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Discourse on Healthy Cities and Healing Environments

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ABSTRACT: The Central Committee of the Communist Party of China (CPC) and the State Council released a plan in October 2016 entitled “Outline of the Plan of ‘Healthy China 2030’.” The objective outlined in the plan was to “integrate health into the whole process of urban-rural planning, construction and governance, and promote the harmonious development between cities and human health.” As an indispensable part of building a healthy China, the healing environment concept has proven integral to the physiological and psychological health of human beings. The early achievements made in the psychological science and rehabilitation fields have gradually impacted landscape architecture, urban planning and architecture. In modern high-density city settlements, particularly since the outbreak of COVID-19 in 2020, the importance of healing environments has been highlighted. In recent years, scholars have expanded on and deepened the research by investigating blue-green spaces at different levels, as well as the natural elements of a built environment. They have also attempted to utilize experimental means wherever possible, making remarkable progress in the process. The editorial department of this journal organized an academic conversation on the topic, Healthy Cities and Healing Environments. Six scholars from different backgrounds were invited to take part in a focused, yet diverse, discussion. Based on the relationship between green and health on the urban scale, Li Shuhua explained that cities are places where humans gather and live and, thus, such places continue to develop with the evolution of our species. An ideal city should conform to people’s collective desire for a better life. It should not only meet the needs associated with sustainable ecological development but also provide people with an appropriate living environment in favor of human health. The Green Healthy City Theory provides an ideal perspective toward alleviating current “Urban diseases” and “Urban population health issues”. The Otemachi Forest in the center of Tokyo represents a practical pioneering case of the Green Healthy City Theory. Based on relations between humans, nature and cities, the current study traced the development of ideal cities in Europe, America, Japan and China, and discussed the principles and constituent elements that should be adhered to during practical construction of a green healthy city. There are evident differences among different races in terms of the COVID-19 infection rate in the United States (US), which reflect health justice issues. Therefore, Jiang Bin et al. hypothesized that such differences among races are significantly reduced in areas where green space coverage is high. Taking control over variables covering socioeconomic characteristics and chronic diseases, the current study measured the correlation between racial differences in the COVID-19 infection

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rate and green space coverage using a multi-linear regression model. The findings from the study revealed that, at the county level, higher green space coverage could significantly reduce racial differences of COVID-19 infection rate. Further, four green space types were found to contribute to this reduction. Finally, an encircling mechanism and five core mechanisms were established to interpret such correlation. Du Hongwu et al. determined that it is extremely important that high-density urban scenery meet people's restorative needs, which were highlighted during the COVID-19 outbreak. Two types of sky gardens, which are grown outside well-designed office buildings and residential buildings, both promote restoration. However, their spatial morphologies, influential factors and action mechanisms differ. The spatial locations, combinations and relations between spaces should be arranged in a way that increases the restorative benefits of sky gardens. Toward improving the quality of sky gardens, the influential factors impacting the restorative benefits of sky gardens should be explored further. These include visual accessibility, the spatial level of sky gardens and the green view rates. It is also important to establish supportive environments, to strengthen multifunctionality, to diversify activity types and to increase participation and usage rates. Zheng et al. believed that green contact in cities is crucial for the promotion of urban residents' health. In practical projects, full consideration to functions and the use of streets has to be given to such green contact in order that the associated health benefits are realized. Combining the street reconstruction for a park city in Chengdu, Zheng et al. investigated the walking and business-facility use preferences of 40 respondents in specific street scenes as well as the green space alongside streets for the remainder of the behavioral experiment. Moreover, their first impressions and sub-dimensional evaluation findings of the street environment were collected. At the same time, eye positions of respondents in their relevant choices or evaluations were recorded using an SMI Redn Professional desktop eye tracker. The results of the study provide support for decision-making in the design of healthy streets. Long Hao attempted to review and elaborate on the specific applications of evidence-based design in the design and construction of rehabilitation gardens. He believed that as an important psychological and physiological rehabilitation space in CCRC-type aging communities, rehabilitation gardens should be implemented to improve functions of gardens in psychological counseling based on evidence-based design. The psychological health, depression and anxiety of the aged residents are becoming increasingly prominent issues as the closed management in medical and nursing institutions for the aged is becoming increasingly common as a result of COVID-19. It is expected that the current study will provide reference points and assistance in thinking about rehabilitation garden design into the future and offering a feasible psychological health space for CCRC-type aging communities. Focusing on the age-friendly city framework of the World Health Organization (WHO), Yuan Xiaomei proposed the concept of a "community environment of health management for the aged." This concept helps to establish the key technological system of "the aged+environment+life" from the perspectives of "comfort and safety", "encouragement in activities", "intimacy to nature" and "interaction." She aims to integrate rehabilitation therapy into daily outdoor activities for the aged and provide them with an effective environmental solution to their health-and life-related issues. In the current study, the health performance and application potential of relevant technologies were described through their combination with the findings of the preliminary research and evidence-based practices put forward by the research team led by Professor Yuan Xiaomei.

