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Satisfaction among the Elderly Living in the Ancient Town of Xiangxi

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Abstract: This exploratory study combines the elderly-friendly post-use evaluation theory with the specific context of traditional residential buildings in typical Tujia ancient towns in the Western Hunan region, namely, Furong, Liexi, Xichehe, and Liye. A post-use low satisfaction evaluation model of traditional residential buildings in ancient towns was constructed, and the importance ranking of evaluation factors, along with the importance analysis of secondary indicators, was discussed using statistical methods. The subjective evaluations of elderly residents in different ancient towns toward the living environment and the importance ranking of factors for low satisfaction were examined. The findings of this study showed that we should focus on safety, convenience, health, privacy, belonging and cultural factors, and factors influencing sustainable livability for improving the quality of life of elderly residents in Tujia ancient towns in Western Hunan. Finally, the study proposes targeted improvement strategies to guide the construction of elderly-friendly environments in Tujia ancient towns and provide a reference for low satisfaction evaluations of ancient towns in similar economically underdeveloped areas.

Keywords: living environment; elderly; life satisfaction; ancient town; Xiangxi

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1. Introduction

Population aging has become an inevitable factor in the development of modern society, and this problem is expected to aggravate in all regions of China in the near future [1]. The elderly population in China is rapidly increasing; between 2010 and 2020, the proportions of populations aged 60 and 65 years increased by 5.44% and 4.63% [2], respectively (Figure 1a). By 2050, the proportion of elderly people is predicted to reach one-third of the total population in China [3]. Compared with the global, national, and provincial rates of aging, the aging problem in the Xiangxi Tujia and Miao Autonomous Prefecture (XTMAP) is extremely severe (Figure 1b). According to the Seventh National Census of China [4], the elderly population (over the age of 65 years) in XTMAP accounts for nearly 18.99% of the population, representing a total of 470,000 people, which far exceeds the United Nations standard definition of an aging society (7%) [5]. Population aging increases the burden of elderly care for families, reduces labor supply [6], and presents new demands for the improvement of the existing living environments.

With the issue of population aging intensifying, increasing attention has been paid to the living environments of the elderly. Several researchers [7–15] have focused on elderly care to promote livable and healthy living environments for the aging population. In contrast to younger people, elderly individuals have poor immune function and fewer daily activities as well as declining bodily functions, which make their physical and mental health more vulnerable to threats from the living environment, warranting special focus on their living environment [7], especially in terms of emotional [8,9] and living aspects [10–12]. Emotional research on the elderly has mainly focused on depression [13,14], loneliness, and related mental health factors [15,16]. Astrid Kemperman et al. (Department of the Built Environment, Eindhoven University of Technology, Eindhoven, The

Netherlands) [17] found that the sense of loneliness among the elderly is directly related to their satisfaction with social networks, neighborhood attachment, and local facilities and services. Hossain, M. Anwar et al. (College of Computer and Information Sciences, King Saud University, Riyadh, Saudi Arabia) [18] proposed a framework for an entertainment support system for the elderly to improve their life experiences under different situations. Research related to the living environment of the elderly has mainly focused on indoor physical environments [19,20], surrounding environments [21–23], influencing factors, and evaluations [24,25]. Li Muchun et al. (Department of Tourism Management, South China University of Technology, Guangzhou, China) [26] used a questionnaire survey to analyze the indoor physical environment preferences of elderly people in Chinese cities. Peng, Jianxin et al. (School of Physics and Optoelectronics, South China University of Technology, Guangzhou, Guangdong, China) [27] investigated the acoustic environment of elderly people's living environments in Guangzhou and analyzed the influencing factors. Zhang Huibo et al. (Department of Architecture Doctor of Engineering, Shanghai Jiao Tong University) [28] analyzed the impact of indoor thermal environment on the living environment of elderly people in the urban and rural housing. Almeida-Silva, M. et al. (Instituto Superior Técnico, Universidade de Lisboa, Loures, Portugal) [28] studied indoor pollutants in nursing homes for the elderly. Kunduraci, Arzu Cilasun (Yildiz Technical University, Architecture) [29] conducted a systematic review to identify lighting design clues for achieving visual comfort conditions. Gu, Won-Hoe et al. (Department of Occupational Therapy, College of Medical Science, Soonchunhyang University) [10] used structured questionnaires and household environment checklists to identify the construction needs of living environments for the elderly. Qandeel, Aqsa, and Welyne Jeffrey Jehom (Department of Anthropology and Sociology, University of Malaya) [30] used semi-structured interviews to analyze the living patterns and environments of mobile elderly people in Malaysia. Maity, Shrabanti (Department of Economics, Vidyasagar University) and Sinha, Anup (Department of Economics, Assam University) [31] analyzed the factors that affect elderly people's lives in Northeast India. Modern technologies, such as machine learning [32], the Internet of Things [33], and Web of Objects [34] applications have also been widely employed to investigate elderly households, especially for the elderly people living alone, to ensure their safety.

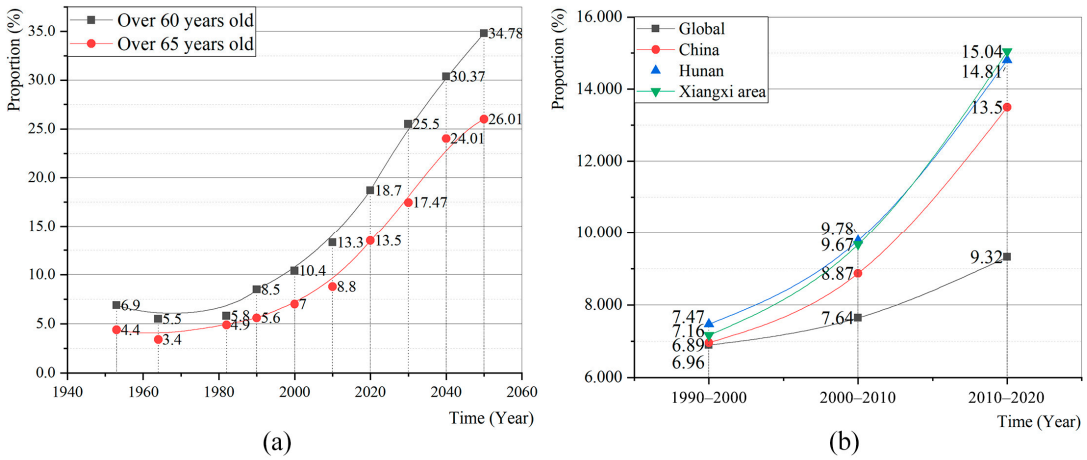

Figure 1. (**a**) Percentage of China's elderly population; (**b**) differences in the level of aging between Xiangxi and other regions.

A review of literature suggests that research on the living environment of elderly people has been conducted mainly in rural areas [35,36], elderly care institutions [37–40], and urban residential areas [41], and no study has focused on the living environment of elderly people in ancient towns. An ancient town is an old city with important cultural heritage, containing historical architectural complexes, historical commercial districts, and

unique folk culture. Xiangxi ancient town is a significant architectural and cultural heritage site that preserves many intact traditional Tujia ethnic minority dwellings [42,43]. With the rapidly increasing elderly population, the existing residential environment in Xiangxi ancient town faces severe challenges. The current status of the traditional residential environment and the elderly care needs in Xiangxi ancient town can be summarized into four aspects:

1. Large-scale traditional residential architecture: There are over 11,000 preserved intact traditional dwellings in Xiangxi; out of these, Tujia traditional dwellings account for more than a half. In addition, over 60 national and provincial protected units exist in Xiangxi [44], representing a rich and irreplaceable cultural heritage of Tujia ethnic minority architecture.
2. Poor living conditions in traditional residential environments: Majority of the dwellings in Xiangxi were built more than a century ago and lack reasonable renovation or new construction, thereby presenting safety and convenience issues [42].
3. Diverse living needs of the elderly: The traditional design of residential environments did not consider the entire lifecycle of users. With lifestyle changes, improvements in living standards, and the emergence of new needs of the elderly, traditional dwellings are becoming increasingly inadequate for meeting the demands of the elderly for high-quality life [45]. Moreover, due to the special ethnic culture and living environment, the living needs of the elderly in Xiangxi ancient town differ from those of people living in urban areas [42]. Therefore, research on the living environment of the elderly in Xiangxi ancient town is highly warranted.
4. Protection of traditional architectural and cultural heritage: Compared with suitable renovations, large-scale reconstruction and demolition destroy the original style and cultural heritage of traditional dwellings, leading to resource consumption, high costs, environmental pollution (carbon dioxide emissions), and other problems [46]. Therefore, exploring the satisfaction levels of the elderly with existing residential environments in Xiangxi ancient town and conducting targeted, scientific, and reasonable renovations to care for the elderly are essential.

