older adults and stable living patterns, making it representative.

The study area is defined as a 500-meter walking radius centered on Xinlinyuan, corresponding to approximately a ten-minute walk for older adults. (Fig. 1) It includes faculty housing, key outdoor activity spaces, and a senior activity center, with well-developed surrounding facilities that support daily life and social interaction.

Figure 1: Location Map

This study adopts field investigation methods to explore the relationship between elderly interaction behaviors and outdoor activity spaces in the Tsinghua University residential community. The main research methods include:

(1) On-site surveys

Through on-site investigation of outdoor activity spaces within the community, the study identifies different spatial types and summarizes their components and characteristics.

(2) Behavioral observation

Observations were conducted to record the spatial choices of different interaction behaviors among older adults across various outdoor environments. The observation periods were 7:00–9:00, 9:00–11:00, 13:00–15:00, 15:00–17:00, and 17:00–19:00.

(3) Interviews

Behavioral observation serves as the primary method, supplemented by interviews. Considering the limited receptiveness of older adults to unfamiliar interview settings, a “short, repeated contact” interview approach was adopted. A total of 14 elderly residents were interviewed, and the results were cross-validated with observed behaviors and duration of stay. In addition, informal inquiries were conducted with regular users to collect subjective evaluations of spatial comfort and facility satisfaction.

3. Survey of Elderly Interaction Behaviors and Outdoor Activity Space Types

3.1 Survey of Types of Elderly Interaction Behaviors

3.1.1 Social Interaction Activities

Social interaction activities refer to those in which older adults engage in the same activity together, such as square dancing, practicing tai chi, playing cards, and playing chess. These activities are typically characterized by a relatively large group size and tend to occur in fixed locations. Based on the physical demands involved in participation in social interaction activities, they can be classified into the following two categories:

(1) Dynamic social interaction activities

Group-based physical activities such as square dancing, table tennis, and tai chi typically occur during morning exercise periods. (Fig. 2)

(2) Static social interaction activities

Leisure-based activities such as chess and card games mainly take place in the afternoon. (Fig. 3)

Figure 2: Physically active older adults

Figure 3: Chess-playing older adults

In such social interaction activities, the lively and enjoyable atmosphere often exerts an attractive effect on passing older adults, encouraging them to stop, observe, and join static cultural and sports activity spaces. This process further facilitates the formation of concentrated group activities and close interpersonal interactions among older residents, thereby strengthening neighborhood-based social engagement. Spaces where such activities repeatedly occur are also more likely to develop into specific places where particular groups gather at regular times.

3.1.2 Verbal Interaction Activities

(1) Sitting and chatting

This type of verbal interaction activity among older adults, including gatherings, conversations, and casual chatting, mainly occurs in the afternoon leisure period. Participants are predominantly female.

Spatially, these activities tend to take place in environments with high-quality settings and comfortable seating, such as seating areas adjacent to rich green landscapes in leisure spaces, or sun-exposed seating areas within multifunctional activity spaces. (Fig. 4) These settings allow older adults to enjoy sunlight while engaging in verbal social interaction.

(2) Spontaneous face-to-face conversations

Face-to-face interactions among older adults are observed to be relatively random and routine in nature. Such activities are widely distributed across various types of outdoor activity spaces. (Fig. 5)

Figure 4: Older adults sitting and chatting

Figure 5: Older adults in face-to-face conversations

3.1.3 Passive Visual and Auditory Interaction Activities

Passive visual and auditory interaction activity refers to a form of social contact in which individuals primarily obtain information in public spaces through watching or listening, without

direct participation in interaction. It is typically associated with an audience role and is characterized by low engagement and low social pressure.

For older adults, due to physical limitations or personal preferences, some tend to adopt this mode of activity. By observing surrounding people and events, they maintain a connection with the external environment and gain psychological satisfaction and a sense of social presence. Field observations show that this behavior is highly context-dependent and is often triggered by attractive activity scenes that prompt spontaneous stopping and watching. (Fig. 6, Fig. 7)

Participants are mainly older adults accompanying grandchildren, those with mobility impairments, and the oldest-old. They usually stay at the edges of activity spaces and participate in public life in an observational manner.