KEY WORDS: *healthy city; healing environment; green healthy city; health justice; health benefit; rehabilitation community*

"Green Healthy City" Theory

by **Li Shuhua**

Cities are places where human beings gather and live, evolving continuously with human progress. An ideal city should embody people's aspirations for a good life, meeting the requirement of green development for ecological sustainability while providing a suitable living environment that benefits human health. The theory of "Green Healthy City" represents one of the ideal models to alleviate the "city diseases" and "citizens' diseases", with Tokyo's central district "Otemachi Forest" serving as a pioneer case for this theory.

1 Reflections inspired by "Otemachi Forest" in Tokyo's city center

Otemachi is located in Chiyoda on the eastern side of

the Imperial Palace in central Tokyo, known for its concentration of skyscrapers and luxury hotels, making it one of the highest-density areas in Tokyo. This project aims to reintroduce nature and wilderness into urban spaces, creating a new form of urban public space to evoke, by expressing the vitality and profoundness of nature, a sense of a natural "forest" in the city, allowing people to experience the original natural beauty of the earth.

2 Urban development theory and practice based on the relationship between human and nature

Cities evolve to meet the needs of human production and livelihood, with early developments focusing on practical needs such as defense, politics, transportation, and trade in relatively small scales, constrained by productivity and population growth to a slow development. The influx

of rural populations into cities during the Industrial Revolution brought about fundamental changes in urban development, leading to various challenges, among which the discussions and explorations regarding the relationship between human and nature have been ongoing since then.

2.1 Development of urban theories and practices in Europe and America

The Industrial Revolution in the 18th century greatly enhanced social productivity, leading to the urbanization phenomenon in the western countries as the agricultural population and land shifted to cities in the late Industrial Revolution period. The rapid growth of urban populations brought significant economic benefits but also gave rise to various negative issues. Green spaces and public areas were encroached upon by poorly planned residential areas. Poor sanitation conditions, water pollution, and large-scale population movements led to the proliferation of bacteria and contagious diseases. In the first half of the 19th century, infectious diseases such as cholera, typhoid fever, and yellow fever broke out multiple times in countries like England and the United States, posing serious threats to public health. The fast economic development juxtaposed with poor health conditions and significant population deaths drew attention from various social classes. Western countries, represented by the UK and the US, began reflecting on their urban development models and proposed different strategies and theories in response.

In 1898, the British social activist Ebenezer Howard introduced the Garden City theory, aiming to establish a healthy, natural, and economic combination between cities and their surrounding agricultural lands to provide abundant job opportunities for urban residents and enhance their health and living standards. Around the same period as the proposal of the Garden City concept in the late 19th century and early 20th century, the United States witnessed the “City Beautiful Movement” frenzy. This movement also fostered the development of comprehensive, multi-objective urban planning concepts. During this time, cities like Washington, San Francisco, and Chicago achieved notable success in implementing related planning and designs.

In the 1940s, various cities in the UK began construc-

ting and opening public green spaces, providing green areas to the public in the form of parks and urban green belts in cities like London, Manchester, and Nottingham. In 1858, landscape architect Frederick Law Olmsted led the planning of Central Park in New York and later designed a series of city parks in places like San Francisco and Detroit, propelling the practice of the “City Park Movement” in the United States. Good sanitation conditions and ample green open spaces became effective means to address public health issues.

In the mid-20th century, under the influence of sustainable development and systematic thinking, the ecologically oriented concept that integrates social, economic, and natural factors began to emerge as the leading ideology in urban development.

2.2 Development of urban theories and practices in Japan

In 1907, Howard’s Garden City theory was introduced and promoted by the Japanese Ministry of Internal Affairs, sparking societal responses. In 1918, Eiichi Seizo, a prominent figure in the Meiji industrial sector, established the “Garden City” Corporation and developed the garden-style upscale residential area “Garden Tama City” in Chōfu-shi near the Tamagawa in Tokyo. In 1991, Kazuhiko Takeuchi, in line with the realities of Japanese urban development, put forward the concept of a “Green Agricultural City” based on the Garden City concept, primarily addressing Japan’s challenge of creating large circular green belts similar to those in Europe and America due to high levels of urbanization. The proposal suggested the allocation of scattered agricultural and forestry areas on the outskirts of cities, advocating for the flexible utilization of the complementary advantages between urban and rural areas to form an environmental network.

2.3 Development of urban theories and practices in China

In the late 1980s, China actively responded to the UNESCO’s initiative for building ecological cities. Several relevant departments successively proposed different standards for assessing advanced city construction, laying out interim indicators for eventually establishing ecological cities. In 1992, the Ministry of Construction initiated the activity of building “National Garden Cities.” On this initiative, in 2004, the Ministry of Housing and Urban-Ru-

ral Development began the construction of “National Ecological Garden Cities.” Compared to Garden Cities, the standards for Ecological Garden Cities included additional indicators reflecting biodiversity, public satisfaction with the ecological environment, etc., comprehensively assessing the composite development of urban artificial environments and natural ecological environments. Building upon ecological principles, research and practices focusing on Forest Cities, Sponge Cities, and others have been ongoing. Since 2010, urban resilience has also been receiving increasing attention and application.

