

Spatial-temporal characteristics and constraints of daily activities of the elderly in rural areas*

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Abstract

The aging of China's rural population is becoming more and more serious, and the daily behavioral activities of rural elderly people have attracted attention. Based on the family life cycle theory, 456 activity diaries of 234 elderly people in rural communities. China were collected by using the activity diary survey and interviews of the new time geography, and the time-space characteristics and social network relationships of the daily activities of rural elderly people were analyzed. It is Found that: (1) the daily activities of the elderly with different family relationship structures have large differences, the activities of the elderly in multi core and dual core families are more compact and regular, with relatively more working and going out activities, while the activities of the empty nesters and widows are relatively loose, with more domestic activities and watching cell phone and TV; (2) Rural elderly people's working activities are generally within 1,500 meters, leisure activities within 1,000 meters, and living activities within 500 meters, (3) Empty nesters and widows have a stronger need for the companionship of their neighbors and friends, and should pay more attention to the construction of a 15-minute community living circle in the countryside. Then, Sixteen typical activity paths and four constraint patterns are summarized, and the constraints of rural public service facility configuration and family-neighborhood-public activities on the activities of the elderly are analyzed, hoping to propose ideas for the construction of rural community life circle from the perspective of the elderly.

Keywords

Rural elderly, Activity characteristics, Circle of life, New time-geography, Rural communities

1. Introduction

According to the seventh national population data survey of China, as of November 1, 2020, the proportion of China's population over 60 years old is 18.7% and the proportion of population over 65 years old is 13.5%, compared with the past, the number of China's elderly population continues to grow and has entered the stage of population aging(Yuanzhi,G., Yang, Z., and Yue, H.,2019). In recent years, with the accelerated urbanization process, the loss of rural labor force is serious, and the problem of rural aging is more serious, and the daily living circle of rural elderly has received extensive attention from urban planning scholars. In December 2021, the State Council issued the "14th Five-Year Plan", which requires municipalities to actively explore the construction of rural community life circles. The rural living circle can be understood as a rural activity movement system and built environment from the perspective of the spatio-temporal behavior of residents' activities (Daosheng, S., and Yanwei, C.,2018).

Time geography is an important theory in the study of "behavior-space" interaction, and its integrated ecological worldview emphasizes the holistic and unified view of time and space from the perspective of micro-individuals, the constraints of the material world and social systems on individual behavior, and

the "process" of interaction between individual daily life and other individuals and organizations (Hägerstrand, T., 1970; Yanwei, C., 1998). It focuses on the "process" of interaction between individuals' daily lives and other individuals and organizations, aiming to achieve sustainable development of people and the environment (Yan, Z., Yanwei, C., 2016). The core concepts and symbolic systems of time-geography, such as paths, prisms, constraints, project, and the nesting of local orders of activities, have become important tools and theories for the analysis methods of human activities (Ellegård, K., and Yan, Z., 2016). With social changes and the increasing complexity of human activities, the new time-geography represented by Kajsa Ellegard has made a breakthrough in terms of research perspectives, research methods, theoretical development and applied research, and the study of human activities has shifted from "outside the home" to "inside the home", from emphasizing the constraints of "physical space" to emphasizing the constraints of "social culture" (Yaqian, M., and Jiuquan, L., 2020). The new time-geography considers the home as an important pocket of local order in daily life and an important point of residence for individual activities, emphasizing the importance of family project for the organization of individual daily activities and reflecting the influence of family group constraints on individual activities (Ellegård, K., and Palm, J., 2015). For the elderly, they are in the later stages of their life course and family members' activities have an important impact on them. Foreign scholars have focused on family and group perspectives to analyze the behavioral activities of the elderly (Petersen, M., and Minnery, J., 2003; Cochrane, T., et al. 2009). Current research in China focuses on the individual perspective of the elderly, exploring their travel characteristics, activity influencing factors, the interaction between the elderly and the built environment, and the healthy living environment of the elderly (Jianzhong, H. Meng W., and Yang X., 2016; Ren D., Lin, L., and Wen H., 2016; Jie, Z., and Yanwei, C., 2013). More attention is paid to urban elderly in the study, and there is still a shortage of research on rural elderly (Haiqiang, L., Zhihao Z., and Xidong M., 2021; Yi, H., and Xiaoyu, Z., 2018). Therefore, it is necessary to understand rural elderly behavior from a family life cycle perspective.