Evaluating the living environment of the elderly in ancient towns is crucial to gain insights for promoting healthy and happy life [47]. To address this, we propose a satisfaction evaluation method for the living environment of the elderly in ancient towns in Xiangxi. We rank the importance of evaluation factors and analyze the differences among the elderly in different groups and their satisfaction levels in different ancient towns, and thus provide support and guidance for improving the living environment of the elderly in Xiangxi's ancient towns, as well as a reference for creating healthy and livable living environments in ancient towns in other regions.

2. Methodology

2.1. Ancient Tujia Towns in Western Hunan

Ancient town in China is a commercial town with a history of more than a century and is still well-preserved with large-scale ancient residential buildings. It is a form of settlement between an ancient city and an ancient village, mostly developed by commerce. Ancient cities are the political, military, and cultural centers of a place and are the largest in size and often surrounded by walls. Ancient villages are the smallest and are inhabited by agricultural populations. The ancient towns of the Tujia people in Western Hunan are historical and cultural towns, characterized by Tujia historical culture and ethnic traditions (Figure 2). Based on the list of "Historical and Cultural Famous Towns" released by the Ministry of Housing and Urban-Rural Development of the People's Republic of China [48], and in conjunction with relevant research results on ancient towns in Western Hunan, such as "Ancient Villages and Towns in Hunan [49]", "Residential Architecture of the Tujia Ethnic Group in Western Hunan [50]", and "History and Culture of Tujia Ethnic Group in Western Hunan [51]", the most representative four ancient towns were selected in this study as the research objects (Table 1) (Figure A1).

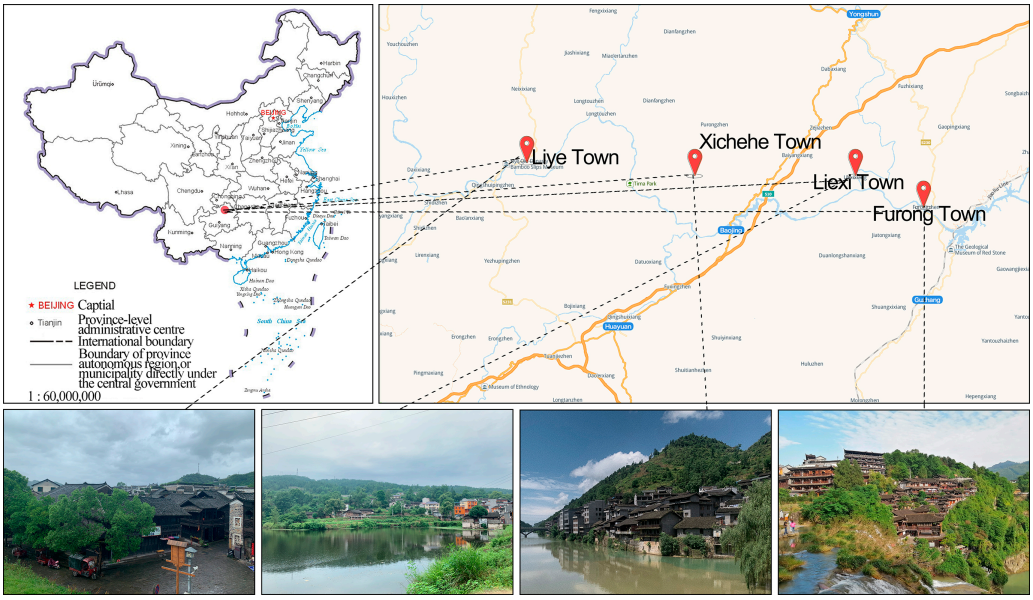

Figure 2. Location of typical ancient towns in Western Hunan in China [42].

Table 1. Specific information on typical ancient towns in Western Hunan.

Ancient	History	Area/(km^2)	Household Population	Description
Liye	Warring States Period	261.26	45,000	National-level Traditional Cultural Protection Villages First batch of commercial towns in the Tujia ethnic group
Furong	939 AD	168	23,382	National Historical and Cultural Famous Towns
Xichehe	Qing Dynasty	175	14,200	"Most Charming Towns" in Hunan Province
Liexi	1727	12	9665	Ancient Towns in Xiangxi, Hunan Province

Traditional Tujia residential architecture refers to the lifestyle of the Tujia people with their ethnic culture preserved during the process of modernization and their homes still maintaining traditional architectural forms and spatial structures (Figure 3). The Tujia region in Western Hunan is often located in a mountainous and complex terrain, and ancient towns often stand by water, such as the ancient towns on both sides of the You River region, which are adjacent to waterway transportation hubs, forming a developed commercial trade space. By contrast, Tujia villages lack a large amount of commercial trade space, and the homes are often built on hillsides, forming many stilted buildings [52]. Due to the differences in terrain, production methods, and other factors between Tujia villages and ancient towns, their residential architecture differs considerably:

- In terms of floor plan type, Tujia residential architecture is mainly divided into three types: The "Zuowu" house, L-shaped, and U-shaped [42].
- In terms of functional layout, shop-houses in ancient towns often include store functions. Based on the store location and living space, the dwellings are divided into two types of dwellings, namely, front store and back house dwellings and lower store and upper house dwellings. The living function is located in the backyard or on the second floor. Due to the high building density of ancient towns, front yards are often lacking (Figure A2) [53].
- In terms of building scale, the span of ancient town houses is often small, with a larger depth, resulting in significant differences from the scale of depth and span of Tujia villages.
- In terms of living and lifestyle, three-room houses in ancient towns often lack a wall separating the hearth space and bedrooms. Handicraft workshops and lodging categories related to daily production are the main commercial space categories.

Figure 3. Dwellings in typical ancient towns in Western Hunan [42].

2.2. Satisfaction Evaluation Questionnaire

2.2.1. Construction of Satisfaction Questionnaire Indicators

Few studies have evaluated the living environment for the elderly in ancient towns. Based on previous field studies by Zhang et al. [42] and indoor air quality evaluations and satisfaction surveys among the elderly [54,55], we selected and screened the factors that affect the satisfaction evaluation of traditional dwellings in ancient towns. Furthermore, we consulted scholars and experts in the field of elderly studies, and based on their feedback, we modified the evaluation indicators.

For selecting evaluation indicators, differences in the factors that affect the satisfaction evaluation of elderly-friendly living environments between different building types and regions were considered. Primary indicators were selected based on the subjective evaluation of the living environment of the elderly and the evaluation elements of the studies related to the living environment of the elderly (Figures 4 and 5, and Table A1), (using the web of science library from 2004 to 2022 as a data source for studies related to the residential environment of the elderly). Through a combination of unstructured interviews and structured questionnaires among specific groups of elderly residents, we integrated and screened the factors that affect their satisfaction with their living environment and determined the primary and secondary influencing factors. The unstructured interview questions covered all spaces within the dwelling, including the entrance, hall, shop, bedroom, hearth, outhouse, courtyard, transportation, and storage room, with a focus on the physiological aspects (Table A2). The semi-structured questionnaire was used to study the implicit needs, such as psychological and emotional needs of the elderly residents that were not directly highlighted or clearly described during the interview process (Table A3). Combined with the evaluation studies related to the elderly living environment, the satisfaction questionnaire factors include elements affecting physical health, such as safety [56,57], convenience [58], and air quality [59,60] and elements affecting mental health, such as belonging and culture [61], and companionship [62–64].

We modified the evaluation indicators based on the feedback received via email, calls, and interviews from a total of 16 scholars and experts who were engaged in research in fields, such as architecture, interior design, and psychology of elderly population.

For confirmation of evaluation indicators, we used factor analysis to determine the potential commonalities among multiple variables and selected representative evaluation factors. We confirmed the evaluation indicators by comparing the differences in the factors affecting the living environment between self-caring and non-self-caring elderly residents. The questionnaire data in this study were analyzed using the SPSS software, based on Yanrong's research [65], to analyze the factors affecting aging.