3 “Green Healthy City” Theory

3.1 Principles of constructing “Green Healthy Cities”

In essence, a green city is an eco-friendly city, a healthy city is one that promotes the physical and mental well-being of its residents, and a “Green Healthy City” is a composite term that combines the characteristics of both green and healthy cities. A Green City serves as the foundation of a Healthy City, and a Healthy City is the objective of a Green City. To meet the requirements of a city’s eco-friendly environment and the physical and mental well-being of its residents, the following principles should be adhered to in urban green space construction:(1) rich biodiversity and the establishment of natural-like artificial ecosystems are the foundation for sustainable development of urban environments.(2) Symbiosis and circulation are the basic principles for urban green space construction in the context of a low-carbon society.(3) From tree planting and grass seeding to ecological restoration and natural regeneration.(4) In the selection of green space plants, native plants should be the primary focus. Avoid non-healthy plants.(5) Understanding nature is the most fundamental attribute of humans. (6) Urban green spaces are essential factors in guaranteeing the physical and mental well-being of citizens.

3.2 Elements of “Green Healthy Cities”

In ensuring rich biodiversity in green environments and the sustainable and healthy development of urban environments, as well as improving the physical and mental health of urban residents, increasing the index of happiness and quality of life, the constituent elements of “Green

Healthy Cities” include:(1) ecological green web system intersecting water and greenery;(2) urban green spaces designed as biotope habitats;(3) water-friendly near-natural river corridors;(4) health-oriented ecological road corridors and avenues covered with trees;(5) woodlands and large trees with health benefits both for the urban environment and the physical and mental well-being of citizens;(6) building aerial ecological corridors primarily consisting of rooftop gardens and green wall installations;(7) elevated bridge ecological green corridors, with elevated bridges being common large-scale structures in modern cities;(8) environmentally symbiotic housing;(9) flower-lined streets;(10) ecological health trails;(11) vibrant and engaging community gardens and citizen parks;(12) encircling green belts (green rings).

In addition to the aforementioned elements, the refinement of urban water circulation systems, slope greening systems, permeable paving, and green waste recycling systems are also essential for constructing “Green and Healthy Cities.”

Conclusion

How to establish a stable and sustainable urban environment that maintains vitality, while also being comfortable, beneficial, and cultural, ensuring that urban green spaces fulfill six major functions of ecological conservation, landscape beautification, rest and recreation, cultural heritage, disaster prevention, and health and hygiene, remains an eternal topic in the landscape architecture industry.

Landscape Justice: The Significant Relationship Between Provision of Green Spaces and Racial Disparities in COVID-19 Infection Rates in the United States

by Jiang Bin

1 Research highlights

This study is one of the pioneering research efforts to explore the racial disparities in COVID-19 infection rates between Black and White populations in relation to green spaces. A nationwide study was conducted across 135 counties in the United States, with the highest levels of urbanization covering 40.3% of the national population. After controlling for confounding variables, the study found

that higher coverage of various types of green spaces corresponded to smaller racial disparities in COVID-19 infection rates. The study established one peripheral mechanism and five core mechanisms to explain its findings.

2 Research background

Many countries face disparities in health conditions among different racial groups, which can lead to social unrest, economic disputes, and even endanger residents' safety. The health disparities between Black and White populations in the United States are highly representative among developed economies. Since the onset of the COVID-19 outbreak in 2019, the differences in COVID-19 infection rates among different racial groups in the United States have become more pronounced. Previous studies have shown that green spaces may have a positive and independent impact on reducing health disparities between racial groups. However, there has been limited research focusing on the relationship between green spaces and racial disparities in COVID-19 infection rates, as existing studies mainly concentrate on socioeconomic factors and chronic disease factors. There is a wealth of evidence and theories demonstrating the multi-spatial scale and multi-pathway positive impacts of green spaces on resident health. Therefore, we hypothesized that providing green spaces could alleviate racial disparities in COVID-19 infection rates, with regions having higher green space coverage showing significantly lower Black-White racial differences in COVID-19 infection rates.

3 Research design

We compared the racial disparities in COVID-19 infection rates between Black and White populations in 135 highly urbanized counties, while controlling for confounding variables. In this study, "Black-White racial disparities" were defined as the difference in COVID-19 infection rates between Black and White individuals within the same county, which greatly reduces bias caused by variations among counties (including climatic conditions, medical conditions, regulatory policies, etc.). We employed an internal comparison (within counties) research design and conducted statistical analysis and research on a nationwide scale. The COVID-19 infection data were sourced from official websites of public health government agencies in

each county, with data collection up to July 10, 2020.

4 Analysis results

Through data analysis, we identified the following key findings: (1) the infection rate among Black individuals is on average double that of White individuals. (2) Significant disparities exist in COVID-19 virus infections among different racial groups. (3) Model 1 shows a significant correlation between socioeconomic variables and racial differences in infection rates. (4) Model 2, after adding existing chronic disease variables, showed a slight decrease in significance but still remains associated with racial differences in infection rates. (5) Model 3 demonstrates that the independent impact of green space variables is greater than other variables, resulting in an 18% increase in explanatory power. Specifically, there are four green space variables which are significantly related: open space, forests, shrubs, and grasslands.

