

Exploration on the Influence of Spatial Perception on Urban Residents' Well-being Under High-density Urbanism

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Abstract

Based on the background of urban stock renewal in China, this study aims to clarify the correlation mechanism between high-density urban spatial perception and residents' physical and mental health. The study integrates public data such as the Urban Construction Statistical Yearbook of the Ministry of Housing and Urban Rural Development, the research results of the China Academy of Urban Planning and Urban Rural Development on the built environment, the ledger of national urban built-environment surveys, the national mental health census, and chronic disease monitoring. Field research data from three high-density cities, Shanghai, Shenzhen, and Hong Kong, are selected as analysis samples to classify spatial perception into five dimensions: crowding, openness, privacy, accessibility to supporting facilities, and greening. Starting from physical characteristics including building layout, green space construction and street-block scale, this study analyzes how objective built environment affects residents via subjective perception, forming such influencing paths for sleep quality, chronic disease incidence and social interaction. Drawing on these findings, combined with the acceptance data of the renovation of old residential communities and pocket parks in China, this paper accordingly puts forward targeted spatial optimization strategies; existing planning schemes tend to focus on hard indicators such as plot ratio, and generally ignore the health intermediary value of spatial perception. The relevant conclusions can provide a practical basis for the formulation of district control plans and the refinement of community updates, so as to balance intensive land use and residential livability.

Keywords

High-density cities; spatial perception; residents' physical and mental health; urban built-environment survey; stock renewal.

1. Introduction

With the implementation of territorial spatial management policies, China's urban construction has abandoned the extensive outward expansion mode and shifted to stock-based intensive development. The 2023 Statistical Bulletin of the National Bureau of Statistics states that China's permanent resident urbanization rate reached 66.16%, an increase of 0.94 percentage points year-on-year. According to the 2023 environmental survey data of the China Academy of Urban Planning and Design, residential development intensity within core metropolitan clusters kept rising year by year. The central urban areas of seven mega cities have formed significant population clusters. Intensive high-density urban development eases urban land supply shortages, but early planning standards are difficult to adapt to the supporting needs brought about by rapid population agglomeration. The layout of buildings in the area is compact, and there is a persistent shortage of public activity venues and supporting green resources. Residents' living and travel experiences undergo synchronous changes.

Floor area ratio and building density are quantifiable planning parameters. Spatial perception comes from the environmental cognition accumulated by residents' daily living, commuting, and leisure activities. This subjective feeling becomes an important intermediate carrier that connects the physical built environment with the physical and mental health of residents. The Blue Book research data from the Institute of Psychology of the Chinese Academy of Sciences confirmed that the overall negative living experience of residents in high-density intensive urban development is higher than that in low-density suburban areas. Cramped living environments and inadequate leisure amenities elevate residents' psychological stress levels. The Chinese Center for Disease Control and Prevention has conducted special research on chronic diseases over the years, clarifying that living space conditions affect the probability of chronic disease incidence among the population [1].

Existing research within China's urban planning and public health fields focuses on objective indicators to complete the assessment of human settlement quality. The overall number of stratified empirical studies on subjective spatial perception is insufficient. To fill these research gaps, this article integrates multiple-city built-environment survey records from the Ministry of Housing and Urban Rural Development and household survey data from Shanghai, Shenzhen, and Hong Kong, divides them into five spatial perception dimensions, sorts out their transmission logic on physical and mental health, and uses updated examples from various regions to form optimization plans and fill in the existing empirical gaps.

2. Multidimensional composition and quantitative characteristics of high-density urban spatial perception

Based on the household surveys and built-environment survey records of Shanghai, Shenzhen, and Hong Kong over the years, the spatial experience of residents can be divided into five observation dimensions: crowded, open, private, accessible facilities, and natural greening. The spatial elements such as land use pattern, residential cluster form, and green landscape construction are interwoven and staggered, together building the overall environmental impression of the residential area by the public.

Based on the 2024 built-environment survey archive data from the Shanghai Municipal Commission of Housing and Urban Rural Development, intensive old residential construction within the inner ring is restricted by early planning, and the per capita indicators for outdoor public spaces are relatively low; A comparison between tower and slab-type residential blocks reveals the proportion of complaints regarding cramped living space in tower-style residential areas was higher, and the relevant conclusions have been included in Shanghai urban built-environment archives [2].

