Design Paradigm of Dual-Dimensional Renewal for Old Residential Communities Guided by Active Aging

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Abstract: Against the dual background of a deeply aging society and urban renewal, the basic aging-adaptation renovation of traditional old residential communities can no longer meet the higher-level needs of older adults for health, participation, and security. Taking the concept of active aging as the core, this paper proposes that the renewal of old residential communities should undergo a paradigm shift from passive environmental adaptation to active vitality activation. It first analyzes the research background. It then constructs a theoretical framework for renewal that integrates spatial creation and social activation, systematically elaborating on the design paradigm of dual-dimensional renewal. Ultimately, this paper aims to provide an integrated design strategy with both theoretical foresight and practical operability, transcending patchwork aging-adaptation renovation to achieve empowering community renewal.

Keywords: Active Aging; Old Residential Communities; Dual-Dimensional Renewal; Design Paradigm

1. Introduction

At present, China has entered a deeply aging society, presenting a complex situation marked by advanced age, empty nesting, and declining birth rates. Meanwhile, urban development models are shifting from incremental expansion to stock renewal. A large number of old residential communities built in the 1980s and 1990s have become the main battleground for urban renewal. The proportion of elderly residents in these communities is often significantly higher than in newly built ones, making old residential communities the most concentrated spatial carriers of urban elderly care pressure.

The renovation of old residential communities is both a livelihood project and a development project, representing a win-win endeavor that benefits the country and its people [1]. In recent years, the central government has frequently introduced policies to promote the renovation of old residential communities. With the end of the shantytown reconstruction model characterized by large-scale demolition and construction, the traditional approach of "demolish and rebuild" has become unsustainable. Currently, most cities in China have gradually formed a pattern where new and old urban areas coexist [2]. However, the increasingly diverse needs of older adults for health promotion, social participation, and value realization have not yet received systematic responses within existing renovation frameworks. The core logic of aging-adaptation renovation is to eliminate environmental barriers so that older adults can live safely. The underlying premise of this logic is to view older adults as a group in need of care and experiencing functional decline, with the task of environmental design being to compensate for their declining physical functions.

However, active aging theory fundamentally challenges this view. Aging is not only a physiological process but also a social process. Older adults are not merely recipients of services but also participants and contributors to community life. In 2002, the World Health Organization formally proposed the active aging policy framework, emphasizing the three pillars of health, participation, and security to support older adults in continuing to realize their potential and life value. Based on this, this paper summarizes the overall goal of renewing old residential communities as creating a living community that is safe and convenient in space, attractive in environment, and closely supportive and vibrant in social relationships. This goal treats environmental quality and social relationships as two sides of the same coin, ensuring that renewal is no longer limited to engineering improvements but returns to the essence of life.

2. Research Background

2.1 The Connotation of Active Aging

Active aging theory represents the international community's response to proactively addressing population aging. In 1997, the G7 Summit in Denver first proposed the concept of active aging. In 1999, the World Health Organization launched the Global Movement for Active Aging. In 2002, the Second United Nations World Assembly on Ageing formally adopted the Active Aging Policy Framework submitted by the World Health Organization, promoting it globally. The purpose of active aging is not to define the truth of aging but to reveal more possible worlds [3]. Active aging is not a simple replacement of concepts such as successful aging or healthy aging but represents a fundamental shift in perspective. Its core lies in viewing older adults as subjects of development rather than burdens, emphasizing that society should create conditions for older adults to continue participating in economic, social, cultural, and civic affairs. Active aging is based on a capability-based perspective, arguing that aging does not necessarily lead to diminished capacity. Assessing a person's abilities solely based on age is not objective. Older adults remain important resources for families and society, playing irreplaceable roles in production and daily life.

