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From living heritage to healing place: synergistic healing mechanisms of the water villages in Lingnan, China

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Abstract

Lingnan water villages in the Pearl River Delta, China, represent a unique form of living cultural and ecological heritage. Although their heritage and landscape values are widely recognized, less is known about how these everyday rural environments contribute to visitors' restorative experience and rural well-being. This study investigates the perceived restorative potential of Lingnan water village landscapes using the Perceived Restorativeness Scale (PRS), Attention Restoration Theory (ART), and structural equation modeling (SEM). Survey data were collected from 415 visitors across six representative villages. Results indicate that natural landscapes and traditional street-alley spaces form a dual foundation for restoration, while folk culture is particularly associated with psychological "Being Away" and fascination. The healing potential is not dominated by a single element but emerges from the synergy of ecology, spatial structure, and cultural practices. This study contributes to rural studies by reframing therapeutic landscapes as a mechanism of rural well-being, place-making, and differentiated revitalization in peri-urban heritage villages. It also offers practical implications for integrating ecological conservation, cultural continuity, and experience-oriented rural tourism.

Keywords: healing landscape; water villages; Lingnan cultural region; perceived restorativeness; rural revitalization tourism

Introduction

In recent years, rapid urbanization and irrational urban planning have increased the health burden borne by urban residents (Liu and Zhou, 2024). Since the COVID-19 pandemic, the health performance of the built environment has received widespread attention. Accordingly, how to improve public physical and mental health and restore psychological balance has become one of the key issues in achieving sustainable urban-rural development. Against a background of mounting pressures in modern life, people increasingly seek healing environments that can relieve stress and restore mood. A seminal early study provided concrete evidence that a natural view could accelerate patient recovery from surgery (Ulrich, 1984), suggesting a potent, possibly restorative effect of nature. This effect was later systematically theorized through Attention Restoration Theory (ART) (Kaplan, 1995), which posits that natural environments facilitate the recovery of fatigued directed attention

through characteristics such as fascination, being away, extent, and compatibility. Supporting evidence for these health benefits has accumulated on multiple fronts. For instance, systematic reviews confirm that exposure to green spaces (Twohig-Bennett and Jones, 2018) and blue spaces (Völker and Kistemann, 2011) is associated with a wide range of positive health outcomes, including physiological stress reduction, improved mood, and recovery from directed attention fatigue. Furthermore, structured engagement with culturally or aesthetically rich environments, such as visiting museums or art galleries, has been associated with mental health and a lower incidence of depression in older adults (Fancourt and Steptoe, 2019; Fancourt and Tymoszuk, 2019), implying that culturally defined places may operate through health-promoting mechanisms analogous to those of natural environments. Research on stress recovery has demonstrated the restorative relevance of natural environments (Ulrich et al., 1991). Building on this evidence, the present study examines how cultural factors may complement natural settings in traditional villages.

Traditional villages not only contain diverse natural landscapes such as mountains, water, and cultivated countryside; they are also human settlements rooted in specific local civilizations and endowed with rich historical memory, cultural connotations, and folk activities. Conceptual work on place attachment provides a basis for considering how natural elements and cultural identity may jointly shape place experience (Scannell and Gifford, 2010; Lewicka, 2011). Research on rural therapeutic experiences and community resilience offers complementary perspectives on the social context of these settings (Meijering et al., 2017; Gocer et al., 2024; Zhang et al., 2022). This study examines visitors' perceived restoration in traditional villages, including escape from everyday bustle and a sense of relaxation.

Lingnan water villages are backed by the Nanling Mountains and face the South China Sea. They are scattered across the dense river-network landscape of the Pearl River Delta and are adjacent to major international metropolises such as Guangzhou, Shenzhen, Hong Kong, and Macao. Representative cases include Xiaozhou Village, Shawan Ancient Town, and Fengjian Water Village. Lingnan water villages are distinguished by meandering canals, ancient bridges, banyan trees, and mulberry-dike fishpond systems, while also integrating profound cultural traditions such as ancestral halls and temples, distinctive Cantonese dwellings, dragon-boat traditions, martial arts, and water-related folk customs. They embody a harmonious symbiosis between natural ecology and Lingnan culture, making them valuable peri-urban settings for physical and psychological restoration (Wen et al., 2010) and one of the core resources for rural economic revitalization in the region. In 2024, Guangzhou received a total of 104 million rural-tourism visits. During the 2025 May Day holiday, Guangzhou's cultural and tourism market experienced explosive growth, with rural tourism performing especially strongly: 5.54 million visits were made to nearby villages, accounting for 46.6% of total tourist volume (Cai, 2025).

