Research Paper

Waterfront Space Feature and Its Impacts on Elderly People's Social Life in Winter

A Case Study of Harbin section of Songhua River Basin

Qing YUAN, School of Architecture, Harbin Institute of Technology; Key Laboratory of National Territory Spatial Planning and Ecological Restoration in Cold Regions, Ministry of Natural Resources, CHINA

Hongrui LI, School of Architecture, Harbin Institute of Technology; Key Laboratory of National Territory Spatial Planning and Ecological Restoration in Cold Regions, Ministry of Natural Resources, CHINA

Jiaxuan ZHAO, School of Architecture, Harbin Institute of Technology; Key Laboratory of National Territory Spatial Planning and Ecological Restoration in Cold Regions, Ministry of Natural Resources, CHINA

Hong LENG, School of Architecture, Harbin Institute of Technology; Key Laboratory of National Territory Spatial Planning and Ecological Restoration in Cold Regions, Ministry of Natural Resources, CHINA

Abstract

In the context of "healthy ageing" and "healthy China" strategy, the role of outdoor public space in promoting the physical, mental and social interaction of the elderly has been increasingly emphasized. This paper investigates the characteristics of individual attributes, social interaction activities and the perception of the waterfront space environment of the elderly interviewed in cold urban waterfront spaces through questionnaire interviews and behavioural scenario analysis, and discusses the relationship between the social interaction activities of the elderly and the waterfront space environment in cold urban cities. The study finds that there is a strong correlation between the social interaction activities of the elderly and the spatial environment in cold urban waterfront spaces, in which environmental characteristics such as accessibility, facility integrity, environmental aesthetics and site comfort have different degrees of influence on the social interaction of the elderly. This paper proposes suggestions for optimising the design of waterfront spaces in cold cities from the perspective of promoting social interaction

Keywords

Waterfront space; the elderly; social interaction; healthy; Winter city

1. Introduction

Population ageing is an important trend in the future development of society and one of China's basic national conditions. Actively coping with population ageing has become a long-term strategic task for China. Data from the seventh national census shows that there are 260 million people aged 60 and above in China, of whom 190 million are aged 65 and above. At the same time, the pace of population ageing has accelerated significantly, with the proportion of people aged 60 and above rising by 5.44 percentage points between 2010 and 2020. As older people age, their physical and mental functions deteriorate to a certain extent, which in turn affects their ability to adapt to their environment and reduces the quality of their participation in physical and social activities. It is evident that measures to improve the health and quality of life of the elderly will be an urgent challenge for the government and the community to address.

In recent years, urban waterfront spaces have gained increasing attention for their health-promoting role due to their potential to become healing landscapes and public health resources. The health impacts of waterfront spaces relate to physical activity, social interaction and mental health. Research has shown that waterfront spaces are effective in promoting better outcomes for older people in all outdoor activities as an important place for them to be active outdoors(He Tianjiao et al., 2022). For example, coastal living has a motivating effect on residents' participation in land-based outdoor activities(Carmen et al., 2019), with coastal residents walking an average of 30 minutes more per week for exercise than non-coastal residents(Tpp et al., n.d.); waterfront spaces are considered to be one of the most important places to socialise with friends and family, and often serve as a place for local older people to establish and increase social interactions compared to younger people(Bella et al., 2017). Völker S et al. studied waterfront spaces to influence behavioural activities, measuring waterfront spaces in four dimensions: experiential, symbolic, social and activity(V?Lker et al., 2018); Qian Fang et al. (Qian Fang and Jin Guangjun, 2010)constructed a framework of human health and waterfront win-win design elements for urban waterfront space, and categorized the environmental elements of waterfront space into three thematic elements: natural substrate, linkage skeleton and recreation unit; Hooyberg(Hooyberg et al., 2020) explored the influence mechanism of elements such as environmental characteristics of waterfront space, and explained the characteristics of environmental elements of waterfront space and human mental health, physical activity, social cohesion and other characteristic elements The association between the characteristics of the waterfront environment and the characteristics of human mental health, physical activity, and social cohesion. In general, most of the existing research findings have focused on the impact of waterfront environmental characteristics. In general, most of the existing research findings focus on the role of waterfront space in promoting physical activity among older people, and less on its impact on social interaction among older people.

