Exploration of Online and Offline Community Life Circle with Virtuality-Reality Fusion: Theoretical Advances and Planning Practices

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Abstract: The fusion of virtuality and reality has transformed the combined online and offline service provision, altering residents lifestyles and reconfiguring the layout of community facilities. This shift helps enhance quality of life, ensure equitable access to services, facilitate service allocation, and shape an ideal life circle centered around residences. To this end, this paper explores the concept of the online and offline community life circle by drawing insights from the existing literature. It proposes three major functional characteristics, namely, equalization of services that transcends spatial and temporal barriers, provision of high-level services beyond community limitations, and facilitation of work-life integration to support the development of telecommuting. The paper also predicts two major morphological evolutions, specifically, the expansion of flexible living spaces and living circle boundaries through remote services, and the declining importance of community centers due to the principle of"big dispersion and small agglomeration" and service planning.Furthermore, the paper proposes a "4-layer and 8-category" facility configuration system, incorporating the nature and intensity of service needs to achieve performance levels of"on- line real-time—5-minute arrival—15-minute arrival—30-minute door-to-door". Drawing from case studies, the paper introduces guidelines for facility planning and applies the proposed planning methodology to the design of the"15-minute" service circle for Guanggu Scientific Island, along with policy recommendations.

Keywords: virtuality-reality fusion; community life circle; facility system; Guanggu Scientific Island in Wuhan

Online and offline mode is a new product of the virtual and real integration stage in the information age. Different from the early emphasis on remote communication virtualization service, online is in mobile Internet support, online virtual channels and offline entity channel full collaboration, real-time interaction, common wisdom, efficient production activities of the new mode of [1], including online choose and buy-offline distribution / door-to-door service, offline present experience-online purchase, etc. Virtual and real integration can not only provide virtual services, but also remotely provide physical delivery / door-to-door / experience services, thus broadening the scope of service selection for residents, making them not limited to the limited service content around the residence, but also expanding the service scope and layout flexibility of the facilities, and promoting the supply and demand matching [2]. Therefore, online and offline services have quickly become the mainstream mode of urban service operation, triggering a research boom in urban planning, geography and other fields at home and abroad. The Chinese government is also actively using online mode can assign residents life service, such as the "Guiding Opinions on Accelerating the Digital Empowerment of Life Services" jointly issued by the Ministry of Commerce of China and 12 other departments in December 2023 clearly pointed out the need to "promote online and offline consumption", "build a new education model with deep integration of online and offline", "transform or build integrated online and offline community convenience life service centers", and "improve the quality of services in stores and homes, and online and offline dual scenarios".

Online and offline mode profoundly affect residents living habits and living space [3]. On the one hand, residents can obtain many door-to-door services without leaving home, such as shopping, catering, medical treatment, etc., which may reduce the scope and frequency of residents daily services; on the other hand, residents can obtain services provided by further facilities through online and offline channels, leading to the expansion of the space supporting residents daily life. The "narrowing-expansion" of this life circle may lead to some facilities in the traditional 15-minute

community life circle do not need to be built or replaced by unattended facilities, some facilities are smaller but the scale becomes larger, and the location of some facilities has changed fundamentally. Therefore, scholars in the field of life circle proposed that it is necessary to reflect on and reconstruct the community life circle planning [4] under the framework of the real and virtual activity system. However, in the current planning and construction of community life circle, few scholars study the changes of traditional facilities and the integration and overall layout of various online and offline services. Although the concept [5] of online and offline community life circle has been established, its functions, forms and facility construction requirements have not been defined, so it is difficult to guide practice.

Thus, this paper first through the literature reviewed the online influence of the community life circle planning, and try to combine the new trend of urban production and living in recent years, explore, update the connotation of online community life circle, combined with practice, this paper analyzes its functions, forms and construction guidelines, and takes Wuhan Guanggu Scientific Island as an example to explore the layout methods of online and offline community life circles, in order to promote the construction of an ideal life circle centered on residence, and provide reference for the construction of digital China in the information age and the optimization of urban service systems.

1 Correlation studies

The concept of life circle originated from Japans "fixed living circle". Its core concept is to meet the needs of medical education, employment and commuting, shopping, leisure and life services within the scope of individual activities. The living circle advocates the [7] of various facilities in the living space centered on residents residences. Compared with the traditional index of thousand people, it can better meet the different and diversified needs of residents, so it has quickly become the guiding ideology of urban service facility configuration in the new era.

However, there is an obvious gap between the concept and practice of life circle, especially reflected in the center, boundary and space connotation [8]. Due to the limitations of facility scale threshold, operating cost and service efficiency, the unbalanced and unfair spatial layout of service facilities is unavoidable for [1,9]. Therefore, although the life circle emphasizes residents-centered, it still has to focus on scarce resources in planning practice, take community public space and facilities as the center, and establish clear spatial boundaries (such as community boundaries, roads, rivers, etc.) for easy management and maintenance [10]. It can be seen that this kind of life circle planning still retains the tradition of residential area planning to some extent, and can not fully meet the living needs of residents, and it is still far from the ideal of "life circle".