Given the latent healing value of traditional villages and the practical need for differentiated development, this study takes Lingnan water villages as its research object. From the perspective of

visitors, it identifies the key factors influencing healing experience and their relative weights, reveals the synergistic healing mechanisms of natural environments and cultural settings, and provides a theoretical basis for healing-value creation and distinctive tourism development in traditional settlements in China and beyond. Specifically, this study accomplishes three tasks: first, it constructs an evaluation system for the healing value of traditional villages; second, it provides an overall assessment of the healing value of Lingnan water villages based on visitor questionnaires and SPSS analysis; third, it employs structural equation modeling (SEM) to analyze the synergistic mechanisms and key pathways linking natural and cultural landscapes. By linking visitor-perceived restoration with cultural landscape, the spatial production of rural culture, and rural revitalization pathways, the study is intended to contribute not only to landscape evaluation but also to rural social-science debates on rural well-being and place-based transformation (Zhang et al., 2022; Ye et al., 2020; Wilson et al., 2018).

Literature review

Indicators for evaluating the healing value of landscapes

In the field of health geography, Wilbert Gesler first proposed the concept of the "healing landscape" at the International Medical Geography Symposium in 1990 (Zhou et al., 2023). From the perspective of environmental psychology, the "healing value" of landscape was first operationalized through scale-based measurement of environmental restorative quality. In 1997, Hartig et al., drawing on the Kaplans' Attention Restoration Theory, developed the Perceived Restorativeness Scale (PRS) and demonstrated through four experiments that it was a useful tool for measuring the restorative quality of environments and for comparing restorative differences across settings (Hartig et al., 1997). Building on this work, Laumann et al. (2001) used factor analysis and reliability testing to develop rating scales for ART-based restorative components, distinguishing physical and psychological aspects of Being Away alongside Extent, Fascination, and Compatibility (Laumann et al., 2001). In rural-studies scholarship, therapeutic landscapes have also been interpreted through residents' biographies and everyday engagements with rural environments, suggesting that restorative effects should be examined as situated, changing, and socially embedded experiences (Meijering et al., 2017).

As research extended to the scale of urban space, Chinese scholars began to translate the above restorative theories into studies of the "healing potential" or "healing quality" of everyday environments such as streets. Yin et al. (2020), starting from Attention Restoration Theory and taking its four characteristic factors of healing environments—Being Away, Extent, Fascination, and Compatibility—as the analytical basis, combined restorative-scale questionnaires with mobile eye-tracking technology to identify street-view elements affecting healing experience (Yin et al., 2020). This demonstrates that the four dimensions can empirically connect abstract healing perceptions with specific landscape elements. Research on park environments has likewise examined how visual and

auditory features are related to landscape preference, emotional state, and perceived restorativeness (Li and Liu, 2024).

The four-dimensional structure of Being Away, Extent, Fascination, and Compatibility, grounded in Attention Restoration Theory, has been shown to effectively reflect the healing value of environments across different types of natural and urban settings. On this basis, the present study draws on Attention Restoration Theory and the Perceived Restorativeness Scale and adopts these four dimensions as the theoretical foundation for constructing the indicator system (Table 1):

“Being Away” focuses on the sense of escape from urban noise and routine generated by the village's natural and cultural environment;

“Fascination” evaluates the attractiveness of the village's natural and cultural characteristics;

“Extent” measures the experience of environmental continuity, spatial integrity, and overall comfort during village visitation;

“Compatibility” concerns the degree to which the village environment accommodates personal activities and cultural needs.

Table 1. Evaluation Indicators for Healing Landscapes

Dimension		Evaluation indicators
Being Away	B1	Stress relief associated with village natural landscapes
	B2	Distinctiveness of traditional building layout relative to urban settings
	B3	Restorative comfort associated with the natural soundscape (bird calls, flowing water)
	B4	Restorative effect of the cultural soundscape (opera, ballads, cultural activities, festivals)
Fascination	F1	Attractiveness of natural features (trees, mountains, water, ground materials)
	F2	Artistic characteristics of traditional architecture
	F3	Relaxation response to natural sounds
	F4	Interest in local dialects and traditional ballads
	F5	Engagement with distinctive village landscapes
Extent	E1	Comfort derived from the integration of village spaces with natural elements
	E2	Comfort of the overall spatial layout

	E3	Comfort of the street-space environment
Compatibility	C1	Ease of locating comfortable places within the village
	C2	Suitability of the village for preferred activities (walking, fishing, tea drinking)
	C3	Cultural affinity and comparative advantages relative to urban parks