Figure 6 (left): Observation of Elderly People Playing Table Tennis

Figure 7 (right): Observation of Elderly People Engaging in Fitness Activities

3.2 Survey of Outdoor Activity Space Types for Older Adults

(1) Multifunctional Activity Space

The multifunctional activity space within the residential community is located in an open area at the center of the neighborhood. (Fig. 8) Its spatial components include a public activity plaza, seating areas, fitness equipment, and recreational tables and chairs. The site provides relatively abundant shading within the space.

(2) Sports Activity Space

The sports activity space within the residential community is located in the southern part of the neighborhood, adjacent to the staff canteen. (Fig.9) Its spatial components include a public activity plaza, seating areas, and fitness equipment. The site is relatively open and receives ample sunlight.

(3) Green Leisure Plaza Space

The green leisure plaza within the residential community is located in the inner central area, surrounded by residential buildings. (Fig.10) Its spatial components include pavilions, seating areas, and fitness equipment. The site provides relatively abundant shading.

(4) Campus Front Plaza Space

The residential community contains a primary school and a kindergarten located in the southern part of the site. (Fig. 11) The space includes seating areas and fitness equipment. It is relatively open and receives ample sunlight.

Figure 8 (left): Location of the Multifunctional Activity Space

Figure 9 (right): Location of the Sports Activity Space

Figure 10 (left): Location of the Green Leisure Plaza Space

Figure 11 (right): Location of the Campus Front Plaza Space

4. Subjective Analysis of Spatial Elements and Social Interaction in Older Adults

Based on interviews with 14 elderly residents and informal inquiries conducted among regular users, this study further analyzes the spatial requirements corresponding to different interaction behaviors from the perspective of users' subjective perceptions. These subjective evaluations primarily reflect older adults' experiential understanding of the spatial environment and help reveal the environmental and psychological mechanisms underlying behavioral choices. (Table 1)

4.1 Spatial Perception Characteristics of Interaction Behaviors

Respondents generally indicated that, in dynamic activities such as square dancing, tai chi, and group exercise, sufficient spatial scale directly affects participation willingness. These group-based activities require adequate space for movement; insufficient space during peak periods may cause interference and safety concerns, reducing participation. Therefore, older adults prefer larger, clearly bounded hard-surfaced areas. This suggests that spatial scale and openness are fundamental conditions for sustaining group activities.

Participants also noted the lack of storage space for personal belongings such as clothing and water bottles, which are often placed on the ground or equipment, affecting convenience and order. Although not a determining factor for participation, such facilities influence the overall activity experience.

In terms of environmental conditions, respondents emphasized the importance of shading.

Natural shade from trees is considered more comfortable and helps extend outdoor activity duration, indicating that microclimatic conditions significantly affect the continuity of dynamic social activities.

4.2 Spatial Perception Characteristics of Verbal Interaction Activities

For daily chatting and informal communication, older adults generally prefer seating locations with ample sunlight and vegetated or solid back support. On the one hand, sunlight satisfies physiological needs such as sun exposure; on the other hand, vegetation or physical edges provide a sense of psychological security and spatial enclosure in open environments. This indicates that environmental comfort and perceived safety are key prerequisites for verbal interaction.

Regarding resting facilities, evaluations of seating primarily focus on comfort and stability, such as structural firmness and thermal comfort in winter. This suggests that the ergonomic quality of seating directly affects the duration and frequency of verbal interactions. Insufficient comfort often leads to shorter stays and, consequently, shallower levels of communication.

4.3 Spatial Perception Characteristics of Passive Visual and Auditory Interaction Activities

Table 1: Spatial Elements and Interaction Behaviors from Older Adults' Subjective Perception.

Behaviors Type		Older Adults' Subjective Concerns	Spatial Preference Characteristics	Key Spatial Elements	Mechanism of Behavioral Influence
Social Interaction Activities	Dynamic Social Interaction Activities	Spaciousness and safety; shading; resting and storage facilities	Large-scale hard surface; spatial enclosure; surrounding tree shade	Spatial Scale; Green Shading; Edge Seating Facilities; Storage Facilities	Safe spacing and order; improved participation stability and duration
	Static Social Interaction Activities	Quietness; spatial enclosure and support; seating comfort and stability	Greenery-Adjacent Space	Semi-enclosure; vegetation screening; seating comfort	Extended stay; stable activity node formation
Verbal Interaction Activities		Sun exposure; psychological safety; moderate openness	Sun-facing orientation; vegetated or solid backing; semi-open spatial condition	Solar exposure conditions; rear boundary interface	Enhanced comfort and interaction willingness
Passive Visual and Auditory Interaction Activities		Non-disturbance to others; safety support; availability of observable content	Spatial edge; solid or vegetated backing; facing activity area	Edge location; rear interface; observable scene	Extended stay; low social pressure

Several oldest-old participants reported that having a wall or vegetation as back support provides a stronger sense of security and increases their willingness to stay, indicating that spatial enclosure and boundary support serve as important psychological foundations for passive forms of social interaction.