In the new era, with the rapid development of information technology, the online and offline services of virtual and real integration are widely popularized, bringing the opportunity to realize the ideal life circle. Xiao Zuopeng and other [11] put forward that the life circle needs to pay attention to the behavior change under the technological progress, from "layout facilities" to "layout services". In the era of mobile Internet, with the support of new retail and "Internet +", Chinese online and offline services basically cover all aspects such as medical care, education, elderly care, life, shopping, and government affairs. Many scholars have discussed the spatial characteristics of online and offline services, such as the expansion of online and offline new retail service scope and higher accessibility of [12], e-commerce breeds a large number of scattered small consumption centers [13] in urban edge areas, and mobile office [14] improves the office space of small-scale new city centers in the suburbs. It can be seen that online and offline services are closer to residents residences, and their decentralized and equitable layout is highly compatible with the concept of facility configuration of the ideal life circle. However, in general, online and offline research is still mainly focused on the exploration of online applications of various services [15-16], and lacks a coordinated

and theoretical framework from the perspective of the life circle.

Online and offline services have also expanded the functions of the community life circle and promoted the integration of life and work. Online and offline get rid of the dependence of office on fixed places, and promote the transfer of consulting, management, creation, and research to residence to meet the needs of employment and residential nearby. The space boundary of traditional living, work and leisure is increasingly blurred [18]. Although home office is conducive to improving job satisfaction and efficiency [19], it puts forward a high demand for the production tools and facilities of living space [20], thus generating a new mode of arranging home office facilities near the address. First, the fragmentation trend of online and offline integration can meet the needs of residents to work nearby; second, it can make up for the lack of family hardware conditions, which can create a more comfortable office innovation environment [21]; third, it is more conducive to the employees to balance the work and family life [22]. Relevant practices at home and abroad have been relatively rich, but the study of life circle is still less considered.

In 2019, the author paid attention to the phenomenon and characteristics of online and offline services, and proposed the online and offline community life circle [5] on the basis of the life circle, which caused the extensive discussion of [11] among planners. However, at that time, online and offline applications were not fully launched, so the understanding of the operation rules and spatial characteristics of online and offline facilities was not sufficient. Therefore, this research focuses more on the construction of theoretical framework, defines the concept of online and offline community life circle, and puts forward the supporting content of online and offline facilities and the layout mode of distribution time and circle type. So compared with the traditional life circle, what new functions does the online and offline community life circle integrating virtual and real have? What are the differences in morphology? What are the implications for life circle planning? These have yet to be further explored.

2 The theoretical iteration of the online and offline community life circle

2.1 From the community life circle to the online and offline community life circle

The above analysis shows that the current online and offline services of virtual and real integration have brought new opportunities and requirements for the planning of community life circle. First, it is necessary to grasp the characteristics of the integration of virtual and real services, realize the ideal home-centered community life circle planning, and update the relevant facility configuration methods. Online and offline services can promote the coupling of supply and demand, reduce residents dependence on service centers and the dependence of facilities on market scale, reduce the construction and operation costs of facilities, make equal services possible [23], expand the temporal and spatial scale of residents daily life, and strengthen the supporting role of urban services on residents life. These trends are all consistent with the idea of the ideal life circle. Second, it is necessary to explore the urban service system of "life-work" functions based on the needs of the integration of production and life. Under the requirements of COVID-19 prevention and control, the proportion of telecommuting has increased significantly, and the willingness of workers to telecommuting has been significantly increased [24]. Moreover, with the deep application of artificial intelligence such as Chat GPT and AIGC, more work will be completed with the help of AI, which will expand the industry scope of remote work and the participation group [25]. Therefore, long-distance work will become a key path for individual learning and development, as well as an important support for urban innovation.

In conclusion, in this paper on the basis of [5] research, think online community life circle is based on wisdom, in the online services, for the community all the residents in the home life tolerable walking

travel or home time to provide high quality, equalization, live online living and working space integration (Fig.1). In other words, the online and offline community life circle is a collection of the online and offline personal life circle centered on the home of all the residents in the community.