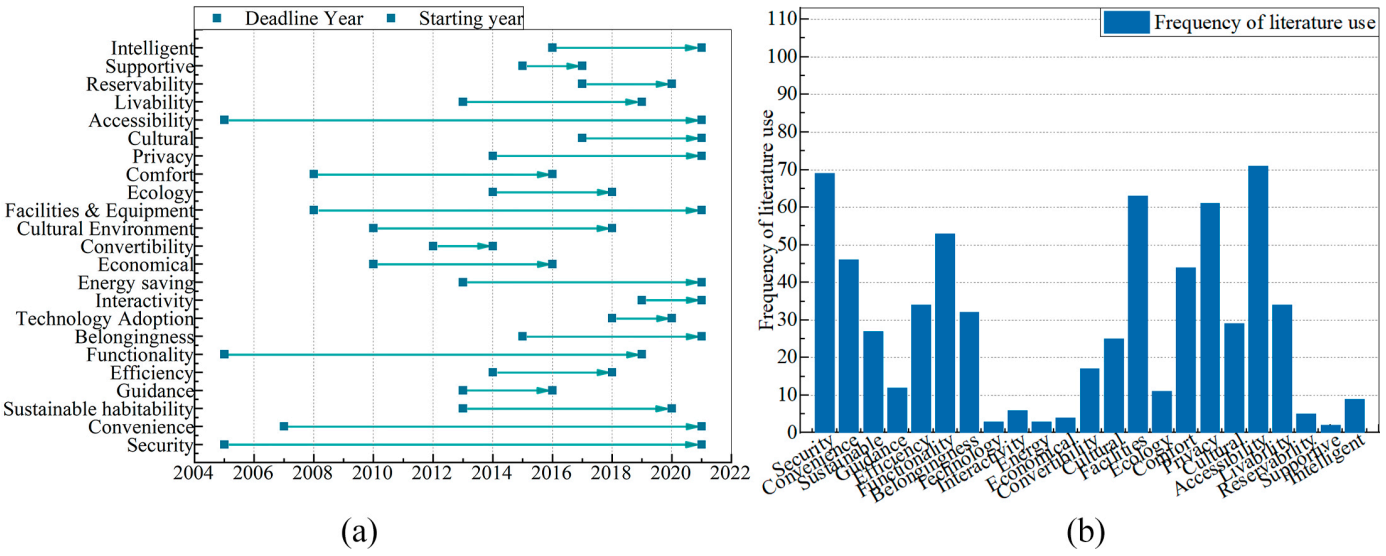

Figure 4. Analysis of Level 1 evaluation elements based on the literature of web of science repository. (**a**) Start and end time; (**b**) frequency of literature use.

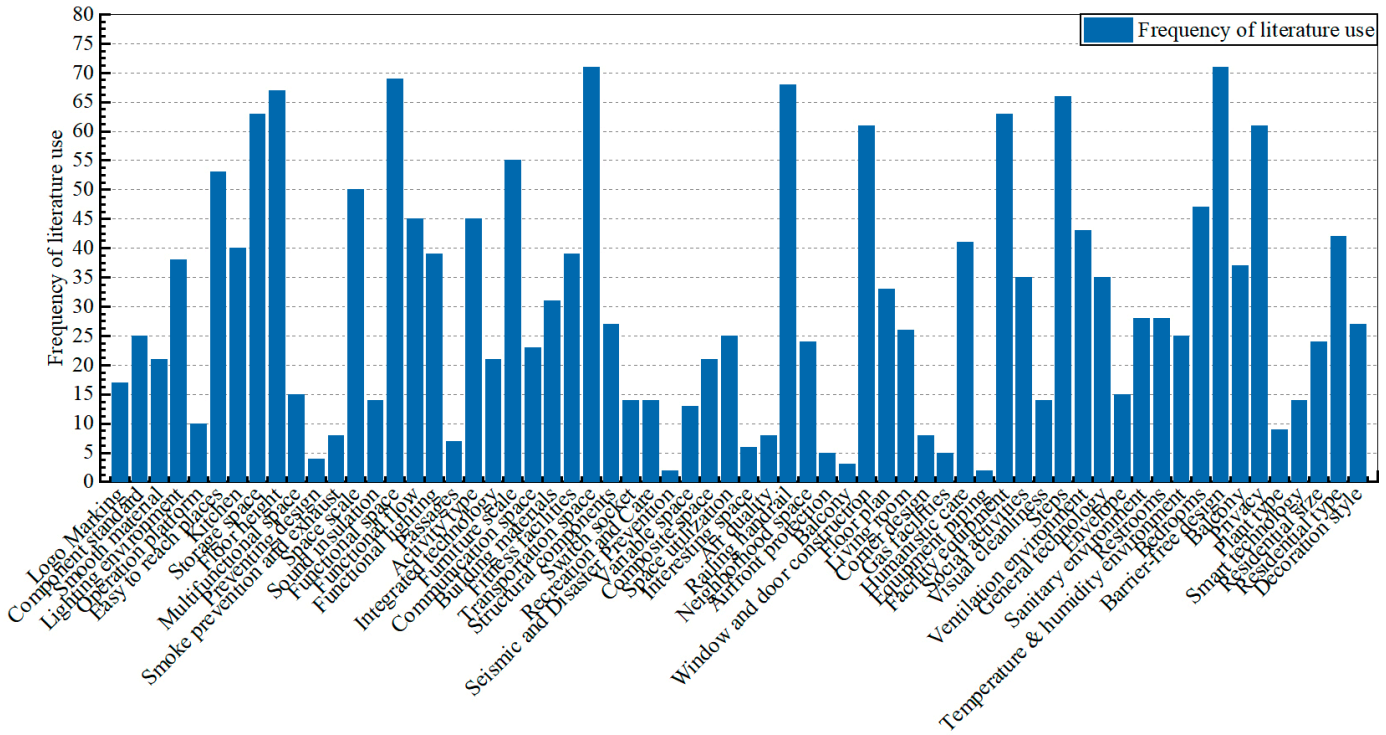

Figure 5. Analysis of Level 2 evaluation elements based on the literature review of web of science repository.

2.2.2. Satisfaction Evaluation

Based on the satisfaction questionnaire indicators developed in (1), the overall evaluation of indoor living environments in traditional houses was conducted and the importance ranking of two evaluation elements was determined. Using the commonly used measurement method for assessing elderly-appropriate design, the Likert scale, the factors for dissatisfaction among older adults were ranked in terms of importance. The evaluation was classified into five categories.

In addition, the importance of each indicator was analyzed using a statistical approach. The indicators were ranked based on their relative importance in affecting the overall

satisfaction (Table 2). The two evaluation elements were also ranked in terms of importance. Finally, the factors for dissatisfaction among older adults were identified and ranked based on their perceived importance. This process was performed based on the principles of elderly-appropriate design and the needs and preferences of the elderly population.

Table 2. Evaluation element level setting.

Evaluation Scope	Evaluation Levels	Levels
X1 > 4.5	Very satisfied	E1
3.5 < X1 ≤ 4.5	Somewhat satisfied	E2
2.5 < X1 ≤ 3.5	Neutral	E3
1.5 < X1 ≤ 2.5	Somewhat dissatisfied	E4
X1 ≤ 1.5	Very dissatisfied	E5

2.3. Subjective Evaluation of Living Environment by Elderly Residents in Different Ancient Towns

We conducted a questionnaire survey on the satisfaction level of elderly residents with their living environments in Liye town, Furong town, Xihe town, and Liexi town. A total of 200 questionnaires were distributed, with a response rate of 97.0%. After screening out logically flawed or randomly filled questionnaires, 194 valid questionnaires were received, resulting in the final effective rate of 85.6%. Respondents anonymously answered the survey questionnaire, and data security and privacy were protected solely for the purpose of this study. Ethical approval was obtained in accordance with formal procedures. The subjects were from the four towns who had been residing in traditional Tujia houses for a long time, and thus, they were familiar with the indoor living environment. Figure 6 presents the specific information of the elderly residents.