Indicators for evaluating the healing value of Lingnan water villages

Lu and Pan (2009) systematically revealed the settlement type of Pearl River Delta water villages as having contiguous mulberry-dike fishponds, orchards, and other commodity-agricultural areas as open external space, while displaying the regional architectural style of the Cantonese lineage and the characteristics of the Lingnan subtropical natural landscape. They emphasized that these villages form an integrated waterscape pattern composed of water inlets, canals and waterways, street spaces, and residential architecture (Lu and Pan, 2009), thereby providing a morphological basis for understanding the landscape characteristics of traditional Lingnan water villages. Duan (2023), in a study on the landscape characteristics of traditional villages in the core areas of Guangdong's three major Han cultural groups, explicitly pointed out that traditional-village landscape systems are complex systems organically coupling natural and artificial spaces, and proposed a research framework centered on the integration of ecology, production, and living (Duan, 2023). Research on rural cultural and ecological resources in China has highlighted participatory design, co-evolution, and value co-creation as approaches to integrating cultural preservation and ecological sustainability (You et al., 2025). These perspectives suggest that traditional settlements should not be understood merely as collections of physical heritage elements, but as living cultural landscapes shaped by the interaction among community practices, professional conservation knowledge, policy support, and everyday spatial use.

Accordingly, when constructing the indicators for landscape characteristics and healing value in traditional Lingnan water villages, this study treats the above scholarship as complementary theoretical and empirical foundations. The evaluation system incorporates natural environments, waterside productive landscapes, and everyday living spaces in an integrated manner; it also draws on cultural-landscape research concerning the classification of elements such as water systems, bridges, water landings, banyan-shaded squares, dike-pond systems, ancestral halls, temples, and water-related folk customs, thereby highlighting the node-corridor-network assemblage characteristic of Lingnan water villages, which are settlements living by water and networked by water. On this basis, the study develops an indicator system centered on five dimensions: natural landscapes, water systems, buildings and street-alley spaces, public spaces, and folk culture (Table 2).

"Natural Landscapes" targets the healing effects of natural elements such as vegetation and resting spaces;

"Water Systems" evaluates perceptual experiences associated with water elements;

"Buildings and Street-alley Spaces" concerns the emotional resonance of historic buildings and street-alley spaces;

"Public Spaces" measures the comfort of public facilities and spatial design;

"Folk Culture" focuses on the healing value of cultural venues and activities.

Table 2. Indicators of landscape characteristics in traditional villages

Dimension	Evaluation indicators
Natural Landscapes	Positive affect associated with village vegetation
	Comfort of resting squares
	Enjoyment associated with characteristic landscape elements (stone bridges, Wen pagodas)
Water Systems	Relaxation response to flowing-water sounds
	Perception of rivers, ponds, and village water networks
Buildings and Street-alley Spaces	Affective attachment to historic buildings (ancestral halls, residences)
	Walking enjoyment in street–alley spaces
	Street-scale suitability and walkability
Public Spaces	Availability and accessibility of resting places (squares, pocket parks)
	Availability and adequacy of resting facilities (benches)
Folk Culture	Spiritual restoration associated with ancestral halls and temples
	Positive affect associated with folk activities (dragon-boat races, lion dances)

Methods

Study area: typical cases of Lingnan water villages

The survey selected traditional villages located in the Cantonese cultural region, adjacent to the Guangzhou metropolitan area, exhibiting typical characteristics of Lingnan water villages, and remaining in active use as research cases. Particular consideration was given to representativeness and

variation in water-system pattern, spatial form, historical and cultural depth, and tourism-development intensity, so that a multi-case comparative analysis could reveal both common patterns and distinctive characteristics in the healing value of different village types.

Following these principles, the study selected Xiaozhou Village, Langtou Ancient Village, Shawan Ancient Town, Fengjian Water Village, Diejiao Water Village, and the Pantang Wuyue Historic and Cultural District as case studies. All six cases lie within Guangzhou's core commuting circle and thus possess strong accessibility and substantial recreational popularity. At the material-spatial level, all are organized by water systems and exhibit the typical coupled morphology and landscape elements of Lingnan water villages, namely the integration of water networks, streets and alleys, and ancestral halls.