Active aging establishes a complete and operational policy framework based on the three pillars of health, participation, and security. At the same time, active aging is not merely a policy tool for addressing population aging. It also signifies a transformation in aging-related work from a traditional survival-based model to a development-oriented governance model, shifting from problem solving to value creation. It emphasizes the intrinsic motivation and subjective initiative of older adults, viewing aging as a period of active participation in work, family, society, and political life rather than a stage of passively waiting for care. In the Chinese context, this concept aligns with the six goals of ensuring security, medical care, contribution, learning, education, and enjoyment for older adults. It provides theoretical support and cultural confidence for developing a proactive aging strategy with Chinese characteristics.

2.2 Paradigm Limitations of Old Residential Community Renovation

Objectively speaking, practical experience in aging-adaptation renovation of old residential communities over the past decade has accumulated certain insights. However, there remains a lack of clarity across society regarding the livelihood significance and attribute positioning of old residential community renewal. Old residential community renewal still faces various challenges such as supply-demand mismatches, weak implementation, and governance ineffectiveness, making the paradigm limitations increasingly evident.

(1) Narrowing of design goals and fragmentation of objects

In current discussions on aging-adaptation renovation of old residential communities, safety has been elevated to the highest or even sole criterion. While this approach is rooted in deep concern for the physical vulnerability of older adults, it inadvertently narrows the value dimension of renovation. An environment that is completely flat and eliminates all elevation differences may reduce the risk of falls from a physical perspective. However, from the perspective of daily life, it may also become monotonous and lack the inviting quality that spaces should have due to the absence of necessary spatial layering and subtle challenges. The life world of older adults is not solely about safety. They also long for the warmth of social interaction, the pleasure of leisure activities, and the dignity of self-fulfillment. Behind this narrowing of goals lies a cognitive bias that equates being aging-adapted with being care-oriented. While being protected, older adults are also deprived of the opportunity for deep interaction with space.

Current aging-adaptation renovation of old residential communities often exhibits distinct point-based characteristics. Renovation work is broken down into individual tasks of adding facilities. Although this patchwork approach can quickly address certain visible problems in the short term, it lacks overall consideration of the community public space system. The daily life of older adults does not consist of isolated points but forms a continuous trajectory, with each outing representing a complete experience of a spatial sequence. However, renovations based on point-based thinking often fail to achieve comprehensive results. The continuity of travel, diversity of activities, and richness of experience

for older adults are difficult to systematically address through such fragmented interventions. The deeper issue is that the fragmentation of spatial systems actually reflects the fragmentation of cognitive systems. Renovators fail to view the community as an organic living entity, instead treating it as a mechanical device in need of repair.

(2) Closed design processes and lack of sustainability

For a long time, aging-adaptation renovation of old residential communities has followed a highly standardized path. Government departments act as clients, contracting renovation tasks to professional institutions, which then complete the entire process of survey, design, and construction. In this process, older residents, as the core target group, have their roles strictly limited to the preliminary research phase. Their opinions are collected through questionnaires and similar methods but struggle to penetrate technical barriers and influence solution generation and core decision-making. This top-down closed model prevents residents from participating in community building. Conventional fragmented and engineering-based renovation measures find it difficult to address renewal tasks that are comprehensive, complex, and sustainable [4].

More concerning than spatial mismatch is the fracture in the time dimension. A large number of aging-adaptation renovation projects follow a project-based operational logic, where completion of final acceptance signifies the successful conclusion of the project. However, for the community, true renewal should precisely begin at this moment. Since responsible entities and funding sources for subsequent maintenance, operation, and renewal are not clarified in the preliminary design, many carefully created aging-adapted facilities are neglected after delivery. Some originally well-designed facilities deteriorate rapidly or even become abandoned within just a few years due to the lack of sustainable operation and maintenance mechanisms. This cycle of renovation, degradation, and abandonment not only wastes public resources but also undermines residents trust and expectations regarding renewal efforts.

2.3 Spatial Demands for Old Residential Community Renewal under the Concept of Active Aging

The three pillars of health, participation, and security proposed by the WHO form the foundation of the active aging policy framework. When these three pillars are projected onto the living environment of old residential communities, they create clear demands for spatial design.