In addition, the seasons have a significant impact on urban waterfront spaces and the behavioural activities of older people. Cold climates cover a vast area with a large number of cold cities(Leng Hong and Yuan Qing, 2003). Cities in the cold regions of North America, the Nordic countries and most of Heilongjiang, Jilin, Liaoning and the northeastern part of Inner Mongolia Autonomous Region in China are typical of cold cities. As a more specific group of cities, cold cities have significant seasonal changes in their climatic environment and the persistent harsh winter climate can have an impact on the environmental quality of waterfront spaces and the mental health status of older people(Leng, Hong and Li, Shuyuan, 2017). Studies have shown that harsh winter weather conditions can significantly reduce the comfort level of the terrestrial environment in waterfront spaces(Zhou et al., 2022), alter the physical form of the watershed environment and constrain the outdoor activity choices of older people, which can have a significant impact on their psychological well-being. Therefore, it is necessary at this stage to carry out theoretical research and practical exploration of cold winter waterfront spaces that promote social interaction among older people.

Compared with existing studies, this study adopts the characteristics of the waterfront spatial environment as the main independent variable in line with previous studies, and also takes into account the individual attributes of older people, their mental health and the climate, with a focus on the winter climate factor. This study uses the winter climate of the cold city of Harbin as a background, and explores the influence of the perceived elements of the waterfront spatial environment on older people's social interactions in the cold city through behavioural observation, questionnaire survey and multiple linear regression analysis. On this basis, it provides some theoretical basis and design guidance for the design of waterfront spaces in cold cities.

2 Subjects and methods of study

2.1 Overview of the study area

In this study, the waterfront space on the south bank of Harbin City in the Songhua River basin was selected as the research object. The Songhua River is one of the seven major rivers in China, with a total length of 1,927 km, and the basin covers as much as 70% of the total area of the three northeastern provinces. Among them, Harbin City is the largest city in the Songhua River basin. As one of the typical cold cities in China, Harbin has cold and long winters, and according to the seventh census data, the city is seriously ageing and the elderly population is still in a state of continuous growth. At the same time, since the development of urbanisation, the waterfront space on the south bank of the Songhua River has become one of the most important leisure spaces for public life, interaction and activities. Therefore, the waterfront space on the south bank of the Songhua River from Yangmingtan Bridge to Songpu Bridge in Harbin City was selected as the study area based on the characteristics of the waterfront space such as area, number of facilities and type of barges.
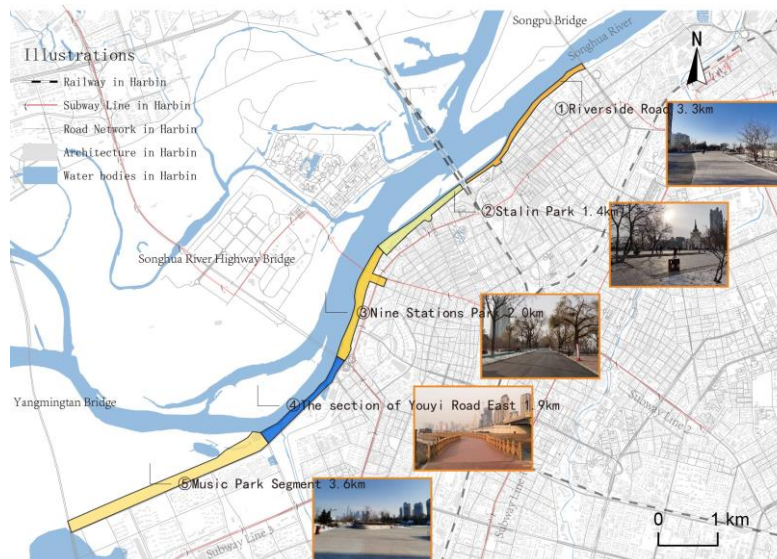
Fig.1 Research area and research unit. Source: Author.

2.2 Research ideas and methods

This study focuses on exploring the intrinsic relationship between the social activities of older people and the environment of cold urban waterfront spaces. Firstly, the main activity locations, types of activities and social interaction information of the elderly in the waterfront space were recorded through observation methods, and typical nodal spaces were selected. Then the social interaction characteristics and environmental perceptions of the elderly were investigated in depth through field research, specifically: the questionnaire was used to obtain information on four parts of the elderly's individual attribute characteristics, activity characteristics, mental health characteristics and perceptions of the waterfront space environment; due to the weakened physical reading and writing functions of the elderly, the questionnaire was completed by means of questions asked by the researcher and then answered by the elderly and then filled in by the researcher; through The interview method was used to understand the activities carried out by older people in organised larger group activities; the number and items of older people's activities in the selected typical nodal spaces were statistically recorded through behavioural observation. Finally, the data were processed by pre-processing the recovered data and then applying multiple regression analysis. Using the winter climate of the cold city of Harbin as the

background, the four dimensions of waterfront space environment perception of place accessibility, facility integrity, environmental planning aesthetics and site comfort were used as independent variables, and the socio-economic attributes and psychological factors of the elderly were used as adjustment variables in the study to construct a model of the influence of waterfront space environment perception on the social interaction of the elderly.