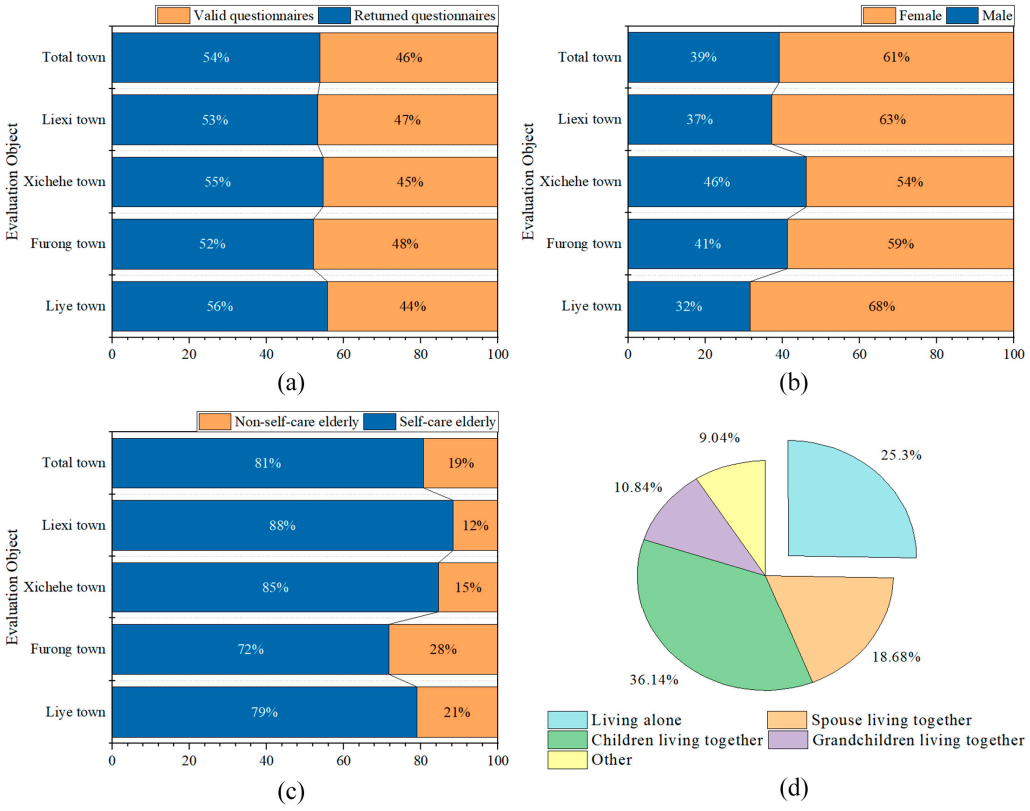

Figure 6. Basic information of interviewees. (**a**) Valid questionnaire; (**b**) gender; (**c**) elderly care categories; (**d**) family composition.

2.4. Ranking the Importance of Factors for Low Satisfaction

Based on the explanation of the indicator ranking questions and the result statistics, the first-level evaluation factors were scored using the direct ranking method and divided into six items according to their importance, ranging from 6 (most important) to 1 (least important). In addition, considering the large number of second-level evaluation factors, the elderly residents of the four towns were allowed to independently choose the factors they considered relatively important for their low satisfaction with the living environment.

3. Results and Discussion

3.1. Satisfaction Evaluation Questionnaire

3.1.1. Evaluation Index Modifications

The results of the evaluation index modifications are presented in Table 3. Compared with the principles related to age-friendly housing [66,67] (Table A1), factors affecting the convenience of daily life for the elderly should be supplemented and modified in order that elderly people can complete their daily activities and travel with more convenient paths and smaller movements, without excessive physical exertion and frequent unsafe factors, such as bending, tiptoeing, and rotating. Specific contents to improve the convenience and safety of the lives of the elderly involve evaluation factors, such as plan layout, functional flow line, space scale, and equipment operation.

Table 3. Process of determining indicators under expert opinions.

Level of Indicators	Expert Modification Suggestions	Modification Results of Indicators
Level 1 evaluation indicators	Whether the specific behaviors of elderly people in the ancient town always result in danger, and whether convenience-related factors rather than safety should be added.	Add convenience factors as a primary evaluation indicator and separate them from safety factors.
	The cultural factors were quite general, and it was unclear whether the elderly's perception of the atmosphere of "home" was solely based on their memories of familiar environments.	The concept of belongingness is added to the cultural factor category, and the positioning of belongingness and cultural factors as a first-level evaluation index.
	Does the addition of new or exclusive functions exist besides the existing functions within the residential housing?	Add caregiving space and medical space as secondary evaluation indicators.
Level 2 evaluation indicators	Does the concept of privacy mentioned by the elderly in the interview include spaces or nodes beyond the toilet and bedroom?	Add sound insulation indicators for commercial areas, partition walls, and other elements as part of the privacy factors for the second-level evaluation criteria related to noise disturbance.
	Does the cultural node raised by the elderly include considerations on the construction of specific nodes? It should be appropriately added.	To enhance the evaluation criteria, the traditional wooden structure has been added to the second-level evaluation indicators as a cultural and attributive element.

3.1.2. Self-Caring and Non-Self-Caring Elderly People

Figure 7 presents an analysis of factors affecting the living environment for self-caring and non-self-caring elderly people. The trend of the scree plot changes from a gradual decrease to a significant and rapid decrease. In Figure 7a, the value is less than 1 at the 9th point, and in Figure 7b, the value is less than 1 at the 8th point, indicating that the eigenvalues do not have clear characteristics. Therefore, eight factors were extracted for self-caring elderly people, and seven factors were extracted for non-self-caring elderly people. This difference was attributed to the difference in sensitivities of non-self-caring elderly people to functional spatial elements and interior furniture elements.

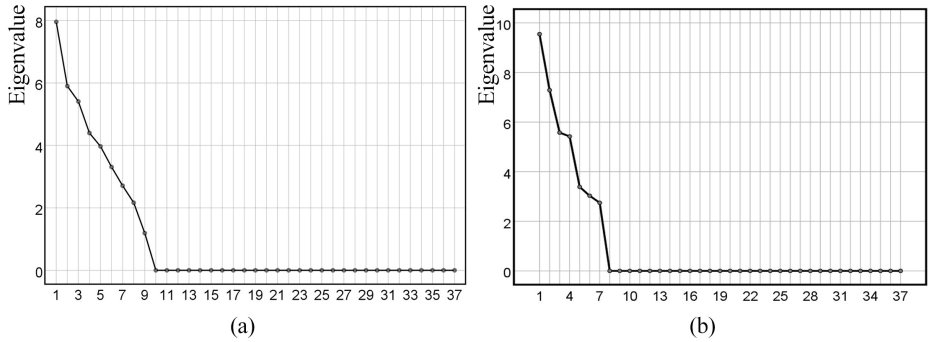

Figure 7. Analysis of evaluation elements of self-caring and non-self-caring older adults. (**a**) Self-caring elderly; (**b**) non-self-caring elderly.

3.1.3. Determination of Evaluation Indicators

Given that the majority (over 80%) of the elderly people in the ancient towns are self-caring, the factors influencing self-caring elderly people were selected as the evaluation indicators. Table 4 presents the questionnaire results for the living environment, ranking the coefficient values in descending order. The elderly people were most concerned about the safety, usability, and traffic accessibility of the traditional interior spaces in the residential buildings of the ancient towns, followed by the operability, indoor environmental quality, and privacy of the furniture and facilities. Finally, the elements for cultural belonging and sustainable living were considered.

Six primary evaluation factors and 36 secondary evaluation factors were determined after discussions with experts, covering all contents of the elderly users' concern of residential houses (Table 5). Safety factor, convenience factor, IEQ factor, privacy factor, belonging and culture factor, and sustainable livability factor were the six primary evaluation factors.

3.2. Satisfaction Evaluation of Self-Caring and Non-Self-Caring Elderly

The reliability analysis results of the questionnaire with the elderly as the control variable are presented in Tables 6 and 7. The Cronbach's alpha coefficient for the 37 items of evaluation elements A1~G was 0.829, which is significantly higher than the commonly used reliability requirement of 0.8, indicating that the questionnaire was overall credible. The value of the Spearman–Brown coefficient was 0.810, which was >0.8, indicating that all 37 evaluation elements of the questionnaire were credible and reliable and suitable for the subsequent data analysis study. The effect of the seven evaluation factors, namely, A5, B4, D1, D3, D7, E1, and F4, on the elderly was found to be significant.

The average satisfaction ratings of elderly residents in the four towns, namely, Liye, Furong, Xichehe, and Liexi, for various elements are shown in Table 1. The average score for the self-caring elderly residents' elements A1–F5 (3.022) did not differ significantly from the overall evaluation G (2.993); however, the average score for the non-self-caring elderly residents' elements A1–F5 (2.883), especially A1, G3, and F3, differed significantly from the overall evaluation G (2.719). The overall evaluation G for self-caring elderly residents was used to represent the average score for each evaluation element. The results of different elderly population groups were homogeneous and diverse.

In terms of homogeneity, elderly residents' overall satisfaction with the ancient town dwellings was generally "fair" or "poor", with scores ranging from 2.500 to 3.500. Specifically, the evaluation scores were graded as follows:

(1) Scores < 3.000 were observed for 14 factors, namely, entrance and indoor floor height difference, step and stair design, furniture scale, functional lighting, traffic space scale, indoor air quality, indoor lighting environment, indoor hygiene environment, shop sound insulation, stove space, decoration style, toilet and bathing space, storage space, and traffic space. These living elements can be considered primarily for improving the living environment of elderly residents.

(2) Scores between 3.000 and 3.500 were observed for seven factors, namely, indoor floor smoothness, room layout, indoor ventilation environment, floor sound insulation, neighbor communication space, family communication space, and care space. These living factors can be appropriately considered in the next stage of improvement for the living environment of elderly residents.