In the health dimension, the functional performance of older adults depends on their adaptation to the surrounding environment [5]. Active participation in social activities helps reduce mortality risk among older adults [6]. A healthy environment should not only avoid causing harm to older adults but also actively promote their physical and mental well-being. This means spaces should support physical activity, meeting the needs of older adults for walking and exercise. They should provide sensory stimulation such as contact with nature and changes in light, while alleviating psychological stress through quiet corners and a sense of territoriality.

In the participation dimension, social connection significantly influences the subjective well-being of older adults, ranking as the most important factor among all influences [7]. The environment should be accessible, enabling older adults to easily enter public spaces, stay there, interact with others, and have the ability to express opinions on the use and transformation of spaces. Participation refers both to the outcome of using spaces and the process of shaping them.

In the security dimension, there is a shift from a traditional needs-based perspective to a rights-based perspective [8]. The environment should provide both physical safety and social support. The former involves physical measures such as accessibility and emergency systems. The latter points to social dimensions such as neighborly relations and community identity. Participation in community governance, driven by a sense of identity, is itself a powerful form of social support.

Clarifying spatial demands under the concept of active aging inevitably requires a fundamental shift in design goals: from ensuring that older adults live safely to enabling them to live fully. In other words, the mission of renewal design should not stop at being aging-adapted but should aim to promote activation. This means using space as a medium to stimulate older adults willingness and ability to participate socially and to cultivate the co-vitality of the community. Based on this, this paper proposes a dual-dimensional collaborative renewal

paradigm of spatial creation and social activation.

3. Dual-Dimensional Collaborative Renewal of Old Residential Communities under the Concept of Active Aging

3.1 Theoretical Logic of Dual-Dimensional Collaborative Renewal

Dual-dimensional collaborative renewal systematically embeds the three pillars of active aging, health, participation, and security, into the renewal process. Health is mainly achieved through spatial creation. Participation is primarily reflected in the process of social activation. Security runs throughout the dual-dimensional process, encompassing both physical safety in the built environment and support security within social networks. These three pillars support and work together in the dynamic process of dual-dimensional renewal, collectively driving old residential communities from passive aging adaptation toward active vitality activation.

The core of dual-dimensional renewal lies in understanding the renewal of old residential communities as a process of collaborative regeneration of two types of resources: spatial capital and social capital. Spatial capital refers to the quality and configuration of the physical environment, including the accessibility of public spaces, the completeness of facilities, and the comfort of the environment. It serves as the foundation for the daily lives of older adults and the material prerequisite for social interaction. Enhancing spatial capital means using design methods to increase the inclusiveness, attractiveness, and adaptability of the environment, providing older adults with more diverse activity possibilities. Social capital is reflected in trust, reciprocity, networks, and norms among residents. It represents the internal driving force for community self-organization and sustained vitality. From the perspective of active aging, social capital is not only an important source of support for older adults but also a key medium for their participation in community affairs and realization of self-worth. If the cultivation of social capital is neglected during the renewal process, even the most exquisite spaces will struggle to avoid the fate of decline after renovation.

The dual-dimensional collaborative renewal strategy of spatial creation and social activation seeks to address a core proposition: how spatial intervention can be effectively transformed into social efficacy. Its theoretical logic is that space serves as the container for social relationships and also the catalyst for social behavior. Appropriate spatial layouts can increase opportunities for older adults to encounter, converse, and collaborate. Comfortable environmental experiences can extend outdoor stay times and enhance the intensity of social use of spaces. Conversely, poor quality and unwelcoming spaces can suppress social willingness and accelerate the decline of public life. Society is the giver of spatial meaning and the source of spatial vitality. No matter how carefully designed, without the continuous use and autonomous maintenance of residents, a space will ultimately decline. Conversely, a community with a strong sense of identity and self-governance capacity can proactively identify environmental problems, negotiate solutions, and mobilize resources to implement micro-renewals, allowing spaces to continuously radiate vitality.