Xiaozhou Village uses its river network as the structural framework of a characteristic waterside spatial pattern of “street-canal-house” and preserves vernacular architectural types such as oyster-shell houses, wok-ear gable houses, ancestral halls, and temples. Xiaozhou Village is also highly relevant to international rural-studies debates, because it has been examined as a peri-urban village affected by aestheticisation, rural gentrification, rent-seeking, and institutional responses to displacement (Qian et al., 2013; Huang et al., 2024). Langtou Ancient Village preserves large clusters of Ming- and Qing-dynasty buildings together with ancestral halls and study halls associated with clan ritual space. Shawan Ancient Town retains groups of historic buildings dating from the Ming and Qing dynasties to the Republic of China period and carries rich material and intangible heritage of waterside culture. Fengjian Water Village is characterized by contiguous fishponds around the settlement and a dense internal water network; its “well”-shaped canal layout divides the settlement into a number of small islands, and many ancestral halls, stone arch bridges, and three-bay-two-corridor dwellings remain within the village. Diejiao Water Village is shaped by a centripetal inward-oriented layout organized around a network of canals, with building clusters distributed vertically toward the water, representing a transformation of the comb-like settlement pattern. Within the historic urban area, Pantang Wuyue still preserves a Qing-dynasty layout, urban grain, and a plain vernacular character. In terms of cultural continuity, the case sites still retain relatively vibrant festivals and folk practices, such as the Birthday of the Northern Emperor and dragon-boat races in Xiaozhou Village, and the “Third Day of the Third Lunar Month: Birthday of the Northern Emperor” and “Fifth Day of the Fifth Lunar Month: Dragon-Boat Drumming” in Pantang Wuyue. The cases therefore possess triple representativeness in terms of waterside landscape, traditional built environment, and folk activities and memory-based micro-renewal practice (Rui et al., 2023), providing a sample system with both comparability and broader applicability for the study of landscape characteristics and recreational/healing value in traditional Lingnan water villages (Table 3).

Table 3. Overview of the case villages

Village Name	Village Profile	Village Landscape

Xiaozhou Village	Location: Huazhou Subdistrict, Haizhu District, Guangzhou Historical period: Founded in the late Yuan and early Ming dynasties Area: 2,300 mu, with canals extending for up to 10 km within the village. Main features: The village uses its river network as the framework, forming a characteristic waterside spatial structure of "street-canal-house" and retaining the distinctive character of a "water village."	
Langtou Ancient Village	Location: Tanbu Town, Huadu District, Guangzhou Historical period: Founded in the Southern Song dynasty, with a history of more than 700 years Area: 9,375 mu Main features: The village retains a complete water system, centered on the semicircular pond in front of the village and organized in a comb-like layout, vividly embodying the fengshui principles and typical morphological features of traditional Cantonese village dwellings.	
Shawan Ancient Town	Location: Central Panyu District, Guangzhou Historical period: Founded before the Yuan dynasty; a historic town with more than 800 years of history Area: An ancient building complex of about 70,000 square meters Main features: Shawan culture is a waterside culture centered on traditional history and folk culture, possessing abundant material and intangible cultural resources.	
Fengjian Water Village	Location: Xingtan Town, Shunde District, Foshan Historical period: The village took shape during the Southern Song dynasty Area: 5.24 square kilometers Main features: Contiguous fishponds are distributed around the village, while the interior contains a dense water network. The "well"-shaped canal layout divides the village into several small islands. A large number of ancestral halls, stone arch bridges, and three-bay-two-corridor dwellings are preserved within the settlement.	

Diejiao Water Village	Location: Guicheng Subdistrict, Nanhai District, Foshan Historical period: Since Wen and Xu first established the village here in AD 1101, it has a history of more than 900 years Area: 3.93 square kilometers Main features: An inward-oriented centripetal spatial layout centered on a network of canals, with building clusters vertically distributed toward the water, representing a transformed comb-like settlement pattern.	
Pantang Wuyue Historic and Cultural District	Location: Fengyuan Avenue, Liwan District, Guangzhou Historical period: The rural settlement took shape during the Ming dynasty Area: 31,000 square meters Main features: One of the very few vernacular settlements remaining in Guangzhou's historic urban area that still preserves a complete Qing-dynasty layout, urban grain, and typical plain vernacular character.	

Questionnaire

This study aims to investigate and analyze the healing value of traditional villages from the perspective of general visitors. The questionnaire consisted of two parts: the core evaluation scale and a basic information survey. The core evaluation scale employed a five-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree) and included 9 dimensions and 26 items to systematically measure respondents' multidimensional experiential perceptions of traditional-village landscapes.

The basic information section collected respondents' demographic characteristics and visit background, including age, gender, education level, place of residence, and purpose of visit. The full questionnaire is provided in the Supplementary information.