In addition, some respondents noted that they are more likely to stop and observe when

children's activities or lively scenes are present nearby. This suggests that the diversity of observable elements and the perceived vitality of the environment are key external factors attracting passive visual and auditory activities.

5. Spatiotemporal Analysis of Elderly Interaction Behaviors and Their Outdoor Spatial Types

From the perspective of place theory, space is not merely a container for behavior, but a meaningful structure that carries emotional projection and identity recognition. [7] The sense of belonging among older adults is not an abstract psychological phenomenon; rather, it emerges through a process of place-making that evolves from "spatial elements-behavioral patterns-social interaction-emotional sedimentation." [8] The following section analyzes the spatiotemporal characteristics of different types of elderly interaction behaviors and their corresponding outdoor activity spaces, and summarizes the relationships between these behaviors and key spatial elements across various activity settings.

5.1 Relationship between Elderly Interaction Behaviors and Multifunctional Activity Spaces

Based on observations and analysis of elderly cultural and sports social interaction activities in multifunctional activity spaces, these activities mainly occur during 7:00–9:00, 9:00–11:00 in the morning, and 15:00–17:00 in the afternoon. The morning periods are dominated by dynamic activities such as morning exercise, group calisthenics, and tai chi, which are mainly concentrated in the central open areas of the multifunctional space, typically equipped with seating and other supporting facilities. The afternoon period is mainly characterized by static activities such as chess and card games, which are primarily distributed in areas equipped with game tables, seating, and shading facilities.

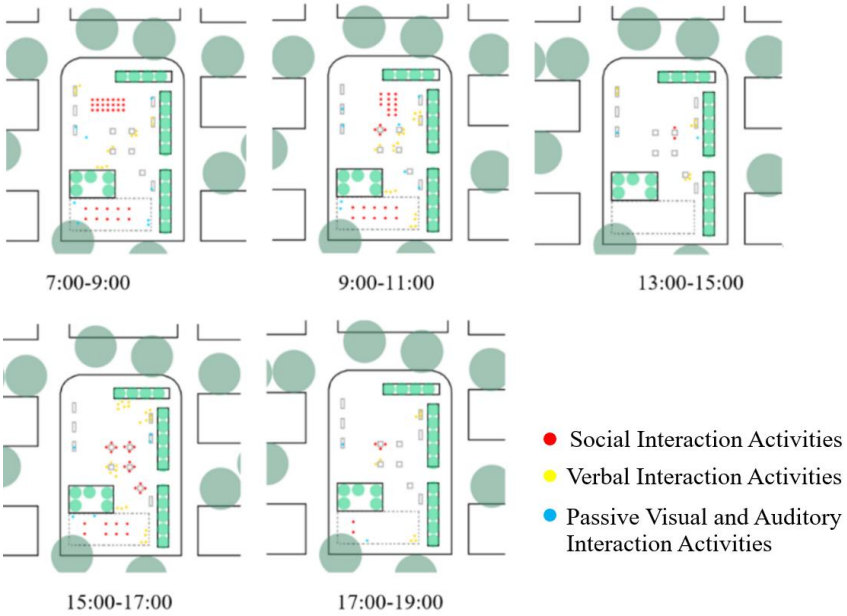


Figure 12: Diagram of the Relationship between Elderly Interaction Behaviors and Multifunctional Activity Spaces

Through observation and analysis, it is found that these activities mainly occur during 9:00–11:00 in the morning and 15:00–17:00 in the afternoon, largely overlapping with the time periods of cultural and sports social interaction activities. Verbal social interaction represents a basic form of social engagement among older adults. It is mainly distributed in seating areas along the edges of

multifunctional activity spaces and also frequently occurs during the rest periods of cultural and sports activities.