Based on Shenzhen's regulatory provisions, this study identifies three control indicators governing block openness: street width, building height limits and reserved vacant land. The three conditions collectively affect the sense of openness of the block. Taking Nantou Ancient City's street renewal as an example, planners improve block openness by restricting building height and broadening pedestrian walkways. Street dimensions define block openness, while housing layout determines residential privacy, as verified by Hong Kong's affordable housing data.

In the early years, low-rent public housing featured compact building layouts and narrow window gaps, and complaints about privacy disturbances remained high for many years; Later public housing improved privacy by adjusting window design and planting native arbors inside residential clusters. In addition to privacy attributes, the completeness of supporting facilities and the supply of green spaces directly affect the comprehensive residential evaluation of residents, and Shanghai community research data can serve as evidence.

Based on the statistical results of the 15-minute living circle construction in Shanghai, the comprehensive residential evaluation of residents in built-up areas with complete supporting green spaces and convenient stations is better than that of old neighborhoods without supporting facilities [3]. Referring to the results of on-site household surveys conducted by the Chinese Academy of Sciences in Xiamen, and based on the feedback from respondents in residential areas with different green conditions, the proportion of residents who reported feeling physically and mentally relaxed in residential areas with abundant green resources is far ahead.

Based on the 2023 Hong Kong Resident Census data, the residential preferences of different age groups are summarized: elderly residents focus on home privacy and nearby green space resources, while middle-aged and young people prefer open streets and convenient commuting conditions. Such demographic preference differences remain consistent across surveys, and the uniform statistical survey data for Shanghai and Shenzhen still needs to be supplemented and improved.

The above multi-city survey data provides an empirical basis for the subsequent analysis of the impact mechanism in this chapter.

3. The impact mechanism and empirical analysis of spatial perception on residents' mental health

With the continuous expansion of high-density central districts of major Chinese megacities, the relationship between living environment and residents' mental health has become an important research direction in the fields of urban and rural planning and public health. This article relies on the national sampling data of the *Report on the Development of National Mental Health in China (2023-2024)*, combined with the community psychological survey data carried out by the Shanghai and Shenzhen disease control departments in conjunction with annual urban built-environment surveys and sub-districts, to sort out residents' spatial perception from five dimensions: crowding, openness, privacy, supporting facilities, and greening. The five spatial dimensions exert impacts on residents' mood via two mediating factors: emotional adjustment and neighborhood interaction. Poor living environments can increase the proportion of psychological sub-health, while comfortable spaces can continuously buffer negative psychology [4].

Old residential communities including Shanghai's Huangpu and Jing'an Districts were mostly constructed in the middle and late 20th century, and due to early planning restrictions, the proportion of public spaces was relatively low. Field surveys indicated that the proportion of feedback on restlessness and insomnia among residents in the area was nearly 30% higher than that of newly built communities in the suburbs of Baoshan and Jiading. Long-term shortage of activity space can weaken individuals' sense of environmental control. Longer residential stay easily builds up negative feelings.

However, the renewal of green spaces can effectively alleviate psychological pressure. From the health monitoring records of Nanshan and Futian in Shenzhen over the years, the addition of pocket parks and group green spaces has led to a gradual decrease in the number of residents' self-reported negative psychological conditions; Research conducted by the Chinese Academy of Sciences has confirmed that respondents who have access to nearby green resources have a significantly lower incidence of loneliness [5].

According to research data from Dongcheng and Xicheng districts in Beijing, residential areas with cramped streets and insufficient privacy of apartment layouts have more complaints from residents who feel uneasy at night. Privacy shortcomings can easily damage sleep quality, leading to a chain problem of environmental defects, poor sleep, and emotional deterioration.

Comprehensive community facilities utilize daily neighborhood interactions to alleviate negative emotions, with frequent interactions between neighbors and a lower risk of depression; On the other hand, in old areas with outdated supporting facilities, elderly people living alone lack social channels and have long-term high negative psychological feedback. In addition, there are significant differences in group needs: middle-aged and young people focus on block size and commuting convenience, while middle-aged and elderly people value nearby greenery and home privacy more; Compared to men, women are more likely to develop negative emotions in crowded environments, and this pattern remains stable in multi-city comparative research.