Data collection

Questionnaire data were collected in the case villages through intercept sampling and face-to-face distribution, completion, and retrieval. The survey was administered by undergraduate and graduate architecture students who had received social-survey training. Data collection was conducted in five rounds between April and June 2025:

First round: on 19 April 2025, five investigators distributed and collected questionnaires in Xiaozhou Village, yielding 51 valid responses;

Second round: on 3 May 2025, five investigators conducted questionnaire distribution and collection in Langtou Ancient Village, obtaining 97 valid responses;

Third round: on 4 May 2025, five investigators completed questionnaire distribution and collection in Shawan Ancient Town, obtaining 52 valid responses;

Fourth round: on 24 May 2025, four investigators conducted surveys in both Fengjian Water Village and Diejiao Water Village, obtaining a combined total of 104 valid responses;

Fifth round: on 21 June 2025, six investigators conducted supplementary surveys in the Pantang Wuyue Historic and Cultural District, obtaining 111 valid responses.

After data cleaning and validity screening, a total of 450 questionnaires were distributed, of which 415 were valid, giving a valid questionnaire rate of 92.2%. As a rule of thumb for structural equation modeling (SEM), the sample size may be assessed against a benchmark of 10 respondents per observed variable (Hair et al., 2019). This questionnaire contained 26 observed items, giving a heuristic benchmark of 260 respondents. The actual sample size (N=415) exceeded this heuristic benchmark.

Ethical approval and informed consent

The study collected anonymous visitor questionnaire responses concerning visit experiences and perceived restorativeness. No personally identifiable information or medical intervention was involved. No formal ethics review or exemption was requested from an institutional review board; consequently, no institutional approval or exemption reference number is available.

The questionnaire began with an informed consent statement explaining the purpose, content, and format of the survey, the investigators' institutional affiliation, the anonymous nature of participation, the exclusive use of collected data for academic research and university education, and respondents' right to withdraw from the study at any time without giving a reason. All respondents provided verbal informed consent before independently completing the questionnaire; written consent was not obtained because the survey was anonymous and no personally identifiable information was collected. Guardian consent was obtained for participants who were minors.

Analysis and Results

Reliability and suitability for factor analysis

Reliability analysis

As shown in Table 4, the overall Cronbach's alpha coefficient of the scale is 0.945, far exceeding the desirable threshold of 0.8, indicating high overall internal consistency.

Reliability by dimension (Table 5) shows that Public Spaces has the highest internal consistency (alpha=0.839), followed by Natural Landscapes (alpha=0.821), Extent (alpha=0.819), and Water

Systems (alpha=0.801), all above 0.8. Fascination (alpha=0.759), Buildings and Street-alley Spaces (alpha=0.743), Being Away (alpha=0.741), and Compatibility (alpha=0.728) fall between 0.7 and 0.8. Folk Culture has an alpha value of 0.652 (2 items); although below the conventional 0.7 threshold, it exceeds the lower bound of 0.6 cited for exploratory research (Hair et al., 2019) and should be interpreted cautiously. All dimension-level analyses use the same sample of 415 respondents.

Table 4. Overall internal consistency

Cronbach's Alpha	Number of Items
0.945	26

Table 5. Internal consistency of each dimension

Variable	Sample Size	Cronbach's α	Number of Items
Being Away	415	0.741	4
Fascination	415	0.759	4
Extent	415	0.819	3
Compatibility	415	0.728	3
Natural Landscapes	415	0.821	3
Water Systems	415	0.801	2
Buildings and Street-alley Spaces	415	0.743	3
Public Spaces	415	0.839	2
Folk Culture	415	0.652	2

Suitability for factor analysis

This study assesses the suitability of the data for factor analysis through the KMO test and Bartlett's test of sphericity (Table 6). The KMO value is 0.944, above the commonly used threshold of 0.7. Bartlett's test yields an approximate chi-square value of 5588.224 (df=325, $p < 0.001$), rejecting the null hypothesis that the correlation matrix is an identity matrix. Together, these results support the suitability of the data for factor analysis (Hair et al., 2019).

Table 6. KMO and Bartlett's test of sphericity

KMO Value		0.944
Bartlett's Test of Sphericity	Approximate Chi-Square	5588.224
	Degree of Freedom	325
	Significance	0.000