Through observation and analysis, these activities occur less frequently within multifunctional activity spaces and are mainly concentrated during 9:00–11:00 in the morning and 15:00–17:00 in the afternoon. Their occurrence shows a positive correlation with overall occupancy in the space. They are primarily distributed at the outer edges of the multifunctional activity area, typically manifested as observation of other participants, and may often evolve into verbal social interaction. (Fig. 12)

5.2 Relationship between Elderly Interaction Behaviors and Sport Activity Spaces

Based on observation and analysis of elderly cultural and sports social interaction activities in the sports activity space, these activities mainly occur during 7:00–9:00, 9:00–11:00 in the morning, and 15:00–17:00 in the afternoon. Morning activities primarily involve exercise around fitness equipment in the surrounding area, while afternoon activities mainly center on the table tennis area. Located under tree shade, this site attracts a larger number of older adults in the afternoon for table tennis activities.

Based on recorded analysis of verbal interaction activities among older adults in the sports activity space, these activities mainly occur during 7:00–9:00 in the morning and 13:00–15:00 in the afternoon, showing a high degree of temporal consistency with active social activities. In the sports activity space, verbal interactions among older adults are more concentrated in seating areas and typically take place during intervals between physical activities.

Based on observation and analysis of passive visual and auditory interaction activities among older adults in the sports activity space, these activities also show a high degree of temporal consistency with active social interaction activities, mainly occurring during 9:00–11:00 in the morning and 15:00–17:00 in the afternoon. They are primarily distributed around the table tennis area. (Fig. 13)

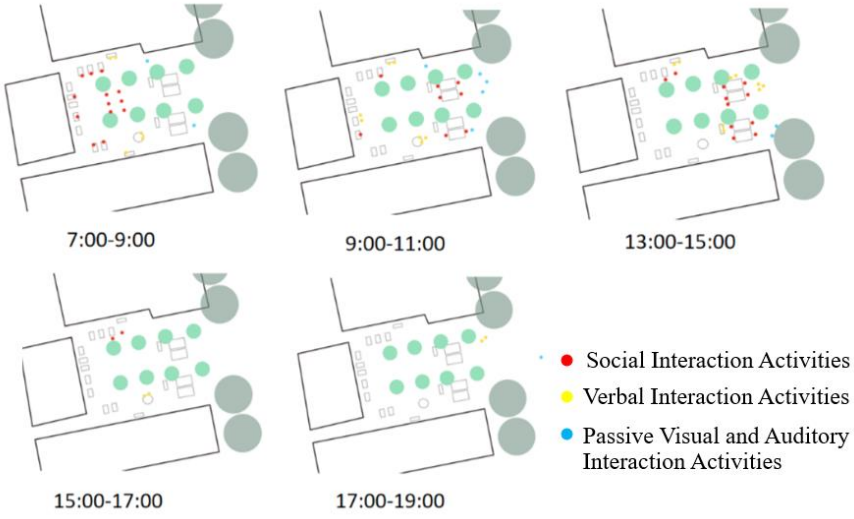


Figure 13: Diagram of the Relationship between Elderly Interaction Behaviors and Sport Activity Spaces

5.3 Relationship between Elderly Interaction Behaviors and Green Leisure Plaza Spaces

Based on observation and analysis of elderly cultural and sports social interaction activities in the green leisure plaza, these activities mainly occur during 7:00–9:00 in the morning. The

dominant dynamic activity is tai chi, which is primarily carried out in the open central area of the plaza. Users of this space are mostly older adults living in the surrounding residential buildings, and the overall number of participants is relatively small.

Based on observation and analysis of verbal interaction activities among older adults in the green leisure plaza, these activities mainly occur during 9:00–11:00 in the morning. They are distributed around seating areas and pavilions, and older adults' length of stay in this area is relatively short.