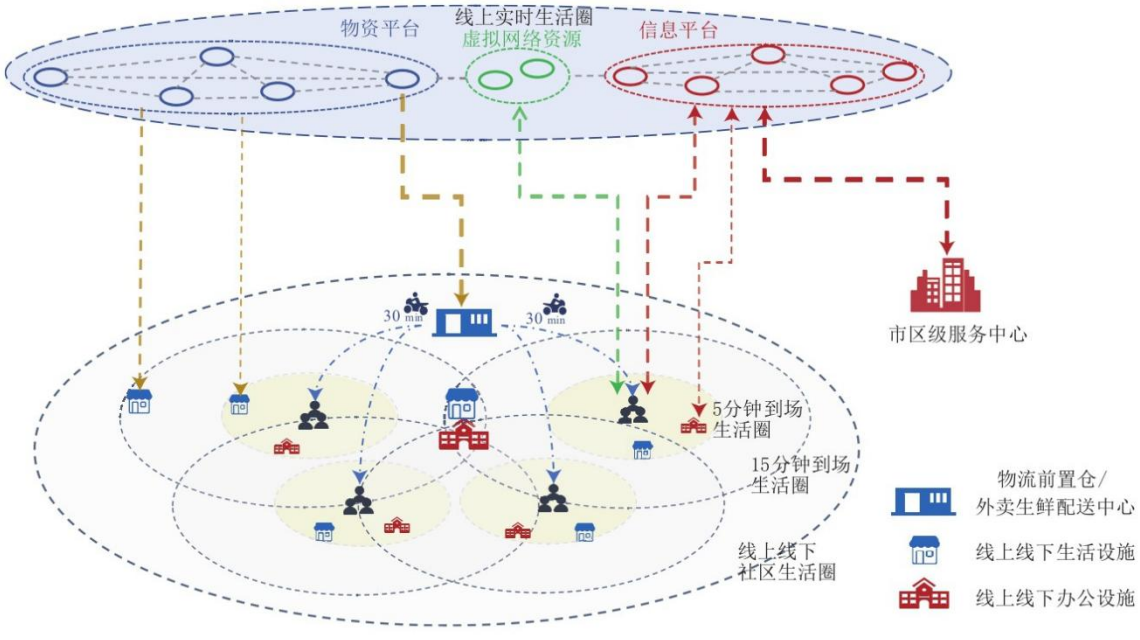

Fig.1 The concept of online and offline community life circle

2.2 The function of online and offline community life circle

2.2.1 Equal services: supply and demand matching across time and space barriers

In the traditional mode, the service scope of facilities is limited, and the service efficiency decreases rapidly with the increase of distance. Therefore, the proximity of community service centers means that residents have the location advantage of enjoying high-quality services. Online and offline mode can overcome the spatial and temporal obstacles, achieve high-quality supply and demand matching, and improve the service performance of [1,26]. For the demand side, residents in the same area can have more diversified service choices, and also enjoy homogeneous and high-quality services provided by higher level facilities. For the supplier, it can reduce the opportunity cost of coupling supply and demand and expand the market size [27]; under the intelligent platform scheduling, the facilities can provide services for a larger range of individual residents through online reservation-offline distribution / service, and realize the efficient operation of the regional facility system through reservation-distribution.

Therefore, the online and offline community life circle will basically realize the equalization of services. The market hinterland of the facility expands, while residents are less dependent on the local service centers. For example, suburban residents can access quality door-to-door services from facilities in the central city, and central urban residents can also eat fresh vegetables produced by suburban farms that day.

2.2.2 Cross-level services: the sinking of high-level services

Community is the high frequency of urban activities, and also the bridgehead [28] of the theory and practice of life circle theory. However, the market size of the community level is limited, so it is difficult to support the continuous operation of high-level service facilities. Therefore, the traditional

community life circle emphasizes "meeting the most basic needs" [29], which has limited support for residents production and life. Relying on online and offline remote services, the services of high-level facilities can directly cover more communities, or establish a closer cooperation mechanism with lower-level facilities, and indirectly connect quality service resources to the community level. For example, e-commerce shopping "half day" reduces the function of department stores to community express stations, and third-class hospitals provide remote assistance to community hospitals.

Therefore, the online and offline community life circle can transcend the limitation of the community only meeting the "most basic needs" of the residents, and fully support the development of human beings. Compared with the past, the service content of online and offline community life circle is more abundant, the facilities are more diversified, and the macro urban service facility system also tends to be flat.

2.2.3 Job and residential integration: support for telecommuting

In the past, the work activities of citizens and life activities were separated, which were connected by employment, residence and commuting, resulting in a series of derivative concepts of life circle beyond the community scope, such as commuting life circle, expanded life circle and other [6]. However, urban production and living activities can be carried out anytime and anywhere based on mobile network devices, and their one-to-one correspondence with space is decoupled from [30]. Individual work activities are integrated into living space (Fig.2). For example, residents, relying on mobile Internet, can carry out design, management, consultation and other activities in home, communities, parks and other places. The urban service system also follows this trend, setting up telecommuting facilities around residents residences, such as Struggle HQ in the Bay Area of California and "Shared International" in Beijing grinding Factory.

Therefore, the online and offline community life circle can realize the integration of life and work services. This not only fits the transformation trend of urban production and life and the immediate needs of residents, but also can stimulate urban innovation and creative behavior, which is conducive to improving the core competitiveness of the city.

2.3 The form of online and offline community life circle

2.3.1 Boundary expansion: resilience from remote services

Behaviors believe that the community life circle is the spatial superposition of the usual behaviors of each resident in the community. This means that the daily life of the residents can be beyond the scope of the community, and the residents of different communities may also act frequently in the same area, resulting in overlapping [31] in the community life circle. Therefore, the current way of demarcating non-overlapping "community life circle units" according to the community boundaries is likely to lead to the mismatch between supply and demand [Fig.2 (b)].