Respondent characteristics

Table 7 shows that respondents span a wide age range, from 15 years old to 65 and above, with slightly higher proportions in the 15–19, 20–24, 25–29, and 30–34 age groups. Respondents aged 15–34 account for 60.9% of the sample; people in these age groups are likely to be in secondary or higher education or in the early stages of their careers and may therefore face considerable pressure related to study, employment, and promotion, resulting in relatively high healing needs. In terms of gender, females slightly outnumber males, accounting for 55.7% versus 44.3% for males, which may reflect gender-related tendencies within the target group or recreation preferences and helps interpret behavioral characteristics and preferences across genders. Regarding education, respondents are primarily at the undergraduate level, accounting for 43.1%; other educational categories include high school or below (20.5%), master's degree or above (17.6%), and junior college (18.8%). Undergraduate and above together account for 60.7%, indicating a relatively well-educated visitor group. In terms of place of residence, most respondents come from Cantonese-speaking areas of Guangdong (63.9%), while other areas of Guangdong and other provinces account for 17.6% and 15.9%, respectively. A small number of international respondents (2.7%) completed the English questionnaire, indicating that the visitor population includes some overseas visitors. Purposes of visit are mainly tourism (35.7%) and leisure/relaxation (45.1%), showing that most visitors come primarily for recreation and tourism; a smaller number indicate multiple purposes such as photography and academic research. Overall, the sample reflects a relatively young, comparatively well-educated visitor group concentrated in the Cantonese-speaking region.

Table 7. Characteristics of respondents (N = 415)

Variable	Specific Category	Frequency	Percentage (%)
Age	15-19	75	18.1
	20-24	62	14.9
	25-29	57	13.7
	30-34	59	14.2
	35-39	35	8.4
	40-44	35	8.4
	45-49	26	6.3
	50-54	31	7.5
	55-59	15	3.6
	60-64	9	2.2
	65+	11	2.7
Gender	Male	184	44.3
	Female	231	55.7
Education Level	High school or below	85	20.5
	Junior college	78	18.8
	Undergraduate	179	43.1
	Master's degree or above	73	17.6
Place of residence	Cantonese-speaking Guangdong	265	63.9
	Other areas in Guangdong	73	17.6

	Other provinces	66	15.9
	Foreign countries	11	2.7
Purpose of visit	Tourism	148	35.7
	Tourism & Leisure	26	6.3
	Tourism,Leisure & Photography	6	1.4
	Tourism,Leisure & Academic Research	1	0.2
	Leisure/Relaxation	187	45.1
	Leisure & Photography	3	0.7
	Photography/Creative Work	9	2.2
	Academic research	13	3.1
	Other	22	5.3

Descriptive statistics of dimensions

Table 8 reflects respondents' overall evaluations of the different dimensions of healing experience. The results show that mean scores for all dimensions are concentrated above 4.0, indicating that respondents generally hold positive attitudes toward the healing experience of traditional Lingnan water villages. Although some differences exist across dimensions, the overall level of perception is high, suggesting a solid basis for healing value.

More specifically, Natural Landscapes, Water Systems, and Compatibility receive relatively high scores, indicating that environmental characteristics centered on natural elements play a leading role in the overall healing experience. Among them, Natural Landscapes performs most strongly, highlighting the importance of the waterside natural environment for emotional restoration and perceptual comfort.

By contrast, Public Spaces and Folk Culture have slightly lower mean scores and relatively larger dispersion, indicating some variation among respondents in their experiences of public-space use and cultural participation. Figure 1 further shows an overall structure in which natural elements score higher, while cultural factors and public space rank somewhat lower, suggesting that the current healing experience is still driven primarily by the natural environment and that the healing potential of cultural activities and public spaces remains to be further enhanced.

Overall, traditional Lingnan water villages already possess a relatively stable foundation of healing value. However, while maintaining the advantages of natural landscapes and water systems, it is necessary to further strengthen the quality of public spaces and the depth of participation in cultural experiences so as to promote the synergistic realization of multidimensional healing effects.

Table 8. Descriptive statistics of dimensions (N = 415)

Variable	N	Min	Max	Mean	SD
Being Away	415	1.75	5.00	4.204	0.616
Fascination	415	1.75	5.00	4.192	0.624
Extent	415	1.67	5.00	4.189	0.716
Compatibility	415	2.33	5.00	4.255	0.602

Natural Landscapes	415	2.00	5.00	4.376	0.606
Water Systems	415	1.00	5.00	4.260	0.764
Buildings and Street-alley Spaces	415	1.67	5.00	4.210	0.660
Public Spaces	415	1.00	5.00	4.077	0.781
Folk Culture	415	1.00	5.00	4.141	0.738