Based on life circle theory and new time geography theoretical methods, we explore the behavioral activity characteristics of rural elderly from the household perspective, dissect the spatial characteristics of rural aging life circles, and explore the solutions of rural elderly welfare facilities and rural community construction in the context of aging society. Taking the rural villages in northwest China as an example, we adopt the new time geography activity analysis method and journal survey method to study the space-time behavior characteristics and social network relationship of rural elderly people's daily life under the influence of family life cycle, analyze the constraints of facility construction and family activities on elderly people's activities, and explore the interaction mechanism between rural elderly people's behavior and activity life circle.

2. Study area, data and methods

2.1. Study area

The study area takes the Qingchun village of Yinghu Town, Ankang City, Shaanxi Province, which is located in the mountainous hilly area south of the Qinling Mountains, about 20 km from the center of Ankang City and about 5 km from the center of Yinghu Town, with relatively convenient transportation, a comfortable but closed living environment, and a weak industrial base of the village (Figure 1). By the end of 2021, the total population of the youth village was 1,690, of which 321 people were over 60 years old, accounting for 18.99% of the total population, and 212 people were over 65 years old, accounting for 12.54% of the total population, and the village had a serious problem of population aging. The case villages help to understand the characteristics of daily life of rural elderly in mountainous hilly areas and provide a basis for future research on aging in different villages.



Figure 1. Study area. Source: Author's painting.

2.2. Data source

The activities of the elderly in the countryside are greatly affected by the seasons, so we chose to investigate the activities of the elderly during the appropriate season and the period of frequent activities. Through filling in activity diaries and interviews, the survey collected a week's worth of activity data from the rural elderly from November 22 to 28, 2021, and obtained 225 valid logs, which was a busy time in autumn when rural activities were more abundant. On the basis of data collation and analysis, a one-week survey of elderly activities was conducted again from February 24 to 30, 2022, and 231 valid logs were collected. This period was the eve of Spring Festival, when family activities had a greater impact on the elderly. Among the respondents, 152 were male and 82 were female; 74.3% were aged 55 to 70, 19.7% were aged 70 to 80, and 6% were aged 80 or above; 64.1% were empty nesters, relatively few were widows and orphans and elderly in multi core families; the economic situation of elderly families was generally average.

Table 1: Basic information of the interviewed elderly. Source: Author's painting.

Category	Properties	Number (s)	Proportion (%)
Gender	Male	152	65
	Female	82	35
Age	55~70	174	74.3
	70~80	46	19.7
	Over 80 years old	14	6
Family Structure	Widowed elderly	22	9.4
	Empty nesters elderly	150	64.1
	Dual Core family elderly	44	18.8
	Multi core families elderly	18	7.7

Annual household income	50,000 or more	26	11.11
	30000~50000	114	48.62
	Under 30,000	84	37.61
	Poor Families	12	5.13

2.3. Research Methodology

From the perspective of individual activities of the elderly in different life cycles, the activities of the elderly are integrated into the local order of the rural community life circle, and the basic characteristics of the daily activities of the elderly in the countryside are grasped by analyzing the characteristics of time use, spatial part and social network relations of the elderly activities. Secondly, we analyze the constraints of rural elderly people's activities by combining the new time-geography constraint model, starting from the physical space and social culture, the authority constraints of rural public service facilities allocation, and the combination constraints of "family-neighborhood-public" activities. In order to propose the idea of planning and construction of rural community life circle based on space-time planning and social security support (Figure 2).

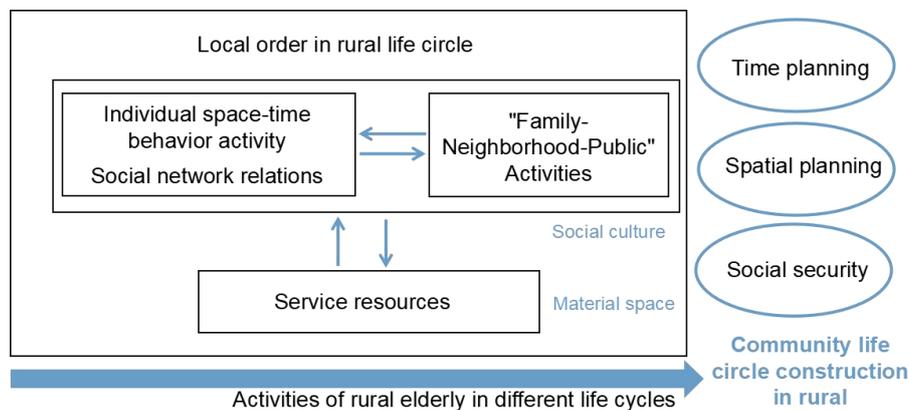


Figure 2. Research framework of elderly behavior activities in rural community life circle. Source: Author's painting

3. Time and space characteristics of daily activities of rural elderly

The activity characteristics of rural elderly were analyzed comprehensively from three aspects: activity time, activity space, and social network relationship of activity companions.