5 Discussion

Based on experimental and theoretical assessments of the influence of environmental factors on disparities in COVID-19 infection rates, this study has identified a peripheral mechanism and five core mechanisms. (1) Peripheral Mechanism: in counties with higher green space coverage, Black and White individuals are more likely to equally enjoy the health benefits of green spaces. An increase in green space availability may provide Black individuals and their communities with sufficient green spaces; inadequate green space supply tends to favor White individuals and White communities. (2) Core Mechanism 1: environmental factors have a social aspect and attract people to outdoor spaces. Existing research indicates that people prefer places with vegetation over barren urban spaces. Such areas can mitigate virus transmission through three main pathways: 1) outdoor air circulation slows virus spread; 2) green outdoor spaces encourage outdoor activities and prolonged outdoor stays; 3) maintaining social distancing is easier outdoors. (3) Core Mechanism 2: urban green spaces provide all races with equal opportunities to connect with nature and offer outdoor activity spaces during the pandemic. Outdoor activities can boost immune functions more effectively than indoor activities. (4) Core Mechanism 3: green spaces in cities contribute to people's

mental health. Studies show that Black individuals endure more mental stress, particularly evident during the pandemic. Green spaces help alleviate mental fatigue and stress, reducing negative emotions. (5) Core Mechanism 4: urban green spaces enhance social health by reducing impulsivity and extreme emotions, promoting communication and social connections among people. (6) Core Mechanism 5: urban green spaces improve air quality and reduce air pollution, resulting in lower infection rates. Black communities often have higher population densities and poorer air quality compared to White communities; increased green spaces can enhance air quality levels.

Conclusion

This study represents the first attempt to understand the relationship between environmental factors and racial disparities in COVID-19 infection rates. We utilized multiple linear regression models to interpret the racial differences in COVID-19 infection rates between Black and White populations at the county level. After controlling for socioeconomic variables, chronic disease variables, and urbanization level variables, we found that higher forest, shrub, and grassland coverage significantly reduces the racial gap in COVID-19 infection rates between Black and White populations. Counties with higher green space coverage exhibit lower racial disparities in COVID-19 infection rates. Furthermore, providing green public spaces in urban environments can mitigate racial disparities in COVID-19 infection rates through various influencing mechanisms. This study demonstrates the potential of green spaces in alleviating health disparities between racial groups and creating a healthy living environment.

Sky Gardens in High-Density Urban Living and Their Restorative Benefits

by Du Hongwu

Starting from the 1960s, the aesthetics and visual preferences of built environments have been emphasized by environmental psychologists, leading to a series of discoveries that prompted further research on the impact of nature on individual psychological and physiological well-being and how biophilic design can be utilized to enhance human psychological and physiological health.

The development of contemporary high-rise buildings has met the demand for more significant spaces but has also disconnected people from close contact with natural elements. The lack of daylight, natural ventilation, and potential isolation from the outdoors can lead to physiological diseases and building-related illnesses such as Sick Building Syndrome (SBS). Research indicates that stress, boredom, irritability, and other psychological conditions are often associated with poorly designed high-density living environments. Natural elements such as green spaces and water scenery serve as crucial restorative elements with benefits like stress reduction, mood enhancement, and cognitive improvement.

For high-density cities, providing opportunities for restorative experiences in everyday life scenes is particularly vital. However, high-density urban spaces greatly restrict the connection between individuals and regenerative environments on the ground, a situation exacerbated by the COVID-19 pandemic.

Sky gardens, as essential spaces for creating regenerative environments, are increasingly demonstrating the positive value. While their regenerative potential has been preliminarily confirmed, relevant research has not received sufficient attention. The complex relationship between the formal elements of sky gardens and their regenerative benefits still remains largely unexplored. In this context, sky gardens refer to elevated recreational environments above ground level, featuring landscape elements, with or without canopy, open or enclosed, and diverse forms. They represent a primary spatial element and design language in contemporary architecture, serving as alternative social spaces that offer multi-dimensional values in high-density cities, including societal, ecological, economic, and health benefits. This study explores the regenerative benefits of sky gardens in high-rise office buildings and high-rise residential buildings.

The study, incorporating numerous case studies in the Pearl River Delta region, identifies key factors influencing the restorative benefits of sky gardens through on-site investigations and literature reviews. In the context of high-rise office buildings, these key factors are selected as three groups of variables, including spatial forms (points, lines,

surfaces), spatial interfaces (glass curtain walls, window sills), and sky visibility (visible, non-visible). By permutating these variables, 12 different aerial courtyard VR experimental scenes are generated along with 2 control scenes without sky gardens, totaling 14 scenes. Participants are equipped with VR glasses and galvanic skin response sensors to record data on their responses during the laboratory stress process and subsequent recovery stages.

Various research methods commonly utilized for assessing health benefits have distinct advantages and focal points. Considering the challenges of data collection and equipment conditions, this experiment employed two physiological indicators - heart rate variability (p-p interval) and skin conductance response (SCR), along with a measure of psychological state - scores from the Profile of Mood States (POMS), to evaluate the health status of participants and indirectly infer the restorative effects of the experimental settings.

Past studies have confirmed that the mechanisms of stress recovery in individuals of the same age group are highly similar. Due to difficulties in recruiting participants and arranging experimental sites, 16 college students were randomly selected as subjects instead of office employees.