(3) Scores > 3.500 were observed for four factors, namely, room space scale, indoor temperature and humidity environment, bedroom living, and privacy of household wall sound insulation. These results imply that elderly residents generally believe that the indoor space is sufficient, the external walls are thick enough, and the room is warm in winter and cool in summer. The beds are equipped with black curtains, resulting in high privacy of the bedroom. In addition, the household wall is generally made of fire-resistant volcanic rock, which is minimally affected by noise. Therefore, these elements should be maintained while improving the elderly residents' living environment.

Table 4. Statistical analysis of the secondary evaluation elements.

Common Factor	Variables	Common Factor							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Safety factors	A1	0.692	0.345	0.331	0.177	0.295	0.008	0.304	0.258
	A2	0.643	0.198	0.217	0.103	0.352	0.235	0.444	0.156
	A3	0.666	0.587	0.070	0.102	0.269	0.311	0.120	0.016
	A4	0.844	0.149	0.150	0.408	0.027	0.252	0.061	0.009
	A5	0.849	0.288	0.238	0.331	0.073	0.041	0.008	0.104
Transportation spatial factors	A7	0.193	0.505	0.317	0.204	0.625	0.242	0.179	0.256
	B2	0.043	0.591	0.142	0.044	0.371	0.616	0.064	0.323
	D4	0.210	0.664	0.476	0.371	0.094	0.260	0.188	0.117
	D7	0.210	0.656	0.343	0.072	0.006	0.111	0.613	0.116
	F5	0.053	0.790	0.221	0.337	0.101	0.168	0.232	0.343
Functional spatial factors	B1	0.249	0.445	0.650	0.239	0.222	0.375	0.251	0.080
	B2	0.332	0.155	0.783	0.103	0.102	0.145	0.265	0.329
	B3	0.265	0.045	0.824	0.013	0.333	0.196	0.046	0.258
	E2	0.143	0.018	0.901	0.280	0.160	0.050	0.001	0.009
	E3	0.660	0.249	0.459	0.344	0.152	0.249	0.233	0.082
	E4	0.132	0.161	0.632	0.188	0.441	0.037	0.484	0.296
Furniture and fixtures factors	A6	0.242	0.207	0.410	0.739	0.248	0.118	0.077	0.212
	B5	0.446	0.293	0.169	0.618	0.349	0.308	0.128	0.227
Indoor Environmental Quality (IEQ) factors	C1	0.227	0.211	0.298	0.615	0.531	0.133	0.158	0.304
	C2	0.327	0.590	0.357	0.352	0.521	0.068	0.126	0.042
	C3	0.269	0.461	0.419	0.226	0.485	0.210	0.315	0.301
	C4	0.357	0.004	0.004	0.005	0.603	0.148	0.277	0.497
	C5	0.201	0.229	0.170	0.181	0.463	0.175	0.078	0.357
Sustainable livability factors	F1	0.342	0.480	0.005	0.060	0.379	0.488	0.098	0.083
	F2	0.380	0.289	0.053	0.684	0.110	0.416	0.133	0.114
	F3	0.362	0.045	0.318	0.299	0.350	0.723	0.156	0.079
	F4	0.229	0.268	0.093	0.422	0.271	0.644	0.079	0.399
Privacy factors	D1	0.185	0.496	0.102	0.112	0.269	0.379	0.582	0.165
	D2	0.384	0.065	0.063	0.382	0.210	0.290	0.496	0.341
	D3	0.066	0.023	0.419	0.428	0.338	0.444	0.529	0.209
	D5	0.121	0.281	0.253	0.110	0.197	0.040	0.457	0.044
	D6	0.357	0.004	0.004	0.005	0.103	0.148	0.497	0.215
Belonging and Cultural factors	E1	0.084	0.221	0.235	0.242	0.398	0.489	0.424	0.619
	E5	0.246	0.336	0.040	0.361	0.107	0.142	0.318	0.735
	E6	0.377	0.408	0.485	0.347	0.190	0.052	0.110	0.414
	E7	0.237	0.224	0.193	0.352	0.231	0.315	0.265	0.553

Table 5. Classification and explanation of evaluation elements at each level.

Level 1 Elements		Level 2 Elements	Specific Description of Elements
Safety factors	A1	Entrance and interior floor level difference	Whether there is easy access between indoor and outdoor spaces
	A2	Smoothness of interior floor material	Whether indoor flooring is slippery and poses a risk for falls
	A3	Safety measures for interior open spaces	Whether areas with a sudden drop-off pose a risk for falls
	A4	Design of steps and risers	Whether stairs and steps are safe and easy to use
	A5	Construction of doors, windows, handrails, etc.	Whether doors, windows, and other building components are safe and function properly
	A6	Furniture scale and proportion	Whether furniture dimensions are appropriate and do not pose a risk for collisions
	A7	Functional lighting	Whether indoor lighting design is practical and functional
Convenience factors	B1	Room layout design	Whether the current layout meets the daily needs and activities of the inhabitants
	B2	Functional circulation in the room	Whether the current flow of activities in the space is convenient and easy to access
	B3	Room spatial scale	Whether room dimensions hinder daily activities
	B4	Traffic spatial scale	Whether the dimensions of traffic spaces allow for convenient passage
	B5	Facility and equipment operation	Whether equipment and facilities are easy to operate and understand
IEQ factors	C1	Indoor air quality	Whether the air quality in spaces, such as the kitchen, bedroom, and bathroom is pleasant
	C2	Indoor ventilation environment	Whether poor ventilation causes discomfort in the indoor environment
	C3	Indoor lighting environment	Whether insufficient lighting inhibits normal activities
	C4	Indoor hygiene environment	Whether clutter and excess waste contribute to discomfort
	C5	Indoor temperature and humidity environment	Whether indoor temperature and humidity levels are uncomfortable
Privacy factors	D1	Privacy in latrines and bathrooms	Whether privacy is obstructed in the toilet area
	D2	Privacy in bedrooms and living rooms	Whether privacy is obstructed in the bedroom area
	D3	Visual cleanliness	Whether clutter and disorganization contribute to discomfort
	D4	Floor sound insulation	Whether footsteps cause excessive noise from the floor above
	D5	Shop sound insulation	Whether noise from nearby businesses causes discomfort in the bedroom area
	D6	Partition wall sound insulation	Whether noise from adjacent rooms causes discomfort
	D7	Staircase sound insulation	Whether footsteps cause excessive noise in the stairway

Table 5. *Cont.*

Level 1 Elements		Level 2 Elements	Specific Description of Elements
Belonging and cultural factors	E1	Traditional wooden structures	Whether the current condition of traditional wooden structures is severely damaged
	E2	Fireplace space	Whether the current condition of the fire pit space hinders normal daily activities
	E3	Ancestral worship space	Whether the ancestral worship space is easy to conduct activities in
	E4	Courtyard space	Whether the current condition of the courtyard space is severely damaged
	E5	Neighborhood communication space	Whether the current condition of the neighborhood communication space meets current needs
	E6	Family communication space	Whether the current condition of the family communication space meets current needs
	E7	Decorative style	Whether severe damage has been caused by renovation, addition, and aging
Sustainable livability factors	F1	Toilets and bathing areas	Whether the current condition of the toilet and bathing space in the thatched cottage meets requirements
	F2	Storage space	Whether the storage space is easily accessible and easy to use
	F3	Accompanying space	Whether the accompanying space is sufficient and properly equipped
	F4	Medical space	Whether the medical space is sufficient and properly equipped
	F5	Traffic space	Whether the space can accommodate current or future wheelchair accessibility

Table 6. Cronbach's alpha reliability analysis.

Evaluation Factors	Number	Cronbach's Alpha Coefficient
A1~G	37	0.829

Table 7. Reliability analysis of the Spearman–Brown coefficient.

Alpha	Part I	Values	0.674
		Items	19α
	Part II	Values	0.747
		Items	18β
	Total		37
Correlation between morphologies			0.683
Spearman–Brown factor	Equal length		0.811
	Unequal		0.811
Gettleman discount factor			0.810

α items: A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, B4, B5, C1, C2, C3, C4, C5, D1, D2.
β items: D3, D4, D5, D6, D7, E1, E2, E3, E4, E5, E6, E7, F1, F2, F3, F4, F5, G.

In terms of diversity, differences were observed in eight factors, namely, indoor open space protection measures (A3), construction, such as door and window handrails (A5), furniture scale (A6), room function flow line (B2), traffic space scale (B4), facility and

equipment operation (B5), care space (F3), and medical space (F4). Non-self-caring elderly residents often live in rooms that were built later, and the area of these rooms can meet the elderly residents' basic needs for daily activity. However, this interferes with family communication. Moreover, non-self-caring elderly residents need wheelchairs and double-passing spaces, and these needs are not met in the existing traffic space. In addition, non-self-caring elderly residents have higher demands for care and medical spaces. Ancient dwellings need to meet both present and future needs of elderly users (Figure 8).