3.1. Activity time utilization

Using the activity diary survey data of rural elderly people, we depicted the "activity-movement" time rhythm of elderly people in different household life cycles and observed the time distribution characteristics of various activities of elderly people (Yanwei, C., and Enzhou W., 2001). In the resident activity rhythm chart, the horizontal axis is the time axis, representing a 24h day, and the vertical axis represents the proportion of the sample in which a certain type of activity occurs at a certain time (Yanwei, C., and Hua, G., 2001). In terms of activity categories, the rural elderly were categorized into six categories of activities: "taking care of themselves (sleeping, eating, personal care), taking care of their families (housework, childcare), leisure activities (walking, meditation, watching TV, looking at cell phones), work activities (farming, business, farming), social activities, going out and other activities" (Figure 3).

In terms of activity rhythm, there are differences in the activity rhythm of the elderly in different families, and the peak activity occurs in the morning and afternoon. The activity rhythm of the elderly in multi core families and dual core families is relatively more restricted by their children, and their activities are more regular and intensive, with 7:30~12:00 and 13:30~19:30 being the more intensive time periods for the elderly: The activity of empty-nest elderly peaks at 8:30, 12:30, 15:30 and 18:00, and there are obvious peaks at these two time points in the afternoon; the activity rhythm of widowed elderly is simpler, and there are obvious peaks at 11:30 and 18:00.

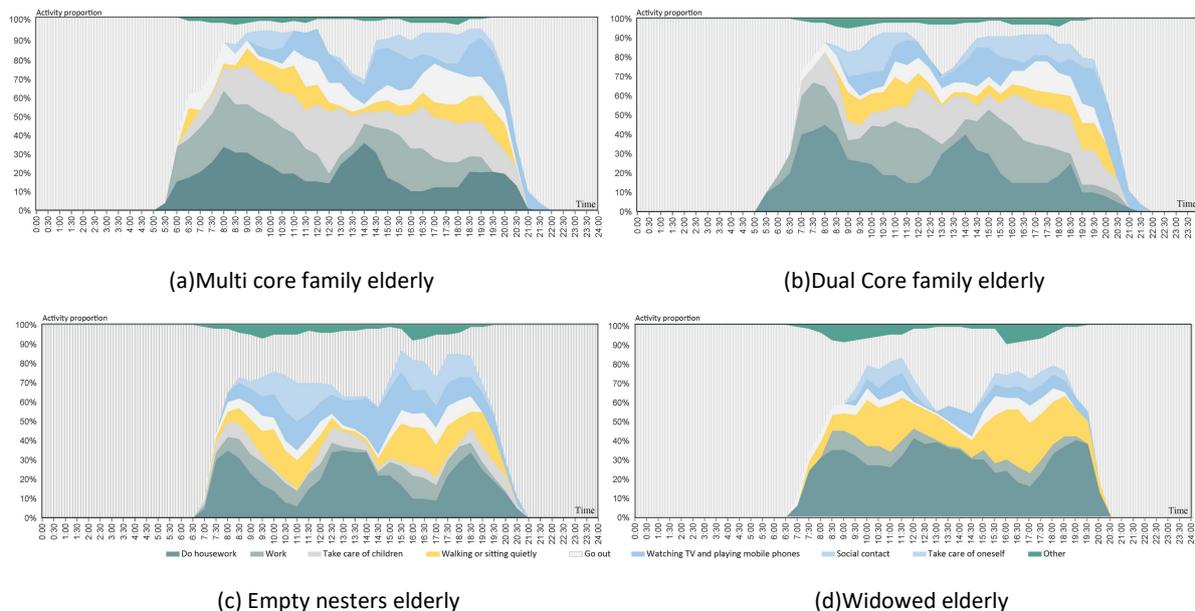


Figure 3:Rhythm of activity time of elderly people in different family life cycles in rural areas. Source: Author's painting