The experimental data confirmed the positive influence of the VR sky courtyard scenes on physiological and mental health recovery. Further exploration of the relationship between the characteristic elements of sky courtyards and their restorative benefits led to the following conclusions: (1) sky courtyards in high-density urban office buildings have restorative effects. Adding sky courtyards when the sky is not visible serves as an effective design strategy to enhance restorative benefits. (2) The presence of the sky alone in high-density environments does not show significant health benefits, but when combined with sky courtyards and natural elements, it can exhibit pronounced restorative benefits. Other restorative factors, when paired with visible skies, can enhance restorative effects. (3) The spatial form and interfaces have a non-significant impact on the restorative benefits of sky courtyards. (4) Sky courtyard scenes with specific feature combinations demonstrate noticeable healing benefits.

For the restorative benefits of high-rise residential

sky gardens, a similar or analogous experimental design to the above study was employed, with the addition of the State-Trait Anxiety Inventory - State version (STAI-S) and the Restorative

Component Rating Scale (RCS). Through field research and survey analysis of the spatial characteristics of residential sky gardens and residents' restorative needs, three primary influencing factors were selected: space types (balcony, courtyard

, overhead sky gardens), space interfaces (real interfaces, virtual interfaces), green view rates (high, low), constructing 15 different VR scenes (including 3 control groups) and conducting restorative benefit experiments with 36 participants.

By collecting and analyzing physiological and psychological data from participants, the following conclusions were drawn: (1) residential sky gardens exhibit both physiological and psychological restorative benefits with specific feature combinations. (2) All three types of residential sky gardens demonstrate restorative benefits, with the compatibility dimension scoring the highest in the Perceived Restorativeness Scale results, indicating that the environmental settings in the experimental scenes align well with participants' expectations for regulating physiological stress, relieving psychological pressure, and improving anxious moods. (3) Significant differences exist in the physiological and psychological recovery benefits of balcony sky gardens with real and virtual interfaces. In the Perceived Restorativeness evaluation, distinct differences were observed in the ratings for the dimensions of escape and extension based on different spatial interfaces, indicating the significant role of visual transparency in alleviating anxious moods, particularly in smaller spaces, emphasizing the importance of visual transparency in the spatial interfaces. (4) Significant variations in the restorative benefits of courtyard and overhead sky gardens were observed based on the magnitude of green view rates, with a higher green view rate demonstrating superior restorative effects compared to a lower green view rate. Different levels of green view rates showed significant differences in ratings for the dimensions of fascination and escape, indicating that for larger-scale sky gardens, appropriately increasing

the green view rate can enhance the scene's appealing features and improve restorative benefits.

The aforementioned studies confirm that well-designed sky gardens in both office buildings and residential settings have restorative benefits. Nonetheless, there are clear differences in spatial forms and influencing factors, while their restorative benefits share similarities, their mechanisms of action are distinctly different.

Based on the conclusions of the aforementioned studies, to improve the restorative benefits of high-density human settlement environments, the following actions should be taken: (1) recognize the significant value of sky gardens, address various constraining factors, and employ multiple measures to promote their development. (2) Plan the layout of sky gardens strategically, organize movement lines effectively, focus on the combination of different sky courtyards and spatial connections to enhance close contact between individuals and sky gardens. (3) Delve deeper into the influencing factors of the restorative benefits of sky gardens and enhance their spatial quality. (4) Establish supportive environments, strengthen multifunctionality, diversify activity types, increase participation and usage rates. (5) Enhance the visual accessibility of sky garden boundaries, enrich spatial and green landscape levels, and choose appropriate green view rates.

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Empirical Study of Green Healthy Streets Usage with Eye-tracking Support

by Chen Zheng

In research, it is often necessary to isolate the factors being studied from other influences for analysis. For instance, in studies of urban health-promoting streets, visible greenery and its health impacts are often isolated to discuss the effectiveness of green exposure and appropriate health dosages such as green view rates and exposure times. In the real world, streets serve multiple functions such as transportation, access to life service facilities, so-

cial interactions, fitness activities, and green exposure. The focus of actual projects often revolves around how to resolve conflicts between these functions. In highly greening yet functionally compromised lifestyle-focused streets, how can design strategies balance the sensory experience of greenery while mitigating the negative impacts on adjacent facilities? What design interventions can better encourage pedestrian activity and leisure green space utilization?

The "Chengdu Urban and Rural Spatial Planning (2016-2035)" proposes "Advancing Park City Street Construction and Enhancing Street Environment Quality." Against the backdrop of the Park City policy, Chengdu has introduced the "Chengdu Park City Street Integration Design Guidelines," guided by the "Park City Block Scene Theory" and the concept of "Street Integration," which are tangible manifestations of the idea of a beautiful and livable park city at the street level. Additionally, there are construction guidelines such as "The Way to Work" and "The Way Home." In the context of Park City development, as the street design paradigm shifts from being car-oriented to people-oriented, a series of issues have arisen: conflicting design concepts, pedestrian safety concerns, conflicts between business interfaces and greenery levels, and more. The problem with greening in urban development is not just about having a higher greening rate; it is more about design issues. Addressing the conflict between city greening and the usage of other functions while ensuring the basic functions of streets requires pinpointed street design optimizations based on more concrete street scenarios.

This paper shares an empirical eye-tracking study providing human decision-making support for the Chengdu Park City Street Renewal project conducted by the Urban Design Institute of Tongji Urban Planning & Design Institute, Shanghai Tongji Urban Planning Design and Research Institute Co., Ltd. We combined the "Chengdu Park City Street Integration Design Guidelines" with scenarios such as "The Way to Work" and "The Way Home" to further deepen the design strategies and conduct validation experiments.