2.3 Study population and sample size determination

This study was conducted on elderly residents aged 55 and above who are active in the waterfront space on the south bank of the Songhua River. The research period was selected to be December 2021, taking into full consideration the influence of different temperatures and weather conditions. The researcher distributed 60 questionnaires in each research unit using the incidental encounter method, with a total of 300 questionnaires distributed across the five research units. Seven questionnaires with missing or identical answers and five questionnaires with "serious illness" were excluded, resulting in 288 valid questionnaires.

3 Characteristics of the waterfront spatial environment and its related elements for the social interaction of older people in winter

3.1 Characteristics of the interviewed population

From the basic situation of the respondents, the proportion of men and women is balanced; the age is mainly 65-75 years old, accounting for 45.7%; the proportion of senior citizens over 75 years old is more than 17%; the majority of senior citizens have a monthly income between 3000-5000 RMB, and the middle and low income senior citizens with a monthly income of less than 5000 RMB account for 55.6% of the total sample; the education level is mainly high school or The majority of the respondents' education level is high school or junior college, followed by other levels such as junior college, college or bachelor's degree, and elementary school; the highest proportion of the respondents' senior living pattern is living with their spouses. In addition, the survey showed that the overall satisfaction of the surveyed elderly with their health status was high, mostly basic satisfaction or very satisfied.
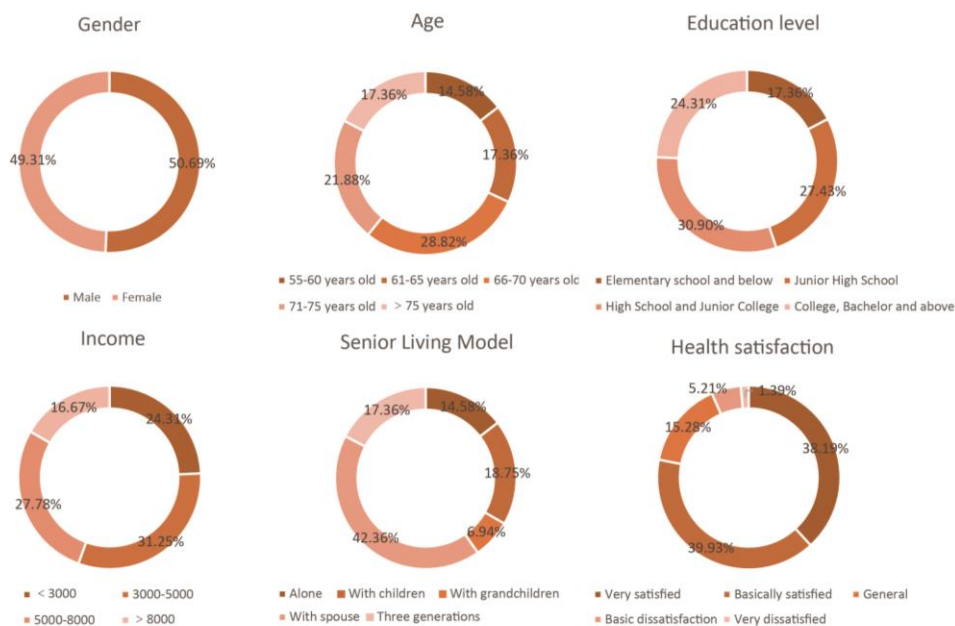

Fig.2 Basic information of the questionnaire sample. Source: Author.