In terms of activity types, the elderly in multinuclear and binuclear families spend relatively less time taking care of themselves in their daily activities due to the higher frequency of bringing up grandchildren, farming and running work activities, and more time taking care of their families, working, going out, and bringing up children, and more average time for leisure and recreational activities. The characteristics of early rising and late sleeping are more obvious in this part of the elderly population, such as getting up at 5:00 am and going to bed at 22:00 pm, which is due to the need to get up early to do housework, work or go out, while late sleeping is due to the influence of activities such as excessive TV and cell phone watching. Empty nesters and widows spend more time doing housework and walking and sitting quietly, and less time going out; compared to other elderly people, empty nesters spend more time watching TV and watching cell phones and socializing in a day, indicating that they need more companionship, while widows are less likely to engage in such activities, mainly due to their closed social circle. Also of concern is the impact of the morning bus departure time, which forces seniors who need to go out to get up early and get to the station at 6:30 a.m. This also increases the compactness of their activities.

3.2. Activity space distribution

The activity space rhythm and time-space paths were used to represent the 24-h continuous activity trajectories of different elderly people in rural areas. From the composition of activity space, the activity space of rural elderly can be summarized into six categories: "home, field, village road, neighbors' homes, square, and city" (Rantakokko, M., et al, 2015). By analyzing the percentage of activity spaces and typical activity paths of the elderly in different households in a day, we explored the differences in the characteristics of activity spaces and activity paths of the elderly during weekends (Figures 4-7).

The rhythm of each elderly activity space is more regular, with the peak of out-of-home activities at 10:30~11:30 and 16:30~17:00, and the peak of home activities at 13:00~14:00. In terms of the proportion of activity spaces, home, fields and village roads are the main activity spaces for rural elderly; elderly people generally choose to go to neighbors' homes or to squares in the afternoon, and a higher proportion of empty nesters go to neighbors' homes and squares compared to other elderly people; elderly people occasionally go to cities, with more opportunities for multi core family elderly to go to cities. Overall, the elderly in multi core family and dual core family elderly households have a higher proportion of activities "outside the home", while the elderly with empty nesters and widows have a higher proportion of activities "at home".

Activity paths reflect the spatial displacement of people's activities (Hägerstrand, T., 1985). By comparing the intra-weekend and weekend activity paths of various categories of elderly, it can be seen that the spatial differences between intra-weekend and weekend activities of the lonely elderly are small, while there are some differences between the elderly in other families.

The multi core family elderly would travel to their children's homes in town in the afternoon on weekends, and accordingly spend more time caring for children and doing housework; the dual core family elderly would have a higher probability of going out for medical treatment in the morning on weekends, so farming activities in the fields would be pushed to the afternoon; the empty nesters would have greater differences in intra-weekend activities, with medical visits to town generally scheduled in the morning during the week, farming activities in the afternoon, and farming activities in the morning on weekends, and have more time to go to neighbors' houses; the widows and orphans have little difference between intra-weekend and weekend activities. It can be found that the return of children to their homes on weekends has an impact on the activity space of elderly in multi core families versus dual core families.

The empty nesters' activities varied more during the week, with medical visits to town generally scheduled in the morning during the week, farming activities in the afternoon, and farming activities on the weekend in the morning and more time to go to neighbors' homes; the widows and orphans had more stable activities during the week. It can be found that the return of children to their homes on weekends has an impact on the activity space of elderly in multi core families versus dual core families.

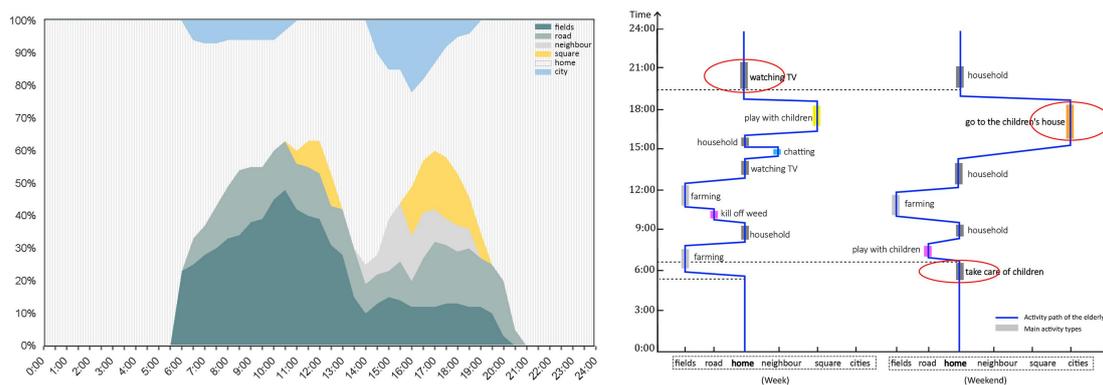


Figure 4:Activity space of elderly people in multi-core families (Left: activity rhythm; Right: active path) . Source: Author's painting