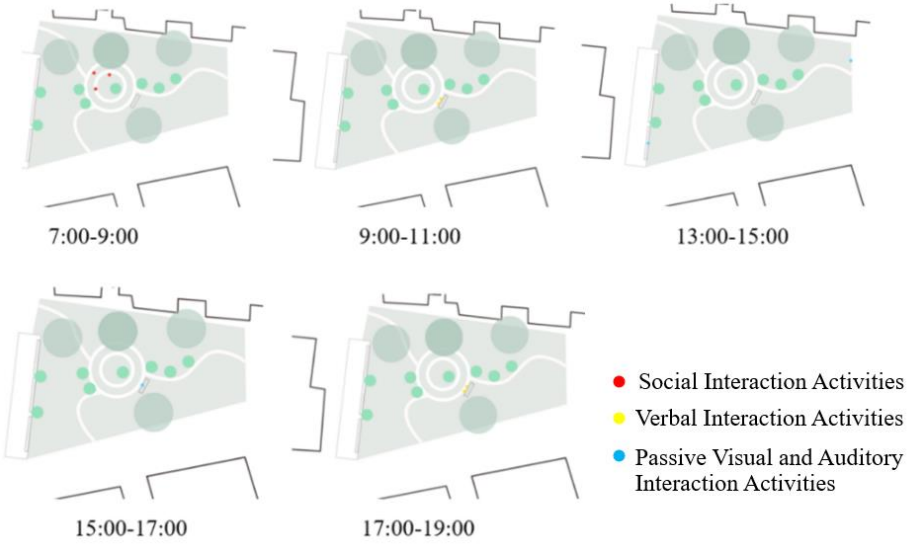


Figure 14: Diagram of the Relationship between Elderly Interaction Behaviors and Green Leisure Plaza Spaces

Based on observation and analysis of passive visual and auditory interaction activities among older adults in the green leisure plaza, these activities mainly occur during 13:00–15:00 and 15:00–17:00 in the afternoon. They are distributed in seating areas around the space, where older adults primarily remain seated and engage in passive observation. (Fig.14)

5.4 Relationship between Elderly Interaction Behaviors and Campus Front Plaza Spaces

Based on observation and analysis of elderly cultural and sports social interaction activities in the campus front plaza, these activities mainly occur during 7:00–9:00 in the morning. They are primarily distributed in the southern area of the plaza, where fitness equipment and seating facilities are located, with activities mainly consisting of individual exercise on fitness equipment.

Based on observation and analysis of verbal interaction activities among older adults in the campus front plaza, these activities mainly occur during 15:00–17:00 and 17:00–19:00. The area includes a kindergarten within the residential community, and the timing of these interactions generally coincides with grandchildren's dismissal time. Some older adults arrive earlier to engage in conversations with other older adults who are also caregivers.

Based on observation and analysis of passive visual and auditory interaction activities among older adults in the campus front plaza, such activities are relatively limited in this area, with temporal distribution consistent with that of verbal interaction activities. Analysis shows that older adults engaged in passive observation are mainly located at the edges of the plaza, and when communication intention arises, these interactions are often quickly transformed into verbal social interactions. (Fig. 15)

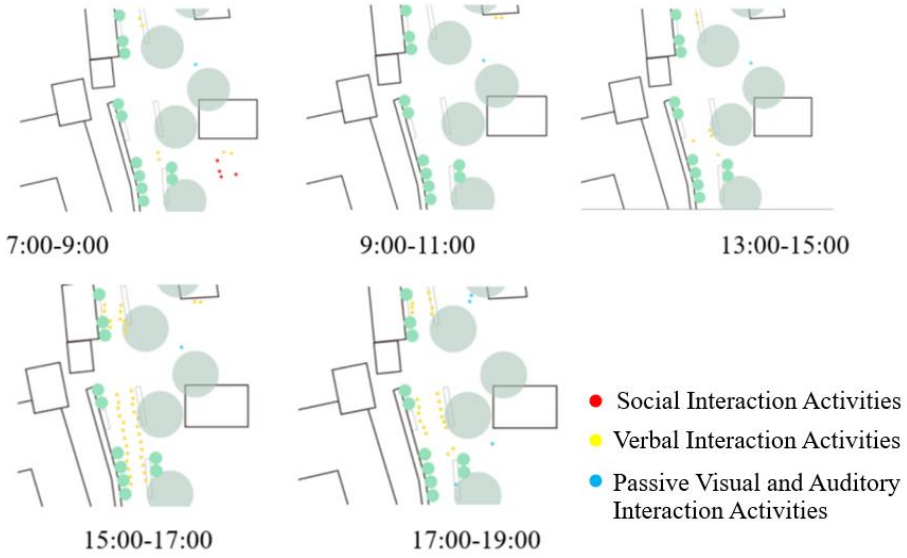


Figure 15: Diagram of the Relationship between Elderly Interaction Behaviors and Campus Front Plaza Spaces

5.5 Summary of the Correspondence between Spatial Elements and Elderly Interaction Behaviors across Different Types of Spaces

A comprehensive analysis shows that elderly interaction behaviors are not random but are closely associated with specific spatial elements. (Table 2)