4. The transmission path and impact effect of spatial perception on residents' physiological health

Spatial perception cannot alter physical indicators directly but works via three core influencing factors: chronic stress, daily outdoor activity duration, and nighttime sleep quality, which affect residents' blood pressure, metabolic levels, and physical immunity. Domestic research data has been compiled into the *Report on Nutrition and Chronic Disease Status of Chinese Residents (2020)* and community health statistical archives retained by local health commissions.

Long-term exposure to crowded living environments can easily lead to sustained chronic stress in the human body. Stress hormones such as cortisol, which remain at high levels for a long time, can increase the risk of cardiovascular abnormalities. Shanghai chronic disease sampling data shows that the prevalence of hypertension in old residential communities in the central urban area is 30.34 %, while the prevalence in newly built low-density residential areas in the suburbs is only 25.96%. Temporary traffic congestion in daily elevators and corridors can cause a rapid increase in heart rate in a short period of time. The repeated momentary tension combined with long-term residential depression gradually increases the incidence of various chronic diseases [6].

The green space at the doorstep can relieve physical and mental stress and help residents improve their physical condition. According to research conducted in the *Journal of Ecology*, residents who can use green spaces for leisure nearby have a higher number of people who meet sleep standards. Stable sleep can maintain a stable endocrine and metabolic system. After the completion of group green space installation and renovation in many old residential communities, the number of residents reporting sleep disorders in the jurisdiction has steadily decreased.

The privacy conditions of a house are directly related to the degree of sleep integrity at night. The high-density public housing buildings built in Hong Kong in the early years had narrow window spacing, and residents were often disturbed by noise and visual interference from neighbors, frequently waking up at night. Long-term intermittent sleep can easily lead to metabolic disorders such as dyslipidemia and insulin abnormalities, and existing environmental epidemiological studies can support this phenomenon.

Complete community amenities help boost residents' regular outdoor activity levels. According to the monitoring data of the National Health Commission, the area lacking footpaths and green space has less outdoor sports, and the proportion of overweight, obesity and type 2 diabetes has increased. Communities with complete supporting amenities boast abundant outdoor space, leading to superior residents' physical indicators.

Integrated urban renewal outperforms fragmented single-item renovation, and green spaces can offset the negative health impacts caused by crowded environments [7].

5. The shaping effect of high-density urban spatial features on spatial perception

The built space directly affects the perception of human habitation, and renovation and optimization can be promoted from four dimensions: residential areas, green spaces, idle sites, and streets and alleys. Many cities in Shanghai, Shenzhen and Hong Kong have successively launched district renewal and carried out urban built-environment survey at the same time. The survey data before and after the transformation directly reflects the change of space transformation on residents' subjective living experience [8].

Optimizing the layout of residential clusters can directly change the experience of open space. According to the renovation data of old residential communities in Shenzhen, the original enclosed high-rise tower clusters have been reported by residents as overcrowded. After the developer maintained the original construction density and transformed the buildings into staggered board buildings and scattered point layouts, the negative evaluation of residents significantly decreased. Dense high-rise buildings often make neighborhoods feel cramped. The newly built public housing in Hong Kong follows the green construction guidelines, leaving vacant land within the cluster and combining it with open green spaces, creating a more open residential atmosphere in the community. In addition to group layout, green space site selection and plant configuration are important tools for optimizing residents' perception of greenery.

The site selection and planting mode of green spaces directly determines the efficiency of greening services. Based on pocket park usage data of downtown Shanghai, small green spaces scattered at the corners and intersections of residential areas are more convenient for residents to visit than large green spaces placed outside the area, and people are more satisfied with the greening. Green spaces planted in layers with trees, shrubs, and herbs provide better living comfort than those with only lawns. The relevant construction practices have been included in the design reference for the renovation of old urban areas in Shanghai. In addition to flat green spaces, revitalizing vacant spaces on elevated roofs is an important way to expand community leisure areas.

Multiple old residential communities in Shenzhen have revitalized elevated and rooftop spaces, and differentiated recreational areas through the use of green plants. After the renovation is completed, residents can maintain a sense of privacy and are willing to use this area frequently. Large areas of fully hard ground lack recreational boundaries, and enclosed small spaces are more conducive to neighborhood stay and interaction.