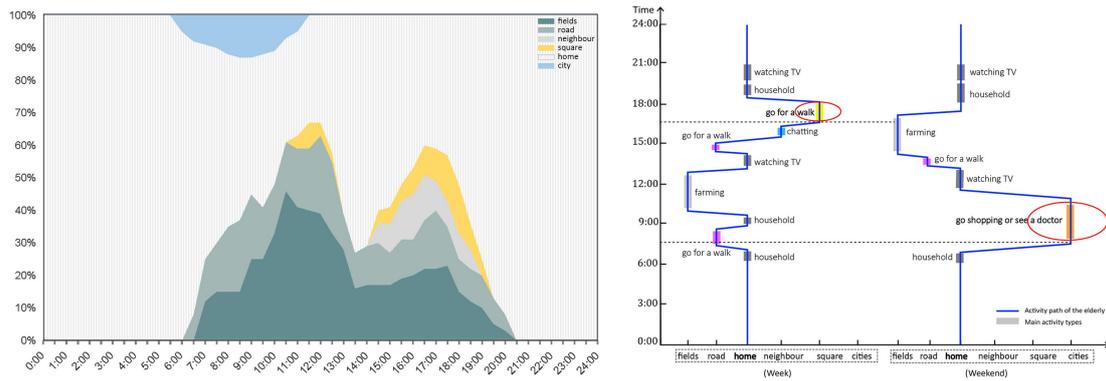


Figure 5:Activity space of empty nesters elderly (Left: activity rhythm; Right: active path) . Source: Author's painting

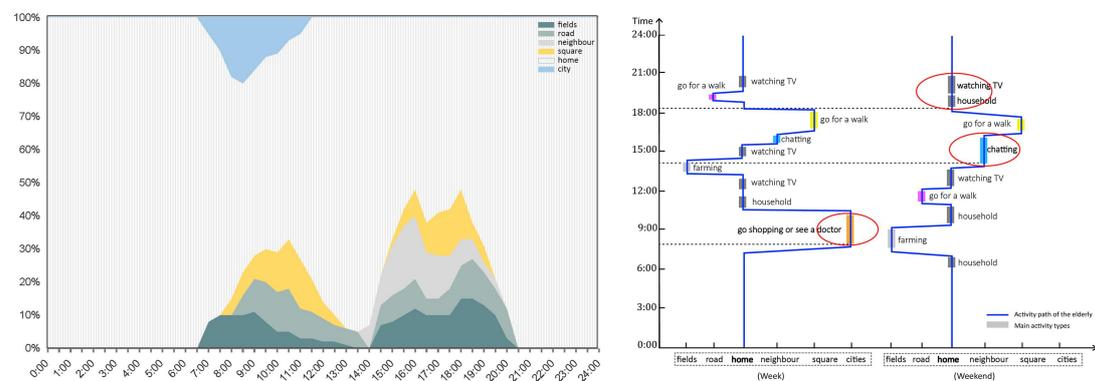


Figure 6:Activity space of empty nesters elderly (Left: activity rhythm; Right: active path) . Source: Author's painting