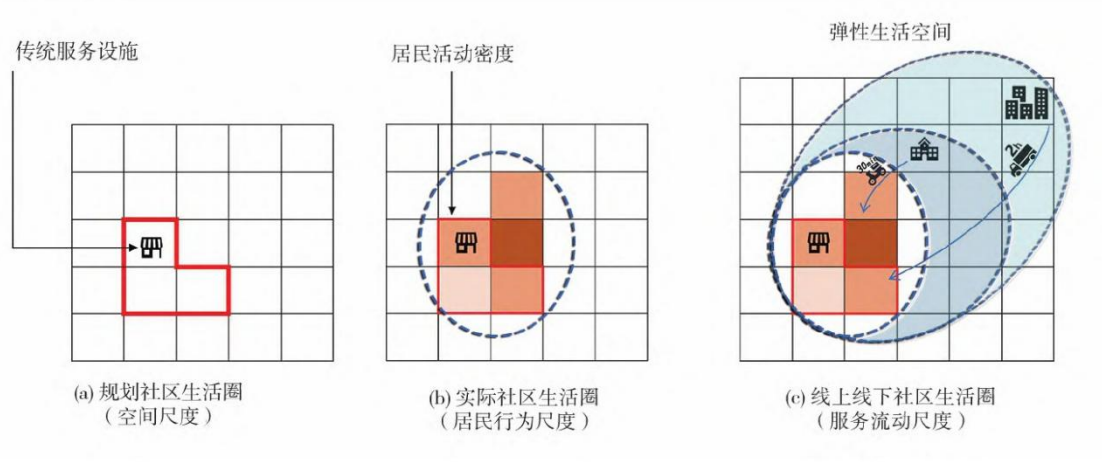

Fig.2 Comparison of the dimensions of online and offline community life circles

The online and offline mode in the new period further expands the boundary of the community life circle. Residents can access services to further areas through door-on-to-door delivery and remote assistance, making the actual space to carry their daily life far beyond the scope of their activities. In essence, it is that residents agree with suppliers through online and offline channels and guide suppliers to deliver services or goods remotely, which replaces residents travel to a certain extent. With the more diversified remote distribution methods of the suppliers (cycling, driving, drones, etc.), compared with the walking scale of the residents in the same time, the residents can enjoy the services in a wider area of the residents with the help of remote supply on the basis of the traditional habitual activity space. Accordingly, the space range of residents physical travel visits will also change. Generally speaking, the space for habitual activities is reduced, and some activities are further visited due to online and offline drainage.

Accordingly, the "flexible living space" brought by this part of remote delivery service should be included in the category of online and offline community life circle [Fig.2(c)]. The so-called "flexibility" refers to the flexible changes of residents to choose a limited range of travel according to their personal preferences, time resources and action ability, and make their living space flexible."Flexible living space" makes the overlap of life circles in different communities become more obvious.

Online and offline flexible living space puts forward new requirements for life circle planning. On the basis of the traditional community life circle planning, also should further analysis of the characteristics of living population and their needs, the daily activities of residents space when space behavior planning study [32], full consideration in its flexible living space using the feasibility of remote services to meet their needs, and on the basis of its diversified demand meet, as much as possible using remote services, rather than blindly through the entity facilities to provide services. In particular, in remote communities and small-scale communities, special attention should be paid to the supporting role of flexible living space in the life of community residents, so as to reduce the cost of service facilities and improve their operational efficiency.

2.3.2 Weakening of centers: the distribution of large scattered and small concentrated facilities

For cost consideration, urban service facilities in traditional life circle planning are often concentrated in advantageous location areas to obtain scale agglomeration economy. However, under the support of online and offline, due to the comprehensive influence of opportunity cost, land rent cost, construction cost and transportation cost, the layout of facilities will generally show a

trend of "large dispersion and small agglomeration".

The first is the "big dispersion". On the one hand, traditional facilities gather in high-quality locations to compete for the flow of people and market size, but it also means higher land rent costs. Online and offline can overcome the time and spatial barriers to promote the matching of supply and demand, and online drainage, which greatly reduces the dependence of facilities on high-quality location [33], so the central facilities can be scattered to low land rent areas, such as plots and upstairs, etc. On the other hand, the online and offline service facilities tend to be more functions, smaller volume and cloud operation, and the construction cost has significantly reduced [23]. Online and offline facilities represented by unmanned terminals can be decentralized and embedded into the community to get closer to the market and meet the high-frequency daily needs of residents.

The second is the "small agglomeration". On the one hand, the same facilities have similar location preferences, for example, the outlets of logistics companies are often close to; on the other hand, some online and offline services rely on high-frequency offline resource distribution, while small-scale agglomeration can reduce the transportation cost of third-party intermediaries (delivery riders), such as delivery factory [34].

Therefore, the centrality of the online and offline community life circle will be weakened. Traditional facilities are similar dispersed and heterogeneous clusters (such as neighborhood centers) under planning intervention to provide diversified services as effectively as possible. However, online and offline facilities already have a large market hinterland, so they are often similar clusters and heterogeneous clusters driven by the market to meet the development needs of the facilities themselves. Compared with the traditional life circle, the layout of facilities and service modes of online and offline can achieve more comprehensive coverage and effective supply of service elements, and provide more equal and accurate urban services for each individual.

2.4 The configuration of the "4 floors and 8 categories" of facilities in the online and offline community living circle

Based on the functions and morphological characteristics of the above community life circle, as well as the needs of residents for virtual and real integration services in the new era, according to the sensitivity of services to time and space requirements, we try to construct four circle systems: online real-time, 5 min presence, 15 min presence and 30 min door-to-door system (Tab.1). At the same time, on the basis of Technical Guide for Community Life Circle Planning and Guide for Complete Living Community Construction, eight types of services, including commercial shopping, life catering, medical and health care, lifelong education, service for the elderly, entertainment, innovation platform and transportation, are summarized. Based on the above architecture, this paper combines the existing literature, excellent case reports at home and abroad, and proposes the land types and space scale of facility allocation. See Tab.2.

Tab.1 Examples of new facilities within the online and offline life circle

	Commercial shopping	Life catering	health care	life long education	Serve the elderly	Sports and entertainment	Innovation platform	Transportation
Online real-time	E bank	Cloud government affairs online payment platform	Cloud hospital psychological counseling platform	MOOC, online school	The AI health management platform	Cloud tourism VR scene hall	Remote conference room consulting platform	

5 min be present	No one sales shop express delivery outlets					Self-service book terminal	Capsule office capsule capsule	Shared car parking station intelligent charging pile smart bus station
15 min be present		Smart experienc e network Intelligent security pavilion	Medical testing station		Communi ty Rizhao pension network	The 24 h library multi-function sports field AR Street Park	Sharing the internation al talent service center	Smart track site
30 min come or go to see sb	Logistics distribution center	Delivery center Fresh distributio n outlets Housekee ping lattice point	Door-to-door detection	Early educatio n home				

Limited by space, Tab.1 and Tab.2 only list the new or transformed facilities in the traditional living circle. In fact, the online and offline community life circle includes not only new online and offline facilities (hereinafter referred to as "new facilities"), as well as traditional service facilities. Most of the new facilities come from the transformation, transformation and upgrading of traditional facilities. Traditional facilities such as schools, theaters and youth palaces are still important, but they are not within the scope of this article for the time being, because there has been no similar innovative practice of integrating reality and reality. In the future, the facility system of online and offline living circle can be gradually expanded according to the actual situation.