In research, we combined experimental design with

planning design practice to explore the street transformation of Chengdu Park City through eye tracking and behavioral experiments. Using photographs, we conducted behavioral experiments with 40 participants to gather their preference choices for walking, dining, leisure activities on specific streets, as well as their initial impressions and multidimensional evaluations of the street environment. Simultaneously, we used the SMI Redn Professional desktop eye-tracking system to record participants' gaze patterns when making relevant choices or evaluations.

The results revealed that the removal of obstructive shrubbery and improvement of green space visibility elevated the overall dimensional evaluations and the vitality of the main functions of the pedestrian-friendly street while ensuring a sense of greenery. When pedestrians select amenities on lifestyle-focused streets, in addition to focusing on storefront facades, they also scan the external display spaces, awnings, and signage along the street to anticipate and compare potential purchasing experiences. Furthermore, in choosing walking paths, while street amenities still influence people's decisions, walkability and accessibility of the street become more critical decision factors. Removing obstructive shrubbery and enhancing the openness of the street's ground level can increase the accessibility of the above mentioned key information, effectively enhancing pedestrian foot traffic (from 35% to 88%) and commercial usage (from 25% to 88%). When selecting green leisure spaces, pedestrians primarily consider elements such as spatial enclosure, seating facilities, and other users that can help anticipate spatial usage experiences. Improving the accessibility of green spaces can significantly enhance pedestrians' recreational and walking activities.

By analyzing spatial attention and behavioral decision outcomes in the two typical activity scenarios of lifestyle-focused streets, we further deepen and expand the design principles and priority sequences of the "Chengdu Park City Street Integration Design Guidelines." In scenarios involving the use of lifestyle amenities, the preferred optimization includes increasing pedestrian area width, controlling green view rates in green belts, and increasing the density of street-front facades. Meanwhile, in

scenarios involving the use of recreational green spaces along the street, the preferred optimization is to ensure appropriate green view rates.

Exploration of Evidence-based Design Theory in the CCRC Community Healing Garden

by Long Hao

At the beginning of 2020, with the release of the "Notice on COVID-19 Prevention and Control for the Elderly" and the "Guidelines for the Prevention and Control of COVID-19 in Elderly Care Institutions (2nd Edition)" by national authorities, elderly care institutions have generally adopted a closed management approach to address the threat of the pandemic. While closed management can prevent the spread of the virus, it has placed significant pressure on the operation and management of these institutions. From the perspective of the physical and mental health of the elderly, closed management has severed the visits of children and friends, leading to increased anxiety and depression due to pessimistic emotions related to the epidemic, thereby doubling the demand for psychological counseling services within institutions. In the context of the recurring and normalized epidemic situation, institutions that have effectively controlled the epidemic gradually began to reopen after about half a year, while institutions in regions experiencing recurrent outbreaks continued to alternate between open and closed statuses. In early 2021, the State Council stated that elderly care institutions had entered an emergency state of prevention and control for the winter and spring seasons, and various regions had successively initiated the closed management of elderly care institutions once again. Continuous Care Retirement Communities (CCRCs) in medical and nursing institutions, as comprehensive elderly communities with long-term care functions, are a crucial component. The psychological health issues among the elderly in the CCRC community caused by the current situation of closed management call for designers to rethink the design concepts and details in CCRC communities in our country. The Healing garden, as a crucial physical and psychological recovery space, assumes even greater importance under the normalized epidemic situation.

The concept of Healing garden or landscape has its roots dating back to ancient Greek times, with early developments seen in the Asclepius Temple within the Epidaurus Healing Sanctuary that advocated for the healing of patients through residential environments, physical exercises, and artistic expressions such as music. This interplay between mental and physical health with the surrounding landscape has been continuously proven in the medical field. A well-designed urban environment plays a significant role in improving residents' mental and physical health, often referred to as a "Restorative Environment" or "Recovery Environment."

In 1984, Professor Ulrich from the School of Architecture at Texas A&M University published an article in the journal "Science," titled "View Through a Window May Influence Recovery from Surgery." This study, using an evidence-based design approach, validated the correlation between natural landscapes and patients' recovery, becoming the origins of evidence-based design theory. Subsequently, theories like Stress Reduction Theory and Attention Restoration Theory continued to contribute to the theoretical development. In 1991, Professor Ulrich established the "Evidence-Based Design Supportive Theory," exploring the creation of optimal medical rehabilitation environments through scientifically validated methods from the perspective of healthcare facility design. In 2009, Hamilton proposed that "evidence-based design is a process: cautiously, accurately, and wisely applying the best evidence available from research and practice, in collaboration with informed clients, to formulate crucial decisions for each specific and unique project."

As evidence-based design has evolved over the years, professional certifications, databases, assessment tools, and models have seen significant advancements. Its scope has expanded from healthcare architecture to areas like landscape architecture, educational institutions, interior design, theaters, and more, playing a crucial role in the field of healing landscape design.