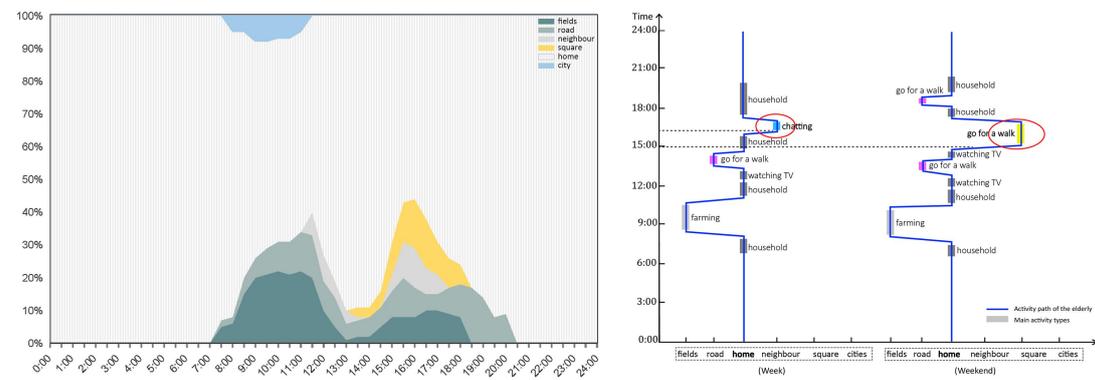


Figure 7:Activity space of widowed elderly (Left: activity rhythm; Right: active path) . Source: Author's painting

Travel characteristics are an important indicator of group activity space mobility measurement (Yanwei, C., Yiming, T., Yue, S., and Meibao, G.,2017). Further statistics on the number of times the elderly reached each activity space in a week and the average travel distance (Table 2). In terms of the frequency of travel and average travel distance, the widowed elderly have more obvious characteristics of home-centered and neighborhood travel, with a smaller range of activities; the empty nesters go out and move around more frequently in the village road and square space, with moderate travel distance. Dual-core elderly and multi-core elderly travel all kinds of space travel frequency is relatively average, travel distance is relatively far, long-distance travel is generally due to work needs.

Table: Travel frequency and average travel distance of daily activities of elderly people in different family. Source: Author's painting.

Family type	Multi core family elderly		Dual Core family elderly		Empty nesters elderly		Widowed elderly	
	Frequency/ number	Average travel distance (m)	frequency/ number	Average travel distance (m)	frequency/ number	Average travel distance (m)	frequency/ number	Average travel distance (m)
Home	523	---	385	---	1083	---	1379	---
Fields	231	1482.38	187	1098.23	54	923.33	119	898.33
Road	124	150.32	163	186.30	87	234.56	91	182.33
Neighbour	16	567.23	13	321.46	22	421.56	5	234.11
Square	18	873.45	14	932.98	32	1001.23	7	736.28
City	2	5421.78	1	5233.65	1	5078.91	0	---

In general, rural elderly people's work-life activities are generally within 1,500 meters, which is due to the fact that rural elderly people are mainly engaged in farming and animal husbandry, and their activities are not far away; leisure activities are within 1,000 meters, which is due to the fact that rural public service facilities are arranged in a more centralized manner, and the service coverage is lower, and village committees and public activity squares are far away from residential points.

3.3. Social Network Characteristics

Social interaction characteristics can reflect the spiritual needs of elderly people's life, as well as their perception of space. By investigating the companionship objects of activities of the elderly at different appropriate scales, the main companionship objects of activities within 500 meters, within 1000 meters and within 1500 meters from the elderly's residence were analyzed, and the social network of the elderly's life was linked to the geographical space (Figure 8).

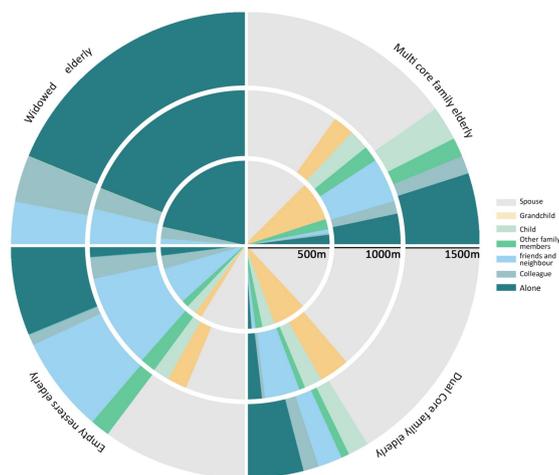


Figure 8: Frequency of activity companions of the elderly at different spatial scales. Source: Author's painting

On the whole, the elderly in multi core and dual core family elderly have more companionship objects in their daily activities and a more even distribution of activity time, and the proportion of their time spent with their spouses in a day is relatively high, which indicates that their dependence on their children's families is more obvious. Empty nesters spend more time with their friends and neighbors, while widows and orphans spend more time alone. Empty nesters and widows have a simpler social network structure, and their dependence on neighbors and friends is very more pronounced.