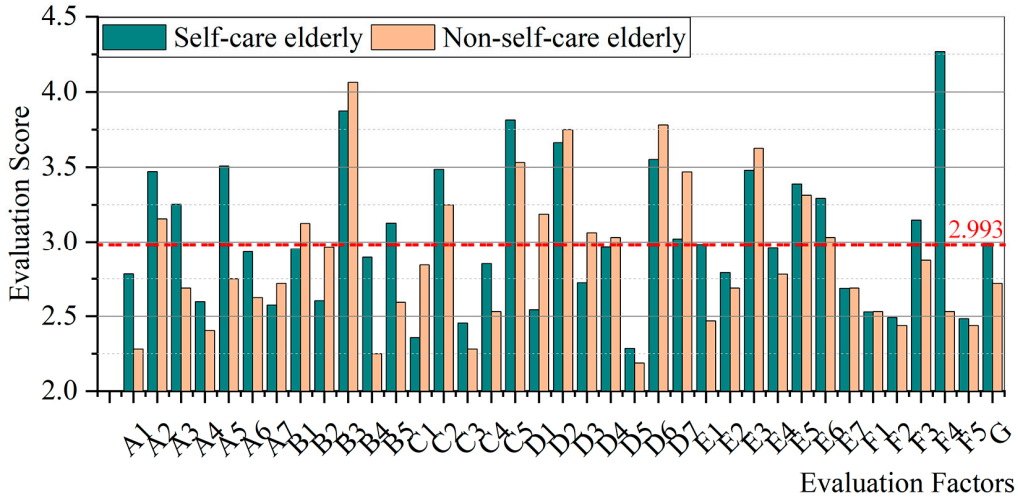

Figure 8. Results of satisfaction with living environment among self-caring and non-self-caring elderly.

3.3. Satisfaction Evaluation of Typical Ancient Towns

The results of statistical analysis of the research data for the controlled variables of typical ancient towns are presented in Tables 8 and 9. For the research data, $\alpha > 0.8$ indicates that the questionnaire was reliable and credible. The Spearman–Brown coefficient split-half coefficient value for each evaluation element in A1~G was 0.810, which was >0.8, indicating the reliability of the questionnaire results from different ancient towns.

Table 8. Cronbach's α reliability analysis.

Evaluation Factors	Number	Cronbach's α Coefficient			
		Liye Town	Furong Town	Xichehe Town	Liexi Town
A1~G	30	0.832	0.785	0.796	0.825

Table 9. Reliability analysis of the Spearman–Brown coefficient.

Alpha	Part I	Values	0.682	0.635	0.612	0.682
		Items	19α	19α	19α	19α
	Part II	Values	0.750	0.660	0.688	0.726
		Items	18β	18β	18β	18β
	Total		37	37	37	37
Correlation between morphologies			0.685	0.641	0.702	0.686
Spearman–Brown factor	Equal length		0.813	0.781	0.825	0.814
	Unequal		0.813	0.781	0.825	0.814
Gettleman discount factor			0.812	0.781	0.824	0.813

α items: A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, B4, B5, C1, C2, C3, C4, C5, D1, D2.
β items: D3, D4, D5, D6, D7, E1, E2, E3, E4, E5, E6, E7, F1, F2, F3, F4, F5, G.

The elderly residents' satisfaction with their residential environment is depicted in Figure 9. Elements with evaluation scores ≤ 3.5 accounted for 81%, indicating that elderly residents considered the living environment of traditional Tujia residential buildings to be average or in need of improvement. Overall, the trends for each category of elements were consistent, indicating that the indoor environment of traditional Tujia residential buildings was similar to some extent. Therefore, improving the evaluation elements with scores less than 3 can be the key for enhancing the living environment for the elderly in ancient towns.

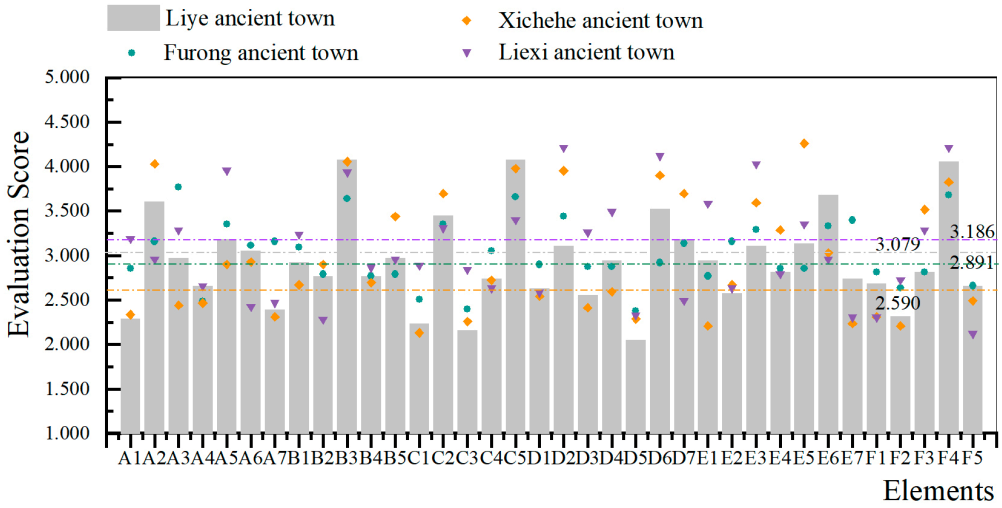

Figure 9. Results of satisfaction evaluation of the elderly people's living environment in different ancient towns.

The elderly residents of Liye were mostly dissatisfied with the lighting, air quality, sound environment, and accessibility of residential buildings, representing the elements A1, A7, C1, C3, D5, and F2. In Furong, the main factors for dissatisfaction among elderly people were the accessibility, lighting, and sound environment of residential buildings, representing the elements A4, C3, and D5. In Xichehe, the main factors were the lack of safety handrails on stairs, a large number of steps and stairs affecting accessibility, poor lighting due to unreasonable layout and lack of scientific functional lighting, poor air quality due to smoke from indoor fire pits, poor sound environment due to commercial and unreasonable layout, and insufficient storage space, representing the elements A1, A3, A4, A7, C1, C3, D3, D5, E1, E7, F1, F2, and F5. In Liexi, the main factors for a low sense of belonging for elderly residents were the inconvenience caused by furniture and the unreasonable size of residential building plans and poor lighting, outdoor noise affecting the rest of the elderly, and the prominent differences between self-built rooms and traditional architectural styles. In addition, with the development of tourism, traditional neighborhood communication places have been transformed into commercial areas, including elements A6, A7, B2, D5, D7, E7, F1, and F5.

3.4. Low Satisfaction Importance Ranking

The importance ranking for low satisfaction among the elderly residents toward indoor environment was as follows: Safety, convenience, and health (most important elements), sustainability, privacy, and attachment to culture. The importance ranking of first-level evaluation elements was as follows: Safety, convenience, health, sustainability, privacy, and attachment to culture; the results, thus, confirm the rationality of the factor analysis results, in addition to highlighting the key aspects that need to be considered for improving the living conditions of elderly residents in the traditional dwellings from the perspective of elderly care (Tables 10 and 11).

Table 10. Level 1 evaluation element importance score and ranking.

Level 1	Safety	Convenience	IEQ	Privacy	Belonging and Cultural	Sustainable Livability
Score	795	708	660	433	386	504
Ranking	1	2	3	5	6	4

Table 11. Level 2 evaluation element importance score.

Level 2	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5
Score	116	68	108	113	104	70	107	86	99	6	44	71
Level 2	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	D6	D7
Score	80	11	79	69	40	49	13	34	18	66	6	8
Level 2	E1	E2	E3	E4	E5	E6	E7	F1	F2	F3	F4	F5
Score	32	94	16	15	23	16	21	65	58	81	5	98

4. Suggestions

The principles of upgrading traditional homes for the elderly should reflect their needs, the status quo of traditional homes, and the direction of transformation. Based on an extensive literature review, combined with exploratory research involving free-form on-site interviews and semi-structured questionnaire surveys of the needs of the elderly for suitable housing, and relevant theories on the design of elderly-friendly housing, we summarize a set of design principles to help elderly people adapt to homes in ancient towns as follows:

4.1. Safety

Safety is the most basic and crucial factor for elderly-friendly design. Due to the decline in the physical functions of elderly people, their ability to adapt to the indoor environment of traditional homes is greatly reduced. Specifically, in the ancient Xiangxi Tujia town, where traditional homes are built on uneven terrain, safety factors have special characteristics, including factors, such as ground level differences, smoothness of ground materials, protection of open areas, stair design, door and window handrails, furniture dimensions, and functional lighting. By addressing safety issues, safety for the elderly people can be ensured and the needs of elderly people living in Tujia ancient towns with intersecting infrastructure can be met.