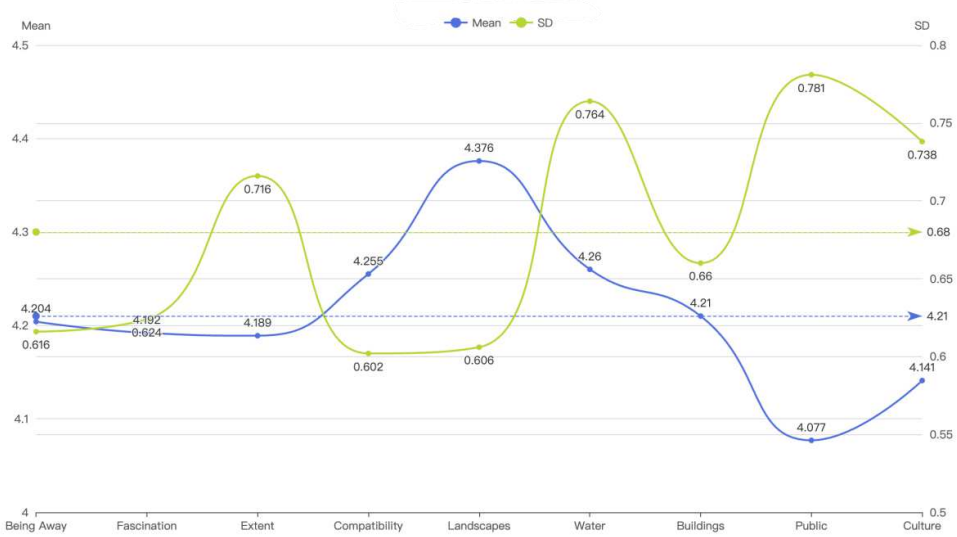


Fig. 1 Mean Scores and Standard Deviations of All Dimensions

Differences by age

Table 9 provides an overall picture of evaluation differences across age groups for the various dimensions of healing experience. The results show that most dimensions do not differ significantly across age groups; only Compatibility reaches statistical significance (p=0.031). The p value for Being Away is 0.051 and does not meet the 0.05 significance threshold. Overall, the influence of age on the perception of healing experience is relatively limited.

Figure 2 shows descriptive variation in mean scores across age groups. Respondents aged 40–49 report the highest mean score for Being Away (4.385), whereas those aged 60 years and above report the highest mean score for Compatibility (4.450), slightly above the 40–49 group (4.421). The 15–19 group has the lowest mean score for Being Away (4.100), and the 20–29 group has the lowest mean score for Compatibility (4.157). Among respondents aged 60 years and above, mean scores for Extent (3.967) and Folk Culture (3.900) are comparatively low. These patterns describe group means; the omnibus tests do not establish which specific pairs of age groups differ significantly.

At the dimension level, statistically significant age-related differences are evident only in Compatibility, whereas evaluations of Natural Landscapes, Water Systems, Buildings and Street-alley Spaces, and Folk Culture are relatively similar across age groups, indicating a fairly high degree of consistency.

Table 9. Dimension scores by age group

Variable	Age	N	M	SD	F	P
Being Away	15-19	75	4.100	0.608	2.220	0.051
	20-29	110	4.176	0.602		
	30-39	94	4.130	0.618		
	40-49	61	4.295	0.552		
	50-59	46	4.298	0.627		
	60+	20	4.350	0.750		
Fascination	15-19	75	4.127	0.682	0.550	0.738
	20-29	110	4.168	0.560		
	30-39	94	4.165	0.595		
	40-49	61	4.275	0.647		
	50-59	46	4.245	0.625		
	60+	20	4.300	0.733		
Extent	15-19	75	4.147	0.754	1.220	0.253
	20-29	110	4.143	0.745		
	30-39	94	4.191	0.596		
	40-49	61	4.266	0.698		
	50-59	46	4.232	0.726		
	60+	20	3.967	0.948		
Compatibility	15-19	75	4.213	0.695	2.402	0.031
	20-29	110	4.157	0.615		
	30-39	94	4.209	0.529		
	40-49	61	4.421	0.554		
	50-59	46	4.262	0.525		
	60+	20	4.450	0.703		
Natural Landscapes	15-19	75	4.233	0.704	1.838	0.087
	20-29	110	4.205	0.593		
	30-39	94	4.227	0.575		
	40-49	61	4.546	0.544		
	50-59	46	4.291	0.568		
	60+	20	4.583	0.630		
Water Systems	15-19	75	4.287	0.709	0.670	0.645
	20-29	110	4.191	0.706		
	30-39	94	4.271	0.771		
	40-49	61	4.344	0.710		
	50-59	46	4.348	0.604		
	60+	20	4.125	0.995		
Buildings and Street-alley Spaces	15-19	75	4.120	0.775	1.281	0.271
	20-29	110	4.146	0.666		
	30-39	94	4.216	0.589		
	40-49	61	4.393	0.632		
	50-59	46	4.225	0.633		
	60+	20	4.267	0.615		
Public Spaces	15-19	75	3.967	0.991	1.913	0.109
	20-29	110	4.029	0.745		
	30-39	94	4.059	0.689		
	40-49	61	4.328	0.779		
	50-59	46	4.163	0.650		
	60+	20	4.125	0.741		
Folk Culture	15-19	75	4.113	0.808	0.893	0.489

20-29		110	4.142	0.605		
30-39		94	4.213	0.616		
40-49		61	4.213	0.772		
50-59		46	4.043	0.926		
60+		20	3.900	0.907		

Note: F and p report the between-group test for each dimension and are repeated across subgroup rows. M = mean; SD = standard deviation.