In terms of different spatial ranges, the 500 meter range and the 1000~1500 meter range are important ranges for the elderly in their daily life and work activities, and the elderly spend more time with their spouses in this range. 500-meter range is the main range for the elderly to carry out daily activities such as taking children and walking, weeding and gardening, etc., while the 1000~1500 meter range is mainly for work activities such as going out, running errands, farming, animal husbandry and business, etc., which require the assistance of their spouses. The 500~1000 meters range is the main activity range for the elderly to socialize with the outside world in the village, and the activities of the elderly are accompanied by more people, and their activities are mainly to participate in public activities, such as chatting with neighbors, playing with children and participating in village public activities. Therefore, we should pay attention to the construction of living space for the elderly in the village within 1000 meters, that is, to build a 15-minute village community living circle to protect the physical and mental health of the elderly and their basic living needs.

4. Analysis of daily activity constraints of rural elderly

The overall activity rhythm of the rural elderly is slow, and the activities are less restricted in time, showing the characteristics of working at sunrise and resting at sunset; the activity space is mainly constraint by the configuration of public service facilities and the combination of family activities, neighborhood activities and public activities.

4.1. Authoritative constraints on the configuration of rural public service facilities

Under the orientation of economic benefits, the allocation of rural public service facilities pursues scale, centralization and efficiency, presenting the defect of allocating based on population size rather than geographical service scope, which not only detaches from the reality of fragmented rural living space, but also restricts the equity of elderly people in remote areas to enjoy public service resource. The current configuration of rural sports facilities and elderly welfare facilities is still inadequate, for example, the school is used as the main place to hold cultural performance activities and conduct fitness and sports activities in rural areas, and there is a lack of specialized cultural and sports-type service facilities; elderly welfare facilities are integrated with village committees, and there is a lack of specialized elderly service centers; public service facilities have a single function and monotonous spatial attributes, which cannot meet the needs of the elderly, and there are no barrier-free facilities, etc. These problems of uneven distribution of resources and inadequate construction of facilities seriously restrict the scope of space and social interaction of rural elderly. In addition, the lack of welfare support for the elderly, especially the lack of support for the basic livelihood of the poor and disabled elderly, makes these elderly still engage in farming and other activities, which is not conducive to their physical and mental health.

4.2. Constraints on the combination of family, neighborhood and public activities

Rural elderly activities are influenced by family activities, neighborhood activities and public activities. Under different combination forms of family, neighborhood and public activities, different degrees of combination constraints are presented, which can be divided into four types (Figure 9). The first type is that family activities, neighborhood activities and public activities have less constraints on the activities of the elderly, and this type is mainly reflected in the daily life of widows and orphans; the second type is that family activities or neighborhood activities or public activities have constraints on the elderly, and this type is related to the scope of activities and the family structure of the elderly, and the degree of constraints varies in different scopes and family structures, and this combination of constraints is more prevalent than the other types. The third type is that family activities, neighborhood activities and public activities all have some constraints on the elderly, and the situation is more prominent when public activities are far away. The fourth type is that family activities, neighborhood activities and public

activities have a greater influence on the elderly, and this combination of constraints is more pronounced when the activities are closer to home.

The analysis shows that when the neighborhood activities and public activities are within 500 meters from home, the influence of various people activities on the elderly is greater; when the public activities are within 1000 meters, the influence of the activities on the elderly is relatively weaker, the household activities have more obvious constraints on the elderly in multi core and dual core family elderly families, the neighborhood activities have more significant constraints on the empty nesters, and the public activities have some constraints on the widows and orphans. And when public activities and neighborhood activities exceeded 1000 meters, the activities did not affect the widowed elderly and had some degree of influence on other elderly. Therefore, it can be seen that all kinds of activities have some constraints on the elderly activities within 1000 meters, and neighborhood activities and public activities within 500 meters from home is a more ideal pattern, and within 1000 meters is a more reasonable range.