The Mental Health Scale for Older People uses the Warwick-Edinburgh Positive Mental Health Scale developed by Tennant et al. The scale consists of 14 items reflecting three aspects of mental health: positive emotions, positive mental functioning and interpersonal satisfaction. The higher the score, the higher the level of positive mental health. The average score on the self-assessment of psychological well-being for the elderly respondents in this study was 56.5, with 38.14% of the elderly respondents achieving high levels of well-being (60 being the recommended cut-off point). Interviews revealed that older people who regularly visited the waterfront space for activities were better adjusted to the change in social roles, less likely to suffer from loneliness and apprehension, and had good mental health.
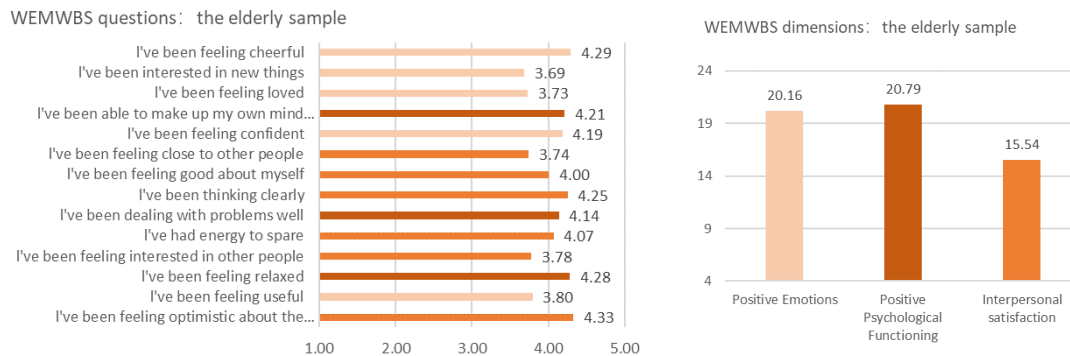
WEMWBS questions：the elderly sample

I've been feeling cheerful	4.29
I've been interested in new things	3.69
I've been feeling loved	3.73
I've been able to make up my own mind…	4.21
I've been feeling confident	4.19
I've been feeling close to other people	3.74
I've been feeling good about myself	4.00
I've been thinking clearly	4.25
I've been dealing with problems well	4.14
I've had energy to spare	4.07
I've been feeling interested in other people	3.78
I've been feeling relaxed	4.28
I've been feeling useful	3.80
I've been feeling optimistic about the…	4.33

WEMWBS dimensions：the elderly sample

Positive Emotions	Positive Psychological Functioning	Interpersonal satisfaction
20.16	20.79	15.54

Fig.3 Mental health characteristics of the elderly Source: Author.

3.2 Characteristics of older people's social interaction activities in winter

3.2.1 Overview of social interaction activities for older people in winter
The characteristics of social interaction activities in winter waterfront spaces for the elderly include three observed variables: type of activity, frequency of activity and duration of activity. The types of social interaction in winter waterfront spaces can be divided into individual interaction and group interaction. According to the observation, walking in pairs is the most common type of social interaction, and other common types of social interaction include walking in pairs, table tennis, group dance, and Tai Chi. Through the statistical analysis of the three observed variables, it was found that the majority of the interviewed elderly people were active in the waterfront space more than five times a week in winter, accounting for 63.88%; the duration of social interaction was mostly 0.5-1h, reaching 54.86% of the sample size; as for the types of activities, the proportion of elderly people who participated in the waterfront space only in individual interaction was 36.11%, and the proportion of those who participated in group interaction activities only was 25.35% The proportion of those who participated in both activities was the highest, at 39.24%.

Table1 Classification of social interaction styles of the elderly. Source: Author.

	Interaction	Examples of activities
Personal interaction	Watching other people's activities	Watching other older people's activities
	Activities with family and friends	walking, talking, sitting, exercising with family and friends
Group interaction	Stretching activities	Group dancing, Tai Chi
	Equipment activities	participation in table tennis tournaments
	Walking activities	multiple people walking together

According to the statistics and analysis of the social interaction activities of the elderly, it was found that the social interaction activity behaviour of the residents in different seasons, at different times and in

different research cells differed: the social interaction activities of the elderly in the waterfront space in winter were significantly shorter and less frequent than those in other seasons. The average length of social interaction activities of the elderly in the waterfront space increased from 0.5~1h in winter to 1.5~2h in other seasons, and the frequency of activities of the elderly increased from 6.54 times per week in winter to 11.23 times per week in other seasons. Based on the above data, it is inferred that the willingness of older people in Harbin to use the waterfront space in winter is still relatively strong, and that older people are forced to reduce the length and frequency of their social interaction activities in the waterfront space due to adverse weather conditions and prolonged snow and ice coverage.

3.2.2 Distribution of social interaction time of the elderly in winter
Combined with the interview results, we analyzed the activity time of the elderly who engaged in social activities in the waterfront space in winter, and found that the time of the elderly who engaged in social activities in the waterfront space was influenced by personal habits, household chores, and temperature. Because of the low temperature in the morning and evening in winter, the elderly seldom chose to engage in activities in the waterfront space before 8:00 am and after 6:00 pm, and the most elderly went out at noon. Most of the elderly people have a single activity length of 0.5~1h and go out once a day.