Online real-time service circle supports non-face-to-face information transmission services, such as payment inquiry, knowledge acquisition, status monitoring, etc. This kind of service has no requirements for activity space and material transportation, and has fully online conditions. Therefore, an online comprehensive service platform can be built in cities and regions to carry such service needs, so as to save urban space. In the implementation, we should focus on opening up the information sharing channels between different subjects.

Tab.2 Suggestions on the configuration of new online and offline facilities(partial)

Facility classification	Facility name	function	Compatible land type and scale recommendations	Case reference
Commercial shopping	Unmanned stores	Offline purchase, online identification and deduction	R/A/B/M/W,20—50 m2	2017The Shanghai Bingo Box
	Express Courier station	Online scheduling, offline and efficient transportation	R/B/M/W,10—30 m2	2019Beijing Cainiao Station

Life catering	Smart experience network	Offline experience, online order and purchase	B/W,80—150 m2	2022Guangzhou Huawei intelligent life hall NewPark store
	Delivery center	Online order, offline more than catering cluster delivery	R/B/M/W,400—800 m2	2017Nanjing Qinhuai District Jinluan building takeout factory
	Housekeeping service outlets	Online selection, offline door-site service	R/B,50—100 m2	2020Wenzhou Dongtou District, Beiao community convenience service point
health care	Medical testing station	Online consultation, offline physical examination	R/B/M/W,100—300 m2	2021Gexiang Community Smart Health Station, Yuhang District, Hangzhou
life long education	Early education home	Online course, offline neighborhood group class practice	R/B,200—500 m2	2021Beijing young starting point wisdom childcare early education
	university for the elderly	Offline chain campus, online live broadcast cloud class	R/B,1000—5000 m2	2020Guangzhou Shengnian University
Serve the elderly	Community Rizhao pension network	Online monitoring and consultation, and offline home care	R/B,200—400 m2	2020Shandong Rizhao, Zhengzhou Road community wisdom health care
Sports and entertainment	Self-service book terminal	Online resources sharing, offline physical borrowing	R/A/B/G,2—5 m2	2021Guangzhou Chujieker self-service book service terminal
	Multi-functional sports ground	Online audio and video interaction, offline intelligent experience	R/A/G,200—1000 m2	2021Tangshan Yimin Garden Smart Community
	AR Street Park	Online and offline synchronous tour	R/G,1000—3000 m2	2021Shenzhen Luohu District Sungang Interchange Community Park
Innovation platform	Sharing	Online payment, and offline sharing of social space	R/B/M/W,200—1000 m2	2022Shenzhen Chuangfu Port Luohu Jinfeng City store
	Capsule sleep capsule	Online query appointment, offline to rest	B/W/M,2—3 m2	2020Chongqing Jiangbei Airport
	Capsule office	Online inquiry and appointment, and offline self-service affairs	R/A/B/S,2—3 m2	2018Tokyo, Japan
transportation	Intelligent charging pile	Online query, offline charging	Combine the parking space design	2017 Shanghai Jingan Yijing Garden Tesla charging pile

	Smart bus station	Online monitoring, payment, and offline ride	Construction according to the standard of bus stations	2022 Meixi Lake Smart bus Station in Changsha
	Intelligent track site	Online monitoring, payment, and offline ride	Construction according to the standard of the track site	2019 Guangzhou Metro Line 3

The 5 min on-site life circle supports basic security services with high time sensitivity and low space demand. First, this kind of service has not high requirements for service personnel and service equipment, which can be realized through Internet of Things monitoring and unmanned operation, and the layout cost is low; second, this kind of service requires frequent demand and high spatial proximity and accessibility, which needs to be widely distributed downstairs of residents, within the community and both sides of the road. In order to meet the above requirements, such service facilities should be characterized by small volume, flexible space and scattered layout, such as unmanned vending machine, capsule cabin, intelligent charging pile, etc. The service radius is based on the 5 min walking distance, namely 300-500 m centered on the residence. Although the back end of such facilities relies on intelligent IOT, the front end still needs manual maintenance and requires the establishment of a long-term and sustainable operation and maintenance mechanism.

The 15 min on-site life circle supports the basic guarantee and quality improvement service with moderate time sensitivity and high space requirements. First, this kind of service focuses on scene atmosphere and face-to-face service, and also has certain requirements for offline service equipment and service personnel; second, this kind of service is mostly for a specific group rather than covering the whole population, and the demand is slightly less than the 5 min service circle. Limited by economy, space and social cost, such services are suitable for reconstruction based on traditional facilities, such as shared office, experience hall, Rizhao pension network, medical testing station, etc.; the service radius is based on the 15 min walk by residents, namely 1-1.5 km centered on residence.

30 min door-to-door life circle corresponds to flexible living space, supporting low time sensitivity, low space requirements, and remote distribution supply leading services. The location of such services is often at home, office, or without clear restrictions, ready for door-to-door service; time flexibility is high, and demanders and suppliers can make appointments in advance and discuss the time freely. Therefore, with the support of online platforms, the scope of such services is suitable for the standard of supplier delivery (electric vehicle, driverless car travel). Considering that the matching and preparation of the service take some time, the service radius is 3-5 k m centered on the residence, that is, the relevant facilities are located in the area with relatively convenient transportation and relatively low land rent within 3-5 k m away from the market subject. At the same time, an efficient slow traffic network should also be reserved in the layout of road traffic to support short-distance logistics distribution and personnel circulation.