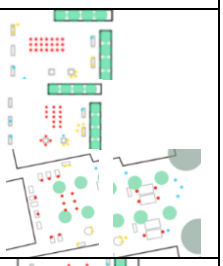
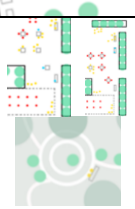
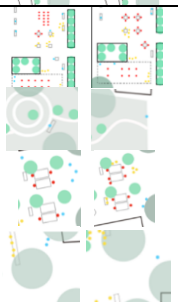
Dynamic activities depend on large-scale hardscape, shading, and peripheral seating, which ensure safe group spaces and reinforce familiar social networks, fostering collective place identity.Static activities tend to occur in smaller, semi-enclosed spaces with fixed facilities, supporting longer stays and deeper communication, and gradually forming stable spatial nodes.

Verbal interactions are more likely to take place in sunlit, greenery-adjacent seating areas with face-to-face arrangements, where comfortable human-scale settings reduce communication barriers and often overlap with other activities, enhancing everyday place attachment.

Passive visual and auditory activities prefer edge locations with solid backing and views toward activity areas, providing safety and observational engagement without direct participation. Overall, spatial elements shape behavioral patterns and contribute to the formation of place attachment and identity among older adults.

In addition, different types of spaces accommodate varying patterns of elderly social interaction. Multifunctional activity spaces, due to their long-term support of group activities, provide highly predictable social settings and gradually transform into places of familiar social networks, making them the most conducive to the formation of a sense of belonging. [8] In contrast, green leisure plazas primarily serve short-term stays, with more dispersed activities and limited accumulation of social relationships, resulting in a relatively weaker sense of place identity. Campus front plazas, shaped by the recurring routine of picking up and dropping off grandchildren, become associated with familial roles and exhibit characteristics of role-based places.

Table 2: Relationship between Elderly Interaction Behaviors and Spatial Elements of Spaces

Behaviors Type	Peak Time	Peak Activity Space	Spatial Distribution Diagram	Key Spatial Elements	Mechanism of Behavioral Influence
Social Interaction Activities	7:00-9:00	Open space (green leisure plaza space)		Large-scale hardscape; fitness equipment; recreational tables and seating; surrounding resting seats; tree shading	Provides safe activity space and interactive equipment and resting facilities, enhancing the stability of group gatherings
		Near fitness equipment (campus front plaza space)			
	7:00-11:00	Open space (multifunctional activity space); near fitness equipment (sports activity space)			
	15:00-17:00	Near tables and seating (multifunctional activity space); near fitness equipment (sports activity space)			
Verbal Interaction Activities	9:00-11:00	Edge seating (multifunctional and sports activity space); seating and pavilions (green leisure plaza space)		Adjacent to social activity areas; equipped with seating	Provides resting facilities around group cultural and sports activities enhances comfort, reduces social barriers, and encourages interaction
	15:00-17:00	Edge seating (sports activity space); open and seating areas (campus front plaza space)			
	15:00-19:00	Open space and seating areas (campus front plaza space)			
Passive Visual and Auditory Interaction Activities	9:00-11:00 13:00-17:00	Outermost areas (multifunctional activity space); near fitness equipment (sports activity space); seating (green leisure plaza space); edges (campus front plaza space)		Seating with solid backing; facing activity area; edge location; tree shading	Provides psychological security; observational vantage; low-engagement participation; maintained social connection

6. Optimization Strategies for Outdoor Activity Spaces in Old Residential Communities Based on Elderly Interaction Behaviors

Previous findings indicate that older adults' sense of belonging in residential outdoor spaces is a

place-making process gradually formed through the repeated occurrence of interaction behaviors and the continuous accumulation of social interactions, supported by specific spatial elements. The key to optimizing outdoor spaces in aging residential communities is not merely the addition of facilities, but rather enhancing the capacity of spaces to support different types of interaction behaviors. This enables behaviors to be stably and repeatedly performed within the same space, thereby facilitating the accumulation of social relationships and the formation of place identity.

6.1 Spatial Optimization Strategies for Interaction Behaviors

6.1.1 Identified Problems

Behavioral observations and interview results indicate that group-based dynamic cultural and sports activities are highly sensitive to spatial scale and boundary integrity. During peak periods, insufficient space may lead to interference and safety concerns, thereby reducing participation stability. In addition, the lack of accessible edge interfaces in activity spaces limits opportunities for lingering, short-term stays, and interaction, while insufficient shading further restricts activity duration. The absence of designated storage areas for personal belongings also affects spatial order and continuity of user experience. Although these issues do not completely prevent activities from occurring, they weaken long-term co-presence within the same space and are not conducive to the stable formation of familiar social networks.