Spatial creation enhances the opportunities and quality of social interaction, thereby catalyzing the accumulation of social capital. In turn, the increase in social capital drives residents to actively maintain and recreate spaces, forming a virtuous cycle. Only through the collaboration of both can the fundamental leap from aging adaptation to vitality activation be achieved. Therefore, spatial strategies and social strategies must be designed and implemented collaboratively. Space serves as the carrier, and society serves as the bond. The two are like the wings of a bird, neither dispensable. This constitutes the core meaning of dual-dimensional renewal advocated in this paper.

3.2 Dynamic Mechanism of Dual-Dimensional Collaborative Renewal

Spatial creation and social activation do not have a one-way deterministic relationship but are a collaborative process of mutual causality and reinforcement. Improved spatial quality attracts more older adults to use public spaces, increases opportunities for social interaction, and promotes the accumulation of social capital. In turn, increased social capital strengthens residents sense of identity and responsibility toward spaces, driving autonomous maintenance and continuous optimization. Once this positive cycle is formed, the community gains

endogenous momentum for self-renewal and sustained growth.

The implementation of dual-dimensional renewal requires addressing a key question: how does the internal heterogeneity of the older adult population affect the effectiveness of renewal strategies? The concept of active aging emphasizes the capability-based perspective of older adults. However, older adults at different ages, with different health conditions and life experiences, have significantly different levels of needs and participation capacities. Therefore, dual-dimensional renewal must be built on a precise understanding of the differentiated needs of the older adult population.

From the perspective of needs hierarchy, the spatial demands of older adults can be divided into three levels. Basic security needs refer to fundamental living conditions such as safety and accessibility. Social interaction needs involve social connections such as neighborly interaction and public activities. Self-fulfillment needs are reflected in higher-level spiritual pursuits such as participation in governance and value creation. These three types of needs do not follow a linear progression but coexist and interweave, with different weight distributions among different older adult groups.

From the perspective of capacity activation, dual-dimensional renewal should establish a closed-loop mechanism of needs identification, capacity cultivation, and participation empowerment. First, differentiated needs of different older adult groups are identified through participatory research. Second, using space as a carrier, older adults environmental awareness and capacity to participate in public affairs are cultivated. Finally, through empowerment mechanisms, older adults truly become the subjects of renewal. The core of this dynamic mechanism lies in the following. Spatial intervention not only responds to existing needs but also activates potential capacities. It not only solves problems but also creates possibilities.

4. Design Paradigm for Dual-Dimensional Renewal of Old Residential Communities under the Concept of Active Aging

4.1 Physical Environment Design Strategies for Promoting Vitality

Public spaces are places where interaction occurs. Transportation systems form the skeleton for daily travel. Service facilities constitute the network of life support. Together, these three elements form the spatial foundation of community life for older adults.

(1) Hierarchical and composite renewal of public activity spaces

Practice has shown that well-designed outdoor activity spaces can encourage spontaneous and social activities among residents, adding vitality to community life and creating a positive community atmosphere [9]. Traditional old residential communities often feature flat public space structures. Central squares and green spaces between buildings often have unclear functions, frequently becoming passive spaces that are visible but not usable.

The hierarchical strategy advocates constructing a three-level public space system: community level, cluster level, and unit level. Large-scale gathering functions are retained in the core square area of the community. Flexible boundary designs transform the edges of the square into active spaces where people can stay and socialize, making the core square truly the vitality magnet of the community. Moving to the spaces between buildings, design shifts toward cluster-level neighborhood living rooms. Spaces between buildings are transformed into nodes for daily interaction, with greenery creating a sense of enclosure and territoriality. For unit-level entrance areas, gray spaces such as unit porches are utilized to install small-scale message boards and shared bookshelves, turning the route home into an opportunity for neighborly greetings.

The composite strategy emphasizes the possibility of a single space accommodating multiple activities. For example, a square can serve as a Tai Chi ground in the early morning, transform into a chess and card area in the morning, become a children's play area in the afternoon, allowing older adults to meet their needs for childcare while participating in outdoor activities and promoting intergenerational interaction [10]. In the evening, it can become a movie viewing or dancing area. Design should avoid overly fixed functions, using neutral paving and other techniques to reserve flexibility for temporal overlap.