3 Planning and exploration of online and offline community life circle: take Wuhan Guanggu Science Island as an example

In the project of "15-minute Service Circle Design Guidelines" of Wuhan Guanggu Scientific Island in 2022, taking "digital empowerment" as one of the design principles of urban service system, taking the lead in implementing the concept of online and offline life circle in the planning. Guanggu Scientific Island is located in the east of Wuhan city and the central core area of Wuhan New City, It

is the innovation source of Hubei Optical Valley Science and Innovation Corridor strategy, The research significance is outstanding; As an area of the new city to be built, Its total area of 17.15 k m2, An estimated population of 67,000, Equivalent to 2 complete residential areas, Moderate scale; With both industrial parks, residential areas, business centers, etc., Comprehensive functions, rich space types, Representative of the research; It is expected to be scientists, high-end service personnel, business owners, etc., Its life and work have a high degree of wisdom, More likely to accept the online and offline urban service operation mode, Research nature is typical.

3.1 Requirement analysis

First of all, combined with the actual situation and planning positioning, clear the population attributes. East Lake Science City is a planned new city to be built. According to the Land Space Planning of East Lake Science City (2021-2035) (compiled simultaneously), the Science Island area is divided into four groups, such as starting area, science and technology research and development area, large scientific installation area and comprehensive service area. The main land composition is shown in Fig.3. Therefore, the age, income and living habits of the population to be settled can be estimated according to the leading industry and land use composition of each group (Tab.3). For the built-up area, the questionnaire survey and big data analysis can also be combined to improve the accuracy.

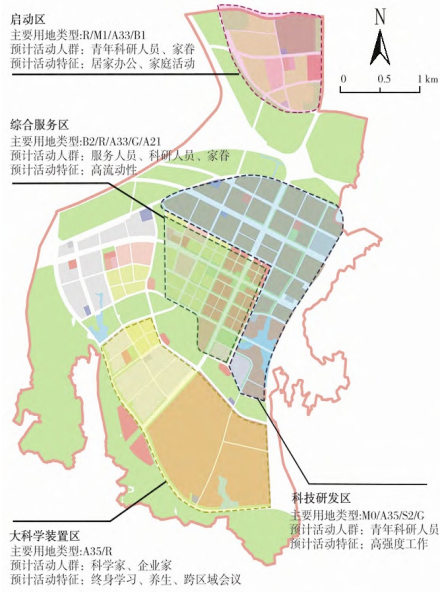

Fig.3 Overview of functional clusters of Guanggu Scientific Island

Secondly, according to the spatial and temporal distribution and living habits of the population, the key allocation content of public services is clearly defined. Since the construction of science island is still in its infancy and there is a lack of temporal and spatial behavior data, this paper simulates the spatial and temporal distribution of people in this area (Fig.4). Take the "startup area" group as an example, the area is expected to live 20,000 people, small family units, working space and time flexibility, home working probability, in weekdays and weekends, need to go to the company or quiet places to work; weekend family leisure activities, to parks, theaters, museums, etc. Therefore, the start-up area not only needs to configure the commercial, living, elderly care and other services required by the traditional living space, but also puts forward higher requirements for the comfort of home office, as well as the convenience of life catering and commercial shopping. On the other hand, the residents in this region are younger and highly knowledgeable, and most of the children are kindergarten and primary school-age children. Therefore, excellent children's education services are also conducive to the introduction of talents in this region, as shown in Tab.3.

Tab.3 Activity characteristics and service needs of each group in Guanggu Scientific Island

Group name	Main land types	The type of crowd	Characteristics of life	Demand type	Public services focus on the direction
promoter	R/M/A/B	Researchers and their families	Youth; home work; home activities	Diversified and personalized needs	Innovation platform, lifelong education, commercial shopping
Science and technology research and development zone	M/A/S/G	Research Specialist Staff	Youth; intensive work	Convenient type, a one-stop shop	Innovation platform, life and catering, sports and entertainment
Large scientific installation area	A/R	Scientists, and entrepreneurs	Middle-aging; nurturing and relearning; cross-regional meetings	Leisure, convenient transportation	Sports and entertainment, service for the old, transportation travel
Comprehensive service area	B/R/A/G	Service staff, family members	High liquidity; low and medium income	Basic public services	Commercial shopping, life and catering, innovation platform

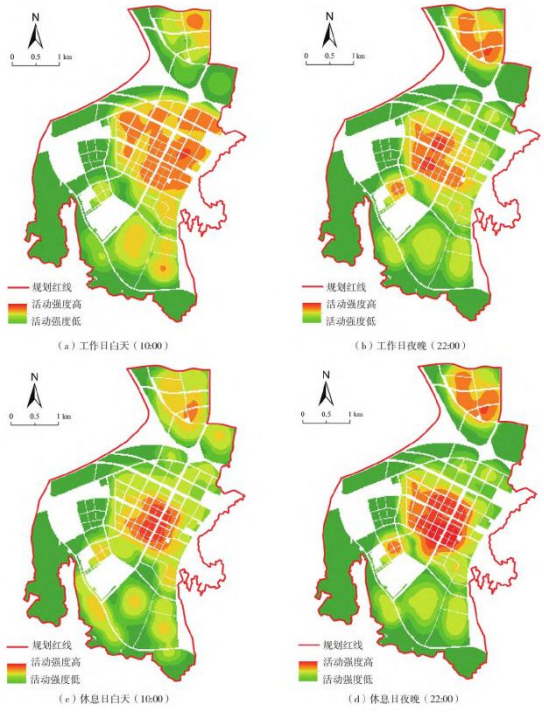

Fig.4 Spatial-temporal human activities in Guanggu Scientific Island(simulation)