6.1.2 Spatial Optimization Strategies

(1) Integrating and forming a well-scaled group activity space

By improving pavement continuity and reducing fragmented obstacles, a hardscape activity area with clear boundaries and appropriate scale can be established. Clearly defined spatial edges help form stable behavioral order and predictable user density, thereby strengthening the social function of the space.

(2) Creating activity edge zones with resting functions

Continuous seating, low walls, hedges, or supportive interfaces are arranged along the periphery to form transitional spaces for viewing, resting, and communication. This enables users with different levels of participation to remain in the space, providing a spatial basis for repeated social interactions.

(3) Improving tree shading systems

Microclimatic conditions are enhanced through combined tree and shrub planting to extend activity duration. Longer dwelling times increase interaction frequency, facilitating the accumulation of social relationships within specific spaces.

(4) Adding edge storage facilities

Fixed storage platforms or wall-adjacent ledges are introduced to improve the completeness of user experience and support everyday use of the space.

6.2 Spatial Optimization Strategies for Verbal Interaction Activities

6.2.1 Identified Problems

The study finds that older adults prefer spaces with a certain degree of enclosure, proximity to vegetation, and adequate sunlight. However, existing sites are often highly open and lack clear psychological boundaries. In addition, insufficient seating comfort limits the duration of stay, resulting in verbal interactions that are short-term and fluid, making it difficult to form stable neighborhood interaction nodes.

6.2.2 Spatial Optimization Strategies

(1) Establishing semi-enclosed interaction nodes

At path intersections and along green space edges, small-scale social spaces are formed through vegetation, low walls, or pergolas. The semi-enclosed structure provides a sense of boundary within an open environment, giving the space a clear capacity for lingering.

(2) Improving ergonomic performance and layout of seating

Seating with backrests and armrests is adopted and arranged in face-to-face or L-shaped configurations to facilitate stable communication. Enhanced comfort helps extend dwelling time, enabling the space to function as a site for repeated social interaction.

(3) Creating interaction environments with both sunlight and shade

Within the same area, seating options with both sun exposure and shade are provided to adapt to seasonal changes and improve long-term usability of the space.

6.3 Spatial Optimization Strategies for Passive Visual and Auditory Interaction Activities

6.3.1 Identified Problems

Older adults of advanced age or with limited mobility tend to adopt edge-based lingering behaviors. However, existing spaces lack supportive boundary interfaces, while insufficient diversity of observable activities reduces their willingness to stay. In addition, the absence of barrier-free access further restricts spatial accessibility.

6.3.2 Spatial Optimization Strategies

(1) Establishing supported observational spaces

Seating is arranged along activity edges with solid or vegetated back support and oriented toward activity areas. This spatial configuration meets safety needs and allows low-engagement users to remain continuously within public life scenes.

(2) Enhancing spatial observability

By strengthening visual connections between children’s activity areas and fitness activities, the vitality and dynamism of the environment are enhanced, encouraging passive visual and auditory engagement.

(3) Establishing a continuous resting network

Barrier-free facilities along circulation paths are improved to enhance accessibility for individuals with limited mobility, enabling sustained participation in community public life.

6.4 An Overall Spatial Strategy Oriented Towards Place Identity

The comprehensive analysis indicates that place identity is formed through the stable repetition of behaviors and the long-term accumulation of social relations. [9] Accordingly, spatial optimization should prioritize maintaining the stability of site form and facilities, avoiding frequent changes in activity layouts; constructing a multi-level interaction network extending from central activity spaces to neighborhood corners; and preserving existing trees and familiar spatial markers to sustain continuity of memory. Through these strategies, space can be transformed from a functional environment into a lived place with emotional significance.

6.5 Conclusion

In conclusion, optimizing residential outdoor spaces for older adults involves creating

environments that support stable and repeated social interactions. By addressing spatial issues such as scale, boundaries, seating comfort, and accessibility, we can enhance the social functions of these spaces, fostering stronger place identity and long-term social bonds. Strategies like improving activity areas, creating resting zones, ensuring appropriate shading, and incorporating barrier-free design are key to facilitating meaningful engagement. Ultimately, the goal is to transform functional spaces into places that offer both social connectivity and emotional significance for older residents.

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