4.2. IEQ

According to academic research, compared with health-related principles for the elderly in cities, health factors faced by the elderly in ancient towns are more extensive. Indoor spaces in traditional homes may not be suitable or may pose health risks. It is recommended that harmful substances should be controlled to provide the elderly with a spacious physical and mentally abundant environment. However, functional health generally includes the creation of social and healthy environments having daylighting, air cleaning, green plants, fitness areas, and places of worship.

Living environment has long-term impacts on the physical health of humans. Compared with adults, elderly people are less sensitive to environmental conditions, but the physical impact on them is greater. For improving the health aspects of the living environment for the elderly in ancient towns, focus should be placed on the following aspects: Indoor air quality, ventilation, lighting, hygiene, temperature and humidity, and communication, among other specific and reasonable environmental requirements.

4.3. Privacy

Privacy generally refers to the degree to which a person's behavior and activities are not disturbed or affected by others. In modern life, it is narrowly defined as the degree of visuality of behavior. The privacy requirements for sight and sound for elderly people

in ancient towns are significantly higher than those for other aspects. In Tujia, due to the noise generated by continuous commercial development, the privacy of elderly people's lives has been affected. Additionally, the wooden structure of the external maintenance and partition walls of traditional homes has further contributed to the increased propagation of noise.

Combined with legal provisions on privacy and the specific situation of Tujia ancient town homes, privacy principles should be applicable to toilets and bathrooms, bedrooms and living rooms, visual cleanliness, floor sound insulation, shop wall sound insulation, partition wall sound insulation, and stairwell sound insulation, among other specific and reasonable environmental requirements. This can help in creating private and exclusive spaces for elderly people.

4.4. Belonging and Cultural

Sense of belonging and cultural identity primarily stem from the longing of the elderly for their past ways of living, habits, and memories. In Tujia, the elderly population follows unique Tujia customs and has social interactions, family structures, religious rituals, and other ethnic characteristics. The traditional architectural is characterized by unique structural design, functional space, social space, and building materials, which can evoke deep emotions and a strong sense of belonging among elderly people. For elderly people of Tujia, the principles of belonging and culture should include the protection and inheritance of elements, with special emphasis on factors, such as traditional wooden structures, hearth space, ritual space, courtyard space, neighborhood communication space, family communication space, doorways, water ditches, and decorative styles. Improving and developing these factors can enhance the sense of belonging among the elderly.

4.5. Sustainable Livability

With gradual aging and transition of elderly people from being self-reliant to non-self-reliant, their daily behavioral patterns change, resulting in changes in their daily needs, which must be met by traditional housing with sustainable livability features. For instance, when elderly people require facilities, such as wheelchairs to maintain self-reliance, the corresponding needs for indoor functionality in traditional housing should change accordingly. If these situations are anticipated early and corresponding optimization strategies are prepared, simple space adjustments or streamline optimizations can be carried out to transform traditional housing into a future age-friendly living environment.

To improve the living environment of traditional Tujia houses in Xiangxi, attention must be paid to specific elements, such as toilet and bathing space, storage space, caregiving space, medical space, and ritual space to meet the behavioral needs of elderly people undergoing physiological changes. To minimize the impact of buildings on the lives of the elderly throughout their life cycle, appropriate and flexible modifications or additions should be made.

5. Conclusions

This study evaluated the elderly people's satisfaction with their living environment in Xiangxi Tujia Area, China, based on a post-occupancy evaluation survey. Relevant factors for improving elderly friendliness and living environment were identified through unstructured interviews, structured questionnaires, and consultation with experts. The first- and second-level influencing factors for the residents' satisfaction of the living environment in the ancient towns were determined and ranked in importance. An assessment framework was constructed for evaluating the living environment of elderly residents in ancient towns, and the satisfaction of elderly residents' living environment in four typical Xiangxi ancient towns was evaluated. The main findings are as follows:

- Six first-level evaluation indicators for the living environment of elderly residents in Xiangxi Tujia ancient towns were identified, which are as follows: Safety factors, convenience factors, health factors, privacy factors, sense of belonging and cultural

factors, and sustainability. In addition, 36 second-level evaluation factors were identified. Elderly residents are most concerned about the safety, functionality, and traffic accessibility of the traditional interior spaces of ancient residences, followed by the operability, health, and privacy of furniture and facilities, and finally by their need for belongingness, culture, and sustainability.

- Differences were observed in the evaluation of the living environment between self-reliant and non-self-reliant elderly residents in terms of eight influencing factors, namely, protection measures for indoor empty areas, construction of door and window handrails, furniture scale, functional flow lines of rooms, traffic space scale, facility and equipment operation, accompanying space, and medical space. These factors should be given special attention in families where elderly residents cannot take care of themselves.
- Elements with an average satisfaction score of $\leq$3.5 in the evaluation of the living environment of elderly residents in different ancient towns of Xiangxi accounted for 81%. Residents of Liye required improvement mostly for lighting, air quality, sound environment, and accessibility; those of Furong needed improvement in terms of accessibility, air quality, sound environment, and functional layout; and those of Xichehe needed improvement in functional layout, lighting environment, sound environment, and cultural belongingness. These low satisfaction factors must be considered for improving the living environment of elderly residents in ancient towns.

This study has some limitations. Factors affecting the living environment focus mainly on aspects where elderly residents have low satisfaction ratings. However, certain aspects of the physical indoor environment, such as ventilation, insulation, temperature, and humidity, may be inadequate in some traditional homes. These factors may have been overlooked due to the lower sensitivity of elderly residents. Furthermore, we selected typical Xiangxi Tujia ancient towns, including Furong, Liye, Liexi, and Xichehe, as research objects, which differ from other areas in terms of construction features, ethnic culture, and climatic conditions. Therefore, the evaluation criteria proposed in this study should be supplemented and modified according to local conditions. Additionally, we propose strategies for improving traditional homes to meet the needs of elderly residents; however, the lack of appropriate engineering verification warrants further research to thoroughly explore these issues.

Author Contributions: Conceptualization, L.S. and F.Z. (Fupeng Zhang); methodology, F.Z. (Fupeng Zhang) and F.Z. (Fanxuan Zeng); software, S.L. and M.C.; validation, S.L. and F.Z. (Fupeng Zhang); formal analysis, F.Z. (Fupeng Zhang) and F.Z. (Fanxuan Zeng); investigation, F.Z. (Fanxuan Zeng) and M.C.; resources, L.S. and S.L.; data curation, F.Z. (Fupeng Zhang) and F.Z. (Fanxuan Zeng); writing—original draft preparation, F.Z. (Fupeng Zhang) and F.Z. (Fanxuan Zeng); writing—review and editing, M.C. and J.L.; visualization, F.Z. (Fanxuan Zeng); supervision, J.L. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data available on request due to privacy restrictions. The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy considerations. Please contact the corresponding author before use.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

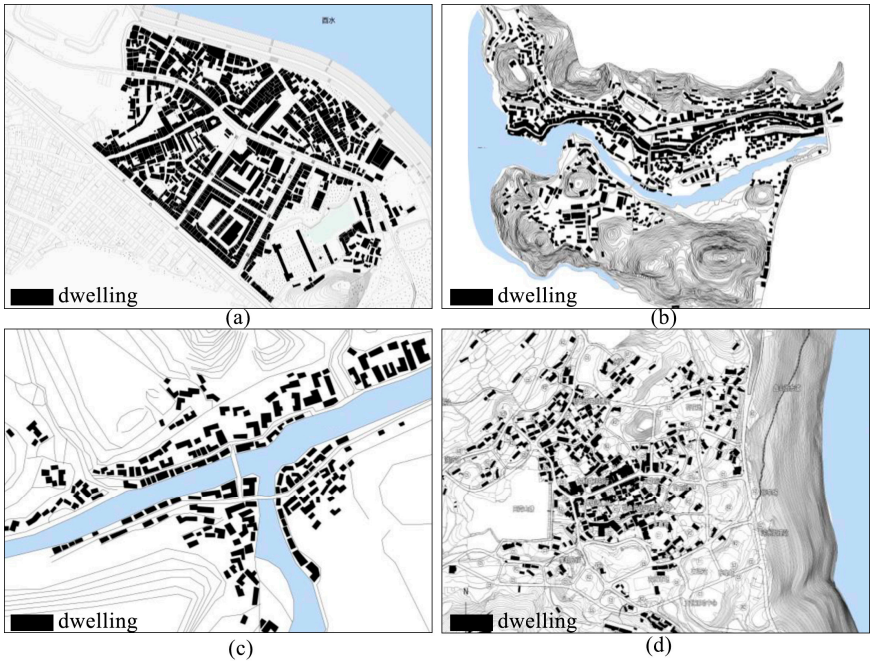

Figure A1. The plans of Xiangxi ancient town. (**a**) Liye ancient town, (**b**) Furong ancient town, (**c**) Xichehe ancient town, and (**d**) Liexi ancient town.