3.2 Supply decision

Combined with the current situation or planning scheme of traditional facilities, the spatial layout and scale of new facilities are proposed. Taking the launch area of Science Island as an example, according to Table 3, innovation platform, lifelong education and commercial shopping are the key allocation points of public services in this area, which are specifically as follows:

(1)In terms of innovation platform, the capsule office cabin and short and medium office sharing interval can be added to meet the needs of home office and adjacent office. According to the employed population of 12,000 and the proportion of home office of 0.5①, Including: normal sharing coefficient 0.3, about 1000 shared work stations; temporary sharing coefficient 0.05 ②, about 180 capsule office spaces shall be provided. In the specific layout, the capsule office cabin can be flexibly and distributed in the open space in front of the house, the green square, the bottom of the viaduct and the green isolation belt, and the sharing space can be arranged in the high-density and low-land rental areas of the residents daily activities inside the plot.

(2)In terms of lifelong education, there is a middle school and primary school in the middle part of the group, and there are many kindergartens in the residential area, which can basically meet the educational needs. Considering residents preference for high-quality educational resources, home early education outlets can be built to provide customized extracurricular interest training and early education courses. The early education home outlets can be set up in combination with the kindergarten, and can also be built in the adjacent parks to facilitate outdoor collective activities.

(3)In terms of commercial shopping, the commercial street concentrated on the east side of the group is not highly convenient, while the stores facing the street outside the residential area are scattered and the business rate is low in the short term. Therefore, e-commerce online shopping is still an important commercial support in the starting area. Therefore, express outlets should be set up in residential areas and shared "honeycomb" in adjacent buildings to improve the logistics terminal network; 24 h unmanned vending shops and several vending machines should be arranged to meet the temporary shopping demand during the construction of the new city.

(4)In addition to the above key services, life catering and entertainment facilities, such as unmanned vending stations and express stations to meet the needs of shopping, and AR parks to meet the needs of sports and leisure, so as to further enhance the regional attractiveness and service completeness.

The above facilities focus on two levels of 5 min and 15 min. The startup area is small and falls within the 30-min on-site radiation range of the adjacent built-up area. Therefore, in the early stage of construction, you can enjoy 30 min door-to-door services provided by other regions, such as takeout and fresh delivery, remotely, online and offline, to improve the quality of life in the region. The relevant layout is shown in Fig.5.

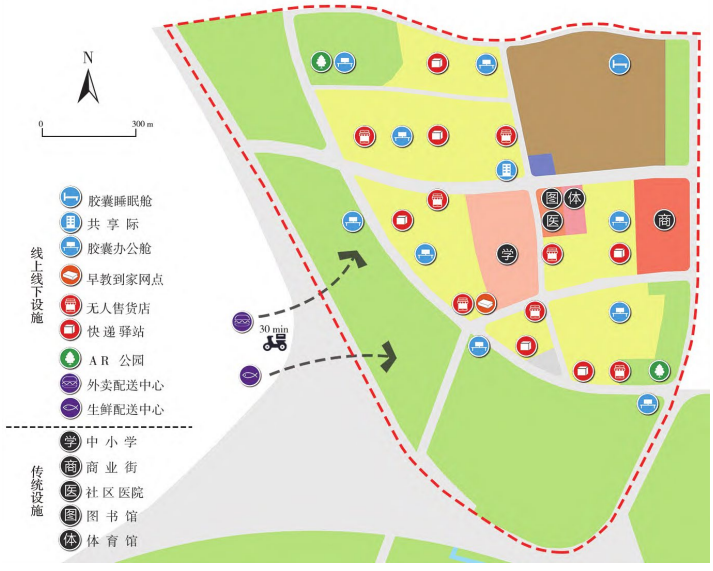

Fig.5 Schematic layout of online and offline facilities in the project launch area

3.3 Planning strategy

First, in the planning and connection, establish the transmission mechanism of service facility configuration between control and regulation. Suggested online service new facilities supporting layout in the rules of public service research list, in accordance with the "crowd characteristics-activity of space and time distribution-demand analysis-facilities supply", clear online services of typical partition and facilities, including online service facilities supply type, scale, distribution of control indicators, and to carry out the construction in the rules. At the same time, because the relevant facilities are mainly combined with other types of land use, involving micro-space construction, the location of the facilities can be flexibly adjusted within a certain range and determined in depth according to the specific plan.

Second, in terms of facility allocation, the establishment of a smart service platform with cities and the operation mechanism of dynamic construction of facilities. First, the online service resources and demand resources are integrated to evaluate the time and space behavior of online and offline intelligent platform, combine the public feedback, flexibly schedule and dynamically construct the facilities of high utilization rate according to the utilization efficiency and community demand. Secondly, considering the substitution / supplement effect of new facilities and traditional facilities in meeting the needs of residents, as well as their respective advantages, a reasonable allocation ratio and scale conversion coefficient of new facilities should be set to improve the resilience of the urban service system.