Amid the COVID-19 pandemic, the implementation of community lockdowns has directly led to a sharp reduction in the social circles of residents within CCRC communities. The usual 15-minute walking radius for social

commuting has now shrunk to within the community or institution boundaries. The sudden residential isolation experienced in CCRC communities is not a result of traditional urban spatial soft segregations such as distance, wealth, cultural levels, or religion. Instead, it is driven by the rigid isolation enforced by disease outbreaks and policies, affecting not only residents but also staff members. While it is true that some large communities or institutions naturally form closed-loop living routes, limiting the elderly's departure from the community in daily life due to considerations of their behavioral abilities and safety, the subjective confinement and forced "lockdown" have distinct impacts on mental and physical health compared to normal levels of soft closure. Restrictions on individual freedom of movement can result in a range of adverse psychological manifestations, including depression, anxiety, emotional disorders, and impaired self-control. In CCRC communities, spaces for daily "exercise" and "activities" are limited to indoor areas within the institutions, making healing gardens essential outdoor spaces for activities.

The elderly population can be categorized based on their physical conditions as self-care seniors, assisted seniors, and care-dependent seniors. Normally, an Active Aging Community (AAC) or an All-Age Community typically comprises predominantly independent older adults who are fully self-sufficient and able to carry out their daily activities without relying on others for assistance. The design of healing gardens in CCRC communities should consider the behavioral characteristics and rehabilitation needs of elderly groups with different health statuses. It is important to note that due to the higher prevalence of illnesses among the elderly, the healing gardens they require differ from typical parks, as what constitutes an engaging garden for healthy individuals may have a different meaning for vulnerable groups such as patients.

Post-pandemic, the healing gardens in CCRC communities face a heavier task of psychological counseling, requiring finely tuned designs for emotional guidance and relief for the elderly in high-stress environments. The process mandates clear goal setting, prediction, and evaluation systems to transform the effects of landscape therapy spaces into medical metrics with clear utility and quantifi-

ability. In accordance with evidence-based design principles, the design should align with a scientific and clear approach. Specific considerations include:

Setting Rehabilitation Goals: the design of modern CCRC communities with rehabilitative gardens should be aligned with contemporary medical recovery assessment systems. Landscape elements should be designed based on the levels of rehabilitative activities conducted by the facility, in coordination with treatment plans such as Physical Therapy (PT), Activities of Daily Living (ADL), and Horticultural Therapy, to establish expected rehabilitation goals.

Evidence Collection: drawing upon research findings in rehabilitation medicine and landscape architecture both domestically and internationally, combining project practicalities with theoretical knowledge to undertake preliminary evidence-based work. Contemporary rehabilitative gardens have proven efficacy in addressing issues such as cognitive impairments, physical functional impairments, and psychological/emotional disorders, with evaluations conducted using measures such as the Mental Health Index (MHI) and the Geriatric Depression Scale (GDS).

Fit-for-Purpose Design: design should be rooted in relevant research, integrating the desired design goals with specific design strategies through a clear logical framework to avoid decision-making errors based on personal preferences or stereotypes. The generation of design logic requires an analysis based on feasible research, experiments, and simulation methods, with the data derived serving as the foundation for design concepts tailored to the specific analytical characteristics.

Outcome Prediction and Verification: traditional design processes often involve designers making informal predictions based on their experiences and project specifics, lacking an integrated validation framework and clear data statistics. Evidence-based design necessitates analyzing and predicting the impact of design strategies throughout the process, comparing them against rehabilitation goals, and subsequently validating assumptions through technical simulations or other methods to determine whether the expected outcomes align with the objectives. **Post-Construction and Usage Evaluation:** By con-

ducting post-occupancy evaluations to gather data after the project's completion, the actual usage scenarios can be assessed against the anticipated goals, identifying discrepancies between assumptions and reality. Integration of findings into a centralized database allows for data archiving to support future design endeavors.

Overall, evidence-based design practices and research in the field of landscape architecture are relatively underdeveloped in China, with the absence of an Evidence-Based Healthcare Design and Landscapes (EBHDL) database. Both theoretical research and operational systems are still in the exploratory phase, and the application of context-specific operational systems has yet to mature, resulting in limited practical utilization in construction projects. Given the context of the pandemic, the normalization of closed environments in medical and elderly care communities emphasizes the need to place greater importance on the psychological guidance capabilities of rehabilitative gardens. Providing robust support for the mental health of vulnerable elderly populations is crucial to constructing resilient and healthy cities.

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Research and Design of Elderly-friendly Community Environments Based on Health Management

By Yuan Xiaomei

1 Concept of elderly-friendly community environments based on health management

As individuals age, various age-related chronic diseases continue to increase. Coupled with the natural decline in physical functions, the ability to live independently gradually diminishes, significantly impacting quality of life. According to statistics, elderly individuals in China, on average, spend more than 8 years living with illnesses (refer to "Several Key Points Emphasized by Sun Chunlan for Good Aging Work", China.com, 2019.10.09). Extending the healthy lifespan of older adults and ensuring their abil-

ity to live independently are urgent issues that must be addressed in active aging. This necessitates a shift in our public health system from traditional disease treatment to health management.