Chaoyangmen Area of Beijing reduces the sense of oppression in high-rise buildings by expanding roads and increasing greenery, effectively enhancing residents' willingness to walk. The implementation effect of collaborative renovation of multiple contents is better than that of single rectification, and the widening of streets and alleys and the matching of green plants can weaken the sense of oppression in the block from a macro level [9].

6. Strategies for improving high-density urban living environment based on spatial perception optimization

Drawing from previous research outcomes and the differentiated living needs of different groups in the previous text, and relying on the implementation of multi-city renovation cases, optimization plans are sorted out from five dimensions. Based on this, a physical space renovation path is proposed to improve the actual living experience of residents and reduce various health hazards brought by high-density development from the early planning stage. From the policies related to stock updates in Beijing and Shanghai, it can be seen that the two cities rely on the policy of adjusting the plot ratio across regions, and without breaking through the overall construction indicators of the area, they break down contiguous high-rise buildings

and use scattered blank spaces to alleviate congestion in the area. When constructing a 15-minute living circle, convenient shops and leisure venues are commonly interspersed in residential areas in various regions. Field research data from the Nanshan contiguous renovation area in Shenzhen shows that after the mixed use land is landed, the level of convenient supporting facilities in the area is significantly improved, and the slow walking trails in the area are also repaired systematically [10]. In terms of residential optimization, Hong Kong's years of construction experience in public housing have reference value. The local area compensates for the privacy shortcomings of high-density residential buildings through staggered layout of buildings, window opening, and group greening design. Combining with the renovation practice of old residential communities in Shenzhen, three-dimensional greening of roofs and facades has become a mature renovation method, which can supplement urban green resources without occupying scarce construction land resources. The pocket park projects that have been implemented in Shanghai in recent years all follow the layout logic of "small dispersion, large concentration", avoiding the extensive mode of large-scale single grass planting, and enriching the green space ecology with the compound planting of trees and shrubs. These small green spaces are mostly embedded in the gaps of residential clusters, while large parks are located on the outskirts of urban areas, making it convenient for residents to enter the park nearby [11]. In the renovation of many old areas, designers will activate the elevated floors, idle rooftops, and street corner open spaces, partition large hard plazas with green buffer strips to separate active and passive leisure zones, and match movable equipment to adapt to different scenes such as daytime leisure and nighttime gatherings.

7. Conclusion

Based on the urban construction statistics, urban built-environment surveys, and population health census data officially released by the National Bureau of Statistics, Ministry of Housing and Urban Rural Development, China Center for Disease Control and Prevention, and Shanghai, Shenzhen, and Hong Kong, this study systematically analyzes the inherent relationship between the built environment, residents' spatial perception, and physical and mental health in high-density urban areas. All cited data can be verified through official government documents and industrial annual reports. Research has confirmed that the living space environment can affect residents' health status at the psychological and physical levels through four pathways: physiological stress response, sleep quality, outdoor activities, and neighborhood socialization. Living in cramped housing for years raises people's bad moods and chronic disease risks and increases the risk of chronic diseases. High-quality greenery and open spaces can effectively buffer environmental pressure, stabilize physical and mental states, and indirectly regulate residents' health levels through residential privacy and supporting facilities.

There are significant differences in environmental adaptation characteristics among different groups of people. The physical and mental health of the elderly group is closely related to nearby greenery and residential privacy. Middle-aged and young people are more concerned about the openness and convenience of the neighborhood, while women are more likely to experience physical and mental discomfort in crowded environments. The differentiated characteristics of this group provide empirical support for refined zoning renewal planning. The renewal practice of mega cities in the eastern region fully proves that optimizing the layout of building clusters, supplementing scattered green spaces, and creating three-dimensional public spaces can effectively improve the living experience and alleviate health hazards caused by high-density development.

As sample data mainly originates from eastern coastal cities and is restricted by regional climate and local construction conditions, relevant optimization strategies are difficult to directly adapt to the old cities in central and western China. In the future, we can rely on the

national human settlement health monitoring big data to conduct long-term tracking research and form differentiated regional optimization frameworks. Overall, the development of high-density urban areas needs to be centered on residents' spatial perception, through refined spatial transformation to balance intensive land exploitation and livable community construction, to help promote high-quality urban renewal and development.

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