Third, in the support system, the establishment of the "sky-earth" integrated service transportation corridor. The area slow traffic system is configured with a high standard, reserve the fast cycling distribution corridor between plots and within plots, and propose the corridor width and density construction requirements; propose to reserve the air transport corridor in the planning, limit the high-rise building and high-pressure corridor, and coordinate the planning in combination with the urban air duct system.

Fourth, in the operation mode, the establishment of community-level "government, enterprise, people" cooperative governance mechanism. Online and offline activities are time and space fragmented, and the scale of facility construction is small and large, so it is necessary to build a collaboration platform with the community as the carrier to improve the efficiency and level of

facility operation. At the same time, in order to avoid excessive investment in public resources, the government should take the lead to promote the active entry of social capital; establish an open and transparent cooperative governance and public supervision mechanism to continuously standardize and improve the operation of online and offline facilities.

4 Conclusions and Outlook

4.1 Main conclusion

The online and offline services integrating virtual and real in the information age improve residents happiness and urban vitality, and also profoundly affect residents daily living habits and living space. In order to adapt to the new trend, meet the new needs, and realize the ideal life circle goal, the community life circle needs to update the concept and planning methods. Based on the concept of online and offline community life circle and the actual situation of online and offline services, this paper once again explores and updates its theoretical connotation, systematically analyzes its functions and forms, and puts forward the facility configuration guidelines and planning methods.

First of all, the functions of the online and offline community life circle are more abundant than those of the traditional life circle. Based on the integration of reality and reality, it can realize the matching of supply and demand in cross-time space, expand the scope of facilities and the selection of residents, and promote the equalization of urban services; beyond the limitation of "most basic services" in community life circle, remotely deliver high-level services to community level, promote the diversification of community services; not only provide daily life services, but also support remote office and home office, which is conducive to the integration of employment and housing and fit the trend of fragmented activities. The above findings can help to deepen the understanding of planning researchers understanding of the role, advantages and mechanism of online and offline services, and also provide a theoretical basis for the subsequent community life circle planning.

Therefore, the form of online and offline community life circle is also more complex. The online and offline community life circle not only contains the traditional usual activity space, but also needs to consider the space for residents to use online and offline services. Under online and offline scheduling, the remote distribution of the supplier replaces residents travel to some extent, which makes the space supporting residents daily life far beyond its offline activity space, that is, the elastic expansion of the community life circle. Secondly, the central location of the traditional community center fades, and the facility location factor reevolves into the layout of "large dispersion and small agglomeration", so as to realize the comprehensive coverage and effective supply of service elements. The above discovery constructs a bridge between online and offline services and community life circle planning, and promotes the update and improvement of the life circle theory in the information age.

Therefore, centering on the above trends and characteristics, this paper constructs a "4 layers and 8 classes of online and offline"."4 layer" refers to the four time space category of "online real-time---5 min arriva---15 min arrival---30 min door" centering on service accessibility, demand level and implementation mode."8 categories" are 8 types of service, such as commercial shopping, living catering, medical care, according to the existing living circle configuration guidelines and existing practice cases. On this basis, combined with practical application, the main functions, land layout and scale of various facilities are put forward from the perspective of spatial planning. The above conclusions can provide a reference for the community life circle planning and the future community construction.

Finally, taking the service circle planning of Wuhan Guanggu Scientific Island as an example, the

above method is applied. In practice, the online and offline community life circle puts more emphasis on the investigation of residents spatial behavior [35], starting from the individual needs of residents to the service supply of facilities, and then allocating the corresponding facilities according to the realization mode and accessibility of services. At the same time, we also put forward a series of planning and management suggestions. The above application further explains the characteristics of the online and offline community life circle, as well as the planning and configuration methods.

4.2 Shortcomings and prospects

There are still some shortcomings in this paper. First, this paper focuses on the connotation and functional form characteristics of online and offline community life circle in the current period, but the facility configuration method is not detailed and comprehensive enough. The selected case of Guanggu Scientific Island also focuses on the application examples of methods, and has not yet obtained the feedback of the implementation after completion and operation. Second, the content of online and offline life circles is being innovated constantly along with the development of information technology, and the system structure and facility scale of its facility configuration scheme still need to be continuously observed and verified. Third, due to space constraints, there is no discussion about the impact of online and offline services on traditional facilities and the adjustments that need to be made in the configuration of traditional facilities.

With the rapid development of artificial intelligence and the construction of digital China, the virtual and real integration of urban services continues to advance, and its depth and breadth are still expanding. The further improvement of the wisdom and mobility of digital services will have a huge impact on urban services: after the improvement of remote diagnosis and treatment, the basic medical needs will be solved without leaving home, and will the medical system be reconstructed? XR technology greatly meets peoples spiritual needs. How to transform cultural and educational facilities? With the 24 h intimate care of medical robots and VR entertainment, whether the content and layout of the elderly care facilities will change. It can be predicted that the urban space is facing a new round of "digital revolution", which also brings opportunities for further optimization of urban space: for the old city renewal, flowing online and offline facilities can improve the performance of urban space utilization, and the saved space can layout more green open space focusing on experience; for urban structure, flat and equal online facilities reduce the importance of central location, promote the decentralization of urban space, relieve the function of urban center, promote the development of suburban communities, and improve the overall performance of urban space [36]. All of these are worth further discussion.

Explanatory note

① According to the Statistical Report on The Development of The Internet in China (2022), the number of online office users in China has reached 469 million, accounting for 45.4% of the total Internet users. Take the 50% here.

② According to the daily office hours of 8:00-22:00,1 hour, that is, the average probability of use of office people except normal sharing is 0.05.

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