3.3 Influencing factors for social interaction activities in waterfront spaces

3.3.1 Factors influencing the frequency of social interaction activities among the elderly
Using the activity of older people's social interaction in the waterfront space as the dependent variable, three multiple linear regression models were used to explore the relationship between different types of variables and the frequency of older people's social interaction activities. Model 1 explores the relationship between the individual characteristics of older people and the frequency of their social interaction activities; model 2 adds the mental health status of older people to model 1; model 3 incorporates four factors describing the environmental characteristics of the waterfront space into the model. The fit of models 1 to 3 gradually increased, with model 3 eventually providing the best fit.

Studies have shown that the environmental perception of waterfront spaces in winter affects the activity duration of social interactions among older adults with different individual characteristics. Specifically, the accessibility, integrity and aesthetics of waterfront spaces significantly influenced the frequency of social interaction among older adults. This suggests that proximity and accessibility are important for the elderly with declining physical functions, and that the perceived satisfaction of the elderly can be increased by providing additional facilities such as seating and equipment, so that they can switch their activity status at any time when they engage in social interaction in the waterfront space, thus increasing the frequency of social interaction in the waterfront space. However, the perceived comfort of the site is not the main reason for the frequency of social activities in the waterfront space, which may be due to the strong willingness of the elderly to engage in social interactions despite the poor perception of the environment in winter. In addition, older adults' age, physical self-assessment and mental health were also positively associated with the frequency of social interaction activities performed by older adults.

Table 2 Multiple linear regression model of the frequency of social interaction activities among the elderly Source: Author.

Potential variables	Observed variables		Model 1 Beta	Model 2 Beta	Model 3 Beta
Individual characteristics of the elderly	Age	65-75 years	0.182	0.121	0.112
		> 75 years old	0.153*	0.142*	0.128
	Education	Junior High School	0.045	0.036	0.028

level	High School, Secondary School	0.173*	0.152**	0.142
	Tertiary, undergraduate	0.145**	0.125**	0.102
Household living composition	Living alone	0.322	0.296	0.154
	Living with your spouse	0.214**	0.176	0.078
	Health self-assessment	0.123**	0.112**	0.142**
Level of mental health	Positive emotions		0.216*	0.145*
	Positive Psychological Functioning		0.122*	0.108
	Interpersonal satisfaction		0.128	0.116*
Waterfront spatial environmental features	Place accessibility			0.170**
	Facility integrity			0.142*
	Environmental Aesthetics			0.078**
	Site comfort			0.087
	R-side	0.202	0.355	0.372
	Adjusted R-side	0.124	0.278	0.318
	F	5.756	6.433	12.212

3.3.2 Factors influencing the length of social interaction activities of the elderly

Using the length of social interaction of older people in the waterfront space as the dependent variable, three multiple linear regression models were developed to explore the relationship between different types of variables and the length of social interaction of older people. Model 4 explores the relationship between the individual characteristics of older people and the length of their social interaction activities; model 5 adds the mental health status of older people to model 4; model 6 is a regression model with the individual characteristics, mental health status and perception of the waterfront environment as the independent variables and the length of social interaction activities as the dependent variable. From the model parameters, it can be seen that the models are all valid, but model 6 is a better fit.

This study found that for the environmental characteristics of waterfront space, the environmental aesthetics and site comfort of waterfront space places positively affect the length of social interaction of elderly respondents, which indicates that under the winter climate conditions of cold cities, the social interaction activities of elderly respondents can be promoted by enriching the plant configuration and enhancing the landscape attractiveness; it can also enhance the sensory comfort of elderly people by improving the perception of thermal comfort and safety comfort. However, the perceived accessibility and facility integrity were not significantly associated with the length of social interaction activities of older adults, possibly due to the higher accessibility of the study area itself or the lower reliance on facilities for social interaction activities in winter due to the climate. Moreover, the study found that the activity hours of older adults showed significant positive correlations with age, education level, aging patterns, and health self-assessment.

Table 3 Multiple linear regression model of the length of social interaction activities among the elderly Source: Author.