(2) Universal accessibility and experience optimization of transportation systems

Due to physiological limitations, older adults generally use neighborhood spaces more frequently, which imposes higher demands on the traffic conditions of outdoor public spaces in

communities [11]. The transportation problems in old residential communities are not only about a single step lacking a ramp but also about discontinuous accessible networks and poor walking experiences.

The universal accessibility strategy requires constructing a fully continuous accessible path from the community entrance, to the unit door, and to major activity nodes. The first step is to eliminate key breaks. Ramps should be installed wherever there is elevation change, with slopes strictly controlled within 1:12, handrails on both sides, and wheelchair turning space reserved on platforms, ensuring the full continuity of travel paths. After breaks are eliminated, parking issues need systematic attention. Reasonably designated parking spaces can reclaim pedestrian space that has been occupied, ensuring the width and continuity of walking paths. With paths made smooth, further detailed node treatment is also indispensable. Accessible access control should be installed at entrances and exits, while rest seats and canopies should be added at unit entrances to facilitate waiting and resting for older adults.

The experience optimization strategy aims to transform travel paths into vibrant corridors. Rest areas are set every 30 to 50 meters, equipped with seats and shading facilities to encourage older adults to walk and stop. Seasonal flowers and trees are planted along both sides of paths to create visual pleasure. Pavement surfaces use non-slip, sound-absorbing, and resilient materials to enhance walking comfort. Nighttime lighting balances safety and atmosphere. Main paths maintain uniform illuminance of no less than 20 lux. Leisure trails can have moderately lower illuminance with warm-colored light to create a tranquil and warm nighttime experience.

(3) Embedded and shared improvement of community service facilities

Old residential communities commonly face problems of insufficient total service facilities, uneven distribution, poor accessibility, and lack of space for expansion. Therefore, the core of the strategy lies not in constructing new large projects but in embedding and sharing.

Embedded improvement refers to implanting functions into idle or underutilized spaces within the community. Abandoned bicycle sheds can be transformed into convenience service points, integrating functions such as parcel collection and sewing repairs. Ground-floor residences that are vacated or publicly owned housing can be converted into embedded elderly care facilities, ensuring service accessibility for aging in place. Micro fitness points and horticultural therapy corners can be embedded at the edges of green spaces between buildings, aligning service facilities closely with daily activity routes.

Shared improvement advocates breaking down facility exclusivity barriers and improving utilization efficiency. Sharing is first reflected in time-based sharing. Community activity rooms are open to older adults calligraphy and painting groups during weekday daytime hours and to younger community groups in the evenings and on weekends. Time-based sharing explores potential in the temporal dimension, while functional integration adds value in the spatial dimension. Community health service stations can also serve health lecture functions. Meal assistance points can be transformed into tea break and social spaces outside meal times, allowing a single facility to support more diverse public services. The meaning of sharing can also extend from space to physical items. Establishing community tool libraries and book exchange corners, with residents borrowing, returning, and replenishing independently, not only reduces maintenance costs but also strengthens community connections through the process of resource sharing.

4.2 Participatory Renewal Mechanisms for Activating Social Capital

(1) Processes and methods for involving older residents in design

Meeting needs necessarily depends on supply. The relationship between demand and supply is a two-way interactive one, with demand determining supply [12]. When renovating and renewing old residential communities, it is essential to deeply explore the needs of older adults and explore pathways for diverse participation. Although comprehensive social participation of older adults is a common consensus in addressing population aging both domestically and internationally, in reality, the social participation rate of older adults in China is only around 22 percent [13]. Participatory design is not a one-time solicitation of opinions but a process of continuous dialogue and co-production.

The first phase is environmental cognition and problem expression. The core of this phase is to guide older adults out of their homes and

rediscover the community. Through community walk workshops, designers guide older residents to walk through all public spaces of the community, marking their favorite places, the most inconvenient places, and the places they most want to change along the way. Simultaneously, using the photo-voice method, they are asked to photograph environmental troubles in their daily lives, using images to express spatial experiences that are difficult to articulate verbally.