Figure A2. Two representative dwelling plans of the ancient towns in Xiangxi. (**a**) Front store and back house dwelling, (**b**) lower store and upper house dwelling [42].

Table A1. Evaluation elements of domestic and international normative policies on care for the elderly.

Country	Type	Source of Evaluation Elements	Summary of High-Frequency Related Indicators
Japan	Standards	Accessible Specific Building Code	Convenience, accessibility, efficiency, accessibility, spatial scale, use function; sustainability, functional variability, facilities and equipment, reserve, height difference, accessibility, structural components, residential area, envelope, intelligent equipment, pipelines, operation platform, building materials, furniture scale, visual effect, general technology, etc.
		Criteria for Recognition of 100-Year Homes	
		Housing Design Guidelines for Longevity Society	
		Evaluation of Homes for the Aged	
		Housing Performance Indication and Evaluation Standards	
		Welfare Housing Construction System Manual	
	Policy	Senior Citizen Residence Act	Convenience, safety, spatial environment, residential area, suitability, orientation, culture, livability, noise, ventilation environment, lighting environment, temperature and humidity environment, recreation and care, communication space, functional space, building scale, sustainability, etc.
		Caring Building Act	
		Long-term Excellent Housing Certification System	
		National Pension Law and Nursing Care Policy	

Table A1. *Cont.*

Country	Type	Source of Evaluation Elements	Summary of High-Frequency Related Indicators
Europe and America	Standards	Design Code for Age-Friendly Housing Classification	Security, convenience, privacy, spatial scale, green landscape, comfort, spatial environment, no height difference access, space sufficiency, automation, intelligence, barrier-free design, facilities and equipment, noise, decoration materials, electrical equipment, spatial function, lighting, lighting view, durability, air pollution, etc.
		Preparatory Standards for Age-Friendly Homes in Germany	
		Code for Latent Design Systems for the Elderly	
		Design Code for Living Environment in the Age of Aging	
		Residential Performance Evaluation Code	
		Residential Quality Evaluation Index System	
	Policy	Residential Building Post Occupancy Evaluation System	Convenience, safety, sustainable livability, accessibility, transportation space, facilities and equipment, air quality, spatial environment, cleanliness, communication space, residential suite, signage, residential area, spatial interest
		Architectural Design Validation Policy for the Aging	
		Age-Friendly Community Assessment Framework	
		100 Rules for Evaluating Assisted Living for the Elderly	
China	Standards	Technical Standards for Residential Performance Evaluation	Safety, convenience, comfort, privacy, sustainable livability, ecology, height difference, building materials, ventilation environment, construction facilities, lighting, floor plan, functional flow, communication space, structural elements, railing and handrail, variable space, accessibility, functional space, residential sets, decorative style, spatial scale, intelligence, temperature and humidity environment, furniture scale, storage space, general technology, etc.
		Residential Building Design Code for the Elderly	
		Standard for the Evaluation of the Ability of the Elderly	
		Architectural Design Standards for Elderly Care Facilities	
		Building Design Code for Elderly Facilities	
		Requirements for Aging-Appropriate	
		Modification of Home-Based Aging	
		Code for Aging-in-Place Services	
		Residential Health Performance Evaluation System	
	Policy	Plan for the Construction of Social Aging Service System	Safety, convenience, accessibility, suitability, spatial environment, functional space, decorative style, building materials, height difference, stairs, livability, social activities, care space, temperature and humidity environment, humanistic care, sense of belonging, space utilization, space interest
		Requirements for Barrier-Free and Age-Friendly Building Products	
		Guiding Opinions on Accelerating the Implementation of Home Aging Adaptation Project for the Elderly	
		Guiding Opinions on Promoting the Construction of a Livable Environment for the Elderly	
		Opinions on Promoting the Development of Elderly Services	
		The State Council issued the "Fourteenth Five-Year Plan" for the development of the national aging career and pension system 2022	
		Opinions on Advancing the Development of Senior Care Services ([2019] No. 5)	

Table A2. Freestyle interviews.

1.	Please provide your first name or last name.
2.	What is your gender?
3.	How old are you?
4.	What is your height? Please select one of the following options: A $\leq$ 1.5 m B 1.5~1.6 m C 1.6~1.7 m D 1.7~1.8 m E $\geq$ 1.8 m

Table A2. *Cont.*

5.	In your living space, which areas do you believe are the most prone to falls, and have you considered making any modifications to improve safety? (Note: Areas frequented by the elderly are considered as functional spaces, and any desired removal should be noted).
6.	What indoor areas or spaces do you feel are the least secure, and why? (Examples: Entryways, living rooms, bedrooms, staircases, wide hallways, etc.).
7.	In each room of your living space, are there any aspects that you find dissatisfying or that do not meet your needs? Please describe all points of dissatisfaction as you move throughout the space.
8.	Which rooms or spaces in your living area are unused or considered unusable, and have you considered ways to improve them? (Please describe reasons for abandonment and why the space is considered unusable, as well as any ideas for potential improvements).
9.	In your daily routine, which areas of your living space hinder your activities or cause inconvenience? Please describe which areas are most problematic.
10.	Are there any facilities or equipment in your living space that you find difficult or inconvenient to use? If so, please explain the reasons for this, as well as the size and type of equipment.
11.	What changes or improvements do you believe could be made to your living space in the future, and how would you suggest making these improvements? (Please describe any suggestions for improvements, as well as any concerns or reasons for rejecting the proposed changes).
12.	Are there any other needs that you feel must be addressed in the future? (Examples: Exclusive bathing facilities, additional storage space, health care facilities, etc.).
13.	Have any of the interior features or design elements of your living space disrupted your previous habits or customs? If so, please describe these habits and customs, as well as any cultural or national significance they may hold.
14.	Which elements of the interior design in your living space do you feel best represent traditional cultural features or symbols of the Tujia family? Please describe any relevant building materials, architectural spaces, or ritual facilities, and assess whether the dimensions are reasonable.

Table A3. Semi-structured questionnaire.

1.	Which functional improvements to the home would enhance your quality of life? a. Bathing facilities b. Storage space c. Caregiving space d. Medical facilities e. Social activity space f. Study or cinema space g. Ritual space
2.	Which functional spaces in a residential setting enhance one's cultural identity? a. Traditional wooden structural elements b. Hearth space c. Ancestral worship space d. Courtyard space e. Aesthetic spatial features
3.	Which factors in a residential setting contribute to a sense of social respect? a. Privacy in the bedroom and bathroom b. Ability to prepare meals c. Ability to engage in sales activities d. Ease of social interaction with neighbors e. Ability to operate furniture and facilities independently
4.	Which areas of the home, such as entrances and doorways, impact your daily mobility? a. Threshold accessibility b. Use of water channels c. Buffer space at the entrance d. Door opening difficulty e. Flooring evenness
5.	What factors in the main living space affect your ability to engage in activities and social interactions? a. Width and depth of the main living area b. Evenness of flooring c. Suitability of facilities d. Layout of the space e. Availability of storage space

Table A3. *Cont.*

6.	Which environmental factors in the main living space make you feel uncomfortable? a. Lighting environment b. Wind environment c. Temperature environment d. Noise environment e. Air quality
7.	Which factors in a residential shop affect your shopping and sales activities? a. Prominent signage b. Appropriate layout c. Obstruction of sight lines d. Length of flow e. Ease of use of equipment and facilities
8.	Which factors in the traffic space of the home affect your daily movement? a. Scale of the traffic space b. Material and identification of the staircase c. Illumination of the traffic space d. Height and location of handrails e. Complexity of flow and interactions with other functions
9.	Which factors in the traffic space of the home affect your daily movement? a. Scale of the traffic space b. Material and identification of the staircase c. Illumination of the traffic space d. Height and location of handrails e. Complexity of flow and interactions with other functions
10.	Which environmental factors in the bedroom make you feel uncomfortable? a. Lighting environment b. Wind environment c. Temperature environment d. Noise environment e. Air quality
11.	Which factors in the outhouse space affect your toileting or bathing behavior? a. Lengthy flow lines b. Construction materials c. Accessibility design d. Odors e. Privacy of the outhouse
12.	Which environmental factors in the hearth space make you feel uncomfortable? a. Lighting environment b. Wind environment c. Temperature environment d. Noise environment e. Air quality

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