Potential	Observed variables	Model 4	Model 5	Model 6

variables			Beta	Beta	Beta
Individual characteristics of the elderly	Age	65-75 years	0.212	0.115*	0.112
		> 75 years old	0.183	0.218**	0.128
	Education level	Junior High School	0.045	0.032	0.028
		High School, Secondary School	0.152	0.145**	0.142
		Tertiary, undergraduate	0.132	0.128*	0.102
	Household living composition	Living alone	0.221**	0.175	0.154
		Living with your spouse	0.125***	0.101	0.078
Level of mental health	Health self-assessment		0.352**	0.236**	0.168**
	Positive emotions			0.223	0.198***
	Positive Psychological Functioning			0.045	0.024*
	Interpersonal satisfaction			0.321	0.308**
Waterfront spatial environmental features	Place accessibility				0.128
	Facility integrity				0.135
	Environmental Aesthetics				0.078***
	Site comfort				0.069**
R-side			0.270	0.312	0.397
Adjusted R-side			0.242	0.226	0.323
F			4.556	8.425	8.769

4 Results and Discussion

This paper uses a multiple linear regression model to explore the relationship between perceptions of the waterfront spatial environment and older people's social interaction behaviour in winter. The results of the analysis in Tables 2 and 3 confirm that in the context of the harsh winter climate in cold urban areas, there are differences in the influencing factors of the different observed variables of social interaction activities, with activity duration being more influenced by the characteristics of the waterfront spatial environment and activity frequency being more influenced by the characteristics of older people's individual attributes, mental health The frequency of activity is more influenced by individual attributes and mental health. Specifically, the aesthetics of the waterfront space and the comfort of the site will directly influence the length of social interaction activities of older people, while the accessibility of the waterfront space, the integrity of the facilities and the aesthetics of the environment will directly influence the frequency of social interaction of older people. To a certain extent, this reflects the importance of planning and designing waterfront environments that take into account the specific needs of older residents

In light of the results of the previous analysis, the author believes that the following aspects can be used to better promote the behavioural activities of older residents in cold cities in winter and to bring into play the health-promoting role of waterfront spaces. 1) Focus on the expression of cultural connotations and create a sense of place in the place. Considering the winter characteristics of cold cities and the winter features of waterfront spaces, the use of ice and snow elements can be enhanced to create public

artworks such as ice and snow sculptures. At the same time, through the design linkage of the inland environment and the waterfront environment of the waterfront space, the narrative of the overall landscape is formed, thus enabling the elderly to have a beautiful experience of their activities in the waterfront space and further strengthening their local reliance on and local identity with the waterfront space. 2) Focus on visual sensory experience and shape a rich winter landscape. The winter landscape of cold cities is often monotonous due to the climate. A variety of colours can increase the attractiveness of the space and stimulate the spontaneous activities of the elderly, so it is necessary to strengthen the colour variations in the landscape design. At the same time, it is necessary to enhance the diversity and comfort of the waterfront landscape by enriching the plant configuration, optimising the plant layout and increasing auxiliary facilities to enhance the texture of the environment. 3) Focus on human interaction to create a harmonious activity space. Firstly, the delineation of functional zoning within the site is strengthened to retain the vitality brought by commerce while reducing the hindrance of retail commerce to the activities of the elderly. Through design guidance, the activity lines of retail businesses and the elderly will not interfere with each other. Secondly, different groups of people have different requirements for exercise and social activities, so the guidance of elderly people's activities can be enhanced by reserving open spaces, adding different types of facilities and holding regular group activities. Finally, the microclimate of the activity site can be improved through the construction of small structures to extend the length of the elderly's activities in the waterfront space. 4) Focus on the sense of belonging to the environment and enhance the suitability of the site for the elderly. In the setting of supporting facilities and the use of landscape elements, the physical condition of the elderly is fully considered to give them a sense of psychological comfort and security. For example, to meet the needs of the elderly of different ages and physical conditions to be able to reach the site, adapt to the phenomenon of visual degradation of the elderly by strengthening the colour change of the road surface, and choose materials with good anti-slip effect.

5 Conclusion

In the process of ageing-friendly renewal of high-density habitats, the impact of waterfront spaces on the social interaction of the elderly deserves attention. For the elderly who are prone to loneliness, dependency, depression and anxiety, the waterfront space in cold cities is the main vehicle for their outdoor activities in winter. Only by fully understanding the strong correlation between the social interaction activities of the elderly and the waterfront space environment can we develop ageing strategies suitable for the waterfront space in cold cities according to local conditions. By paying attention to the different environmental needs of the elderly, it is conducive to promoting the activities of the elderly in winter waterfront spaces, extending their activity time and maintaining their physical and mental health.

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