Broadly speaking, health management aims to improve quality of life and encompasses a series of management processes and methods that include disease prevention, treatment, and rehabilitation. As a non-pharmaceutical intervention, the environment can provide effective support for older adults' independent living and has been proven to be one of the most important health management measures to ensure the quality of life for older adults. The "Global Age-friendly Cities: A Guide" issued by the WHO in 2007 constructed a framework of age-friendly cities covering both physical and social environments across eight dimensions including "Space and Architecture," "Transportation," "Housing," "Social Participation," "Social Inclusion and Respect," "Civic Participation and Employment," "Communication and Information," and "Community and Health Services." Among these, "Space and Architecture," "Transportation," and "Housing" are placed at the forefront, highlighting the special importance of environmental design. Recently released "Opinions of the State Council on Strengthening Work for the Elderly in the New Era" (Xinhua News Agency, November 18, 2021) also includes creating age-friendly living environments as an important component of work for the elderly in the new era, posing new requirements for disciplines such as architecture, urban planning, and landscape architecture.

In alignment with the WHO Age-Friendly Cities framework, we propose the concept of "Elderly-friendly Community Environments Based on Health Management" (refer to Academic Paper Special Issue of "Architectural Journal", 2018(1):7-12), aimed at providing environmental support for older adults with different health conditions to promote a preventive-focused daily lifestyle. At its core is the integration of "elderly individuals + environment + lifestyle," forming relevant environmental intervention techniques.

2 Framework system of "elderly individuals + environment + lifestyle"

Early age-friendly environment design primarily ref-

erenced universal design standards, equating elderly individuals simplistically with people with disabilities. With the introduction of universal design and inclusive design concepts, designs for elderly environments have become increasingly refined. However, to this day, relevant technologies remain fixated on passive support for functional disabilities. Since the 1990s, the health benefits of nature have been continuously proven through scientific research, leading to the emergence of environmental intervention techniques that integrate the health benefits of nature, such as green care, green exercise, and forest medicine. These techniques offer new avenues for proactive health-oriented designs for elderly environments. Based on extensive research findings and practical cases, we conducted a comprehensive survey across various types of communities in Guangzhou, analyzing environmental issues that support healthy living for the elderly from the perspectives of "elderly individuals," "environment," and "lifestyle."

(1) Elderly individuals: in the surveyed communities, individuals aged 60 and above commonly suffer from various chronic illnesses and experience varying degrees of functional impairments, particularly in mobility, psychological functions, cognitive abilities, and sensory functions. Providing targeted environmental support can help reduce the incidence of age-related diseases, delay the decline in physical functions, assist in the recovery from illnesses, and significantly enhance the healthy lifespan of the elderly.

(2) Environment: present community environments pose varying degrees of safety risks. Current designs for elderly-friendly environments lack evidence-based support for health promotion. Some environmental designs may even have negative impacts, and the activity equipment provided in communities tends to cater only to individuals under 60, highlighting the urgent need for relevant foundational research to establish suitable design guidelines.

(3) Lifestyle: due to limitations in community environmental conditions, a significant portion of elderly individuals with functional impairments are unable to engage in independent outdoor activities, profoundly affecting their physical health and quality of life. Most outdoor environments primarily support static activities like chatting,

sunbathing, and napping, necessitating the provision of more suitable environmental support from a health promotion perspective. Survey results also indicate that independent gardening activities are prevalent in Guangzhou communities, especially among the elderly population, fostering a community environment that integrates the health benefits of nature and provides a solid foundation for a quality lifestyle.

Building upon research outcomes, we explored the holistic integration of “elderly individual + environment + lifestyle” from the perspectives of “comfort and safety,” “activity promotion,” “proximity to nature,” and “interactive connections.” We developed initial principles for designing elderly-friendly community environments based on health management and conducted evidence-based practices in institutions for the elderly in Guangzhou, achieving positive health outcomes.

3 Key technologies and evidence-based practices

“Renovation Project of Rehabilitation Garden in Ciyun Building” at the Guangzhou Elderly Care Facility is an environmental design project aimed at improving the physical, psychological, cognitive, and sensory functions of the elderly. This project was developed based on comprehensive research on the physical conditions of the elderly, existing environmental issues, and the health-related needs of daily life. The goal is to integrate medical rehabilitation treatments into the outdoor activities of the elderly to provide targeted environmental interventions that promote the physical and mental well-being of the elderly. Preliminary results from fall prevention experiments conducted in the rehabilitation garden at the Ciyun Building have shown significant improvements in the walking abili-

ties of the elderly and have effectively boosted their enthusiasm for outdoor activities, thereby contributing positively to their overall well-being and encouraging their active participation (for more details, see doi: 10.3390/ijerph17197023).

During the outbreak of the pandemic, the Ciyun Building played a crucial role in isolating elderly residents of the Guangzhou Elderly Care Facility. The garden served as a space to alleviate the psychological stress of the elderly residents and healthcare workers, improving their emotional well-being and demonstrating the significant potential of environmental interventions in addressing public health issues. Such interventions could offer effective and low-cost solutions to alleviate the societal challenges and healthcare pressures arising from the aging population. Ongoing efforts continue to advance these initiatives, aiming to accumulate more experimental results to provide evidence-based support for the development of a health management-based system for elderly-friendly community environments.

This research work is still being further advanced, and it is expected to accumulate more experimental results to provide evidence-based support for constructing an elderly-friendly community environment system based on health management.

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