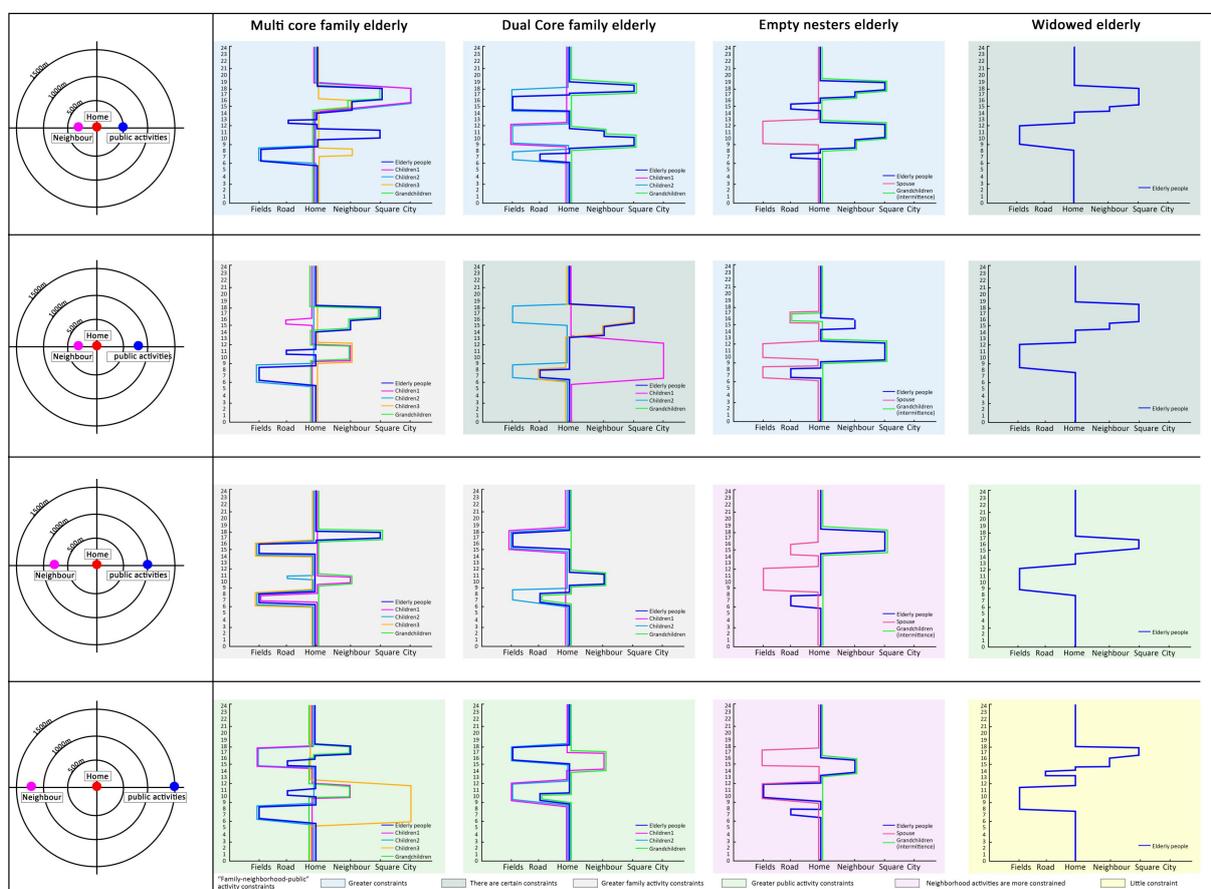


Figure 9: The 16 Path and constraint of elderly activities in typical rural families. Source: Author's painting

5. Conclusion and Discussion

The problem of rural aging is one of the challenges in the construction of rural habitat and community living circle. Through the analysis of time and space characteristics of rural elderly activities and social network relationships, it is concluded that there are large differences in the daily activities of the elderly with different family relationship structures, the configuration of public service facilities restricts the elderly activities from the physical space aspect, and family-neighborhood-public activities influence the daily activities of the elderly from the social-cultural aspect. Based on this, we propose a preliminary response strategy in terms of spatial and temporal planning and social security. The first is time planning.

The elderly have a high desire for public activities in villages, so group activities can be carried out regularly to increase social opportunities for the elderly; extend the opening hours of village clinics to provide flexible medical hours for the elderly; and appropriately adjust the running hours of village buses, which can delay the departure time of the morning and last buses to accommodate the travel needs of the elderly. The second is spatial planning. Public service facilities should be configured according to the geographical distribution of villagers, strengthening the construction of rural sports facilities and elderly service facilities, and appropriately increasing the number of small street squares to provide residents with places to meet and relax; attaching importance to the configuration of elderly service facilities in the 15-minute living circle (1000 meters) of rural communities, which is the main range of activities for various types of elderly people living and relaxing in the countryside, and also the most frequent range of activities for elderly people's social activities. Finally, we propose to strengthen financial support for the elderly in rural poverty, pay attention to the lives of empty nesters and widows, and provide social support in terms of the physical and mental health of the elderly.

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