After fully listening to residents perceptual understanding and daily concerns, participation moves from expressing demands to co-constructing solutions, entering the second phase of solution co-construction and selection. Vision workshops can be organized for this purpose. Using a 1:100 scale community plan as a base map, movable architectural models, facility icons, and greenery symbols are provided, inviting older residents to arrange their ideal community with their own hands.

Once the plan is finalized, the chain of participation does not end but transitions into the third phase of implementation supervision and subsequent maintenance. In this phase, a resident supervision team can be established to monitor the construction process and provide timely feedback on quality issues. Simultaneously, micro-renewal workshops can be conducted. For small projects such as shared furniture, older residents are encouraged to participate hands-on in construction, enhancing their sense of ownership and achievement through practical engagement, making renewal truly their own affair.

(2) Community activity planning based on spatial carriers

Spatial renewal provides a stage for community activities, but the performances still require careful planning. Against the backdrop of implementing the national strategy to actively respond to population aging, older adults should be encouraged to actively participate in various social activities, thereby promoting the smooth realization of their re-socialization [14]. Older residents do not naturally have a willingness to participate. The reconstruction of community culture becomes a continuous driving force.

By setting up morning exercise check-in points along walking loops, assigning flower beds between buildings for older adults to adopt, and providing free tea during fixed hours in neighborhood living rooms, walking, gardening, and chatting become reasons to go downstairs and ingrained habits. Building on this foundation, festive events such as the Double Ninth Festival banquet can be held in the renovated central square. Intergenerational activities such as handicrafts can be organized to break down barriers between buildings and generations, strengthening community identity. Going further, by cultivating community mentors to guide new residents and young families, older residents can grow from activity participants into creators of community culture and core forces of self-organization.

(3) Construction of long-term co-governance management mechanisms

The positioning of community neighborhood committees in China has a particular characteristic. They simultaneously play the normative role of mass autonomous organizations and the actual role of grassroots administrative organizations, constituting the organizational nature of community neighborhood committees [15]. The sustainability of community vitality is highly dependent on the design of governance mechanisms. Addressing common problems in old residential communities such as lack of property management, low resident participation, and shortage of maintenance funds, the following mechanism recommendations are proposed.

A community environment co-governance council is established, composed of representatives of older residents. It holds regular meetings to coordinate the use of public spaces, promote the initiation of micro-renewal projects, and mediate conflicts and disputes. Concurrently, a community public space convention is formulated, clarifying usage rules, maintenance responsibilities, and prohibited behaviors. It is implemented after being voted on by the residents meeting. The convention should be concise, easy to understand, and illustrated, displayed at various activity nodes, ensuring spatial governance has clear rules and regulations to follow.

Establishing the governance structure is only the first step. For this mechanism to truly function, dual support in resources and capacity is also needed. Therefore, a community micro-renewal fund is established with diversified funding sources, including government incentives and subsidies, property fee allocations, and contributions from public revenues. The council

manages the fund in a coordinated manner, using it specifically for daily maintenance and the addition and renewal of small facilities. At the same time, regular community planning workshops are conducted, enabling residents to proactively initiate micro-renewal projects, gradually achieving a transformation from being renewed to self-renewal.

5. Conclusion and Outlook

This paper takes active aging theory as its foundation and systematically constructs a system of design strategies for renewing old residential communities, shifting from aging adaptation to vitality activation. It systematically transforms the three pillars of active aging theory, health, participation, and security, into operational principles within the field of environmental design. From macro principles to meso strategies to micro details, it forms a complete strategy chain connecting concepts, methods, and techniques.

The renewal of old residential communities is not only a physical environmental renovation project for cities but also a strategic social investment in addressing a deeply aging society. When we expand our vision from handrails and ramps to social networks and life value, renewal design gains unprecedented missions and possibilities. The shift from aging adaptation to vitality activation represents both an upgrade in design strategies and an evolution in the understanding of aging. More research and practice are expected to join this exploration, collectively working to create inclusive community environments where older adults are willing to come out, able to stay, and inspired to live vibrantly.

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