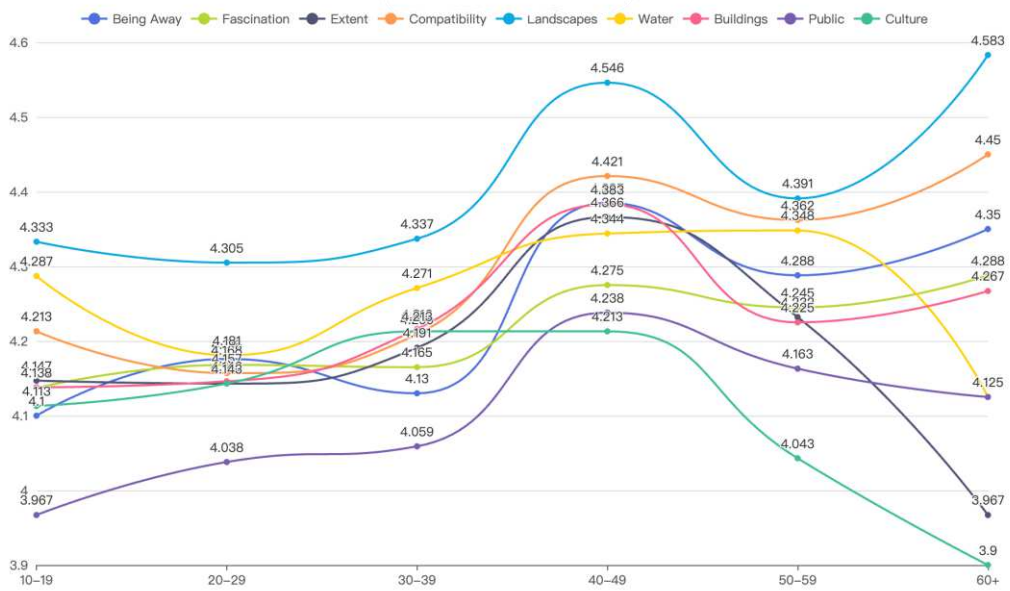


Fig. 2 Mean Scores of Each Dimension by Age Group

Differences by gender

Table 10 shows that overall ratings are similar between male and female respondents across the various dimensions of healing experience, and most differences are not statistically significant ($p > 0.05$), suggesting that gender has a relatively limited effect on the overall perception of healing experience. Figure 3 further indicates that male and female rating trends are largely consistent for Being Away, Fascination, Extent, Water Systems, Natural Landscapes, and Folk Culture, with only slight level differences. By contrast, Buildings and Street-alley Spaces shows a significant gender difference ($p < 0.05$), with females scoring higher than males, indicating that women evaluate experiences related to architectural space and street-alley environments somewhat more positively. Although Public Spaces does not reach statistical significance, female scores are slightly higher overall, suggesting a directional tendency.

Overall, gender differences are concentrated mainly in the spatial-environmental factor of Buildings and Street-alley Spaces, whereas the other dimensions show strong consistency.

Table 10. Dimension scores by gender

Variable	Gender	N	M	SD	F	P

Being Away	Male	184	4.185	0.611	0.309	0.579
	Female	231	4.219	0.621		
Fascination	Male	184	4.173	0.618	0.307	0.580
	Female	231	4.207	0.629		
Extent	Male	184	4.158	0.712	0.626	0.429
	Female	231	4.214	0.719		
Compatibility	Male	184	4.212	0.628	1.662	0.198
	Female	231	4.289	0.580		
Natural Landscapes	Male	184	4.319	0.611	2.945	0.087
	Female	231	4.421	0.599		
Water Systems	Male	184	4.228	0.773	0.579	0.447
	Female	231	4.286	0.757		
Buildings and Street-alley Spaces	Male	184	4.138	0.699	3.963	0.047
	Female	231	4.267	0.622		
Public Spaces	Male	184	4.016	0.839	2.008	0.157
	Female	231	4.126	0.729		
Folk Culture	Male	184	4.101	0.748	0.991	0.320
	Female	231	4.173	0.730		

Note: F and p report the between-group test for each dimension and are repeated across subgroup rows. M = mean; SD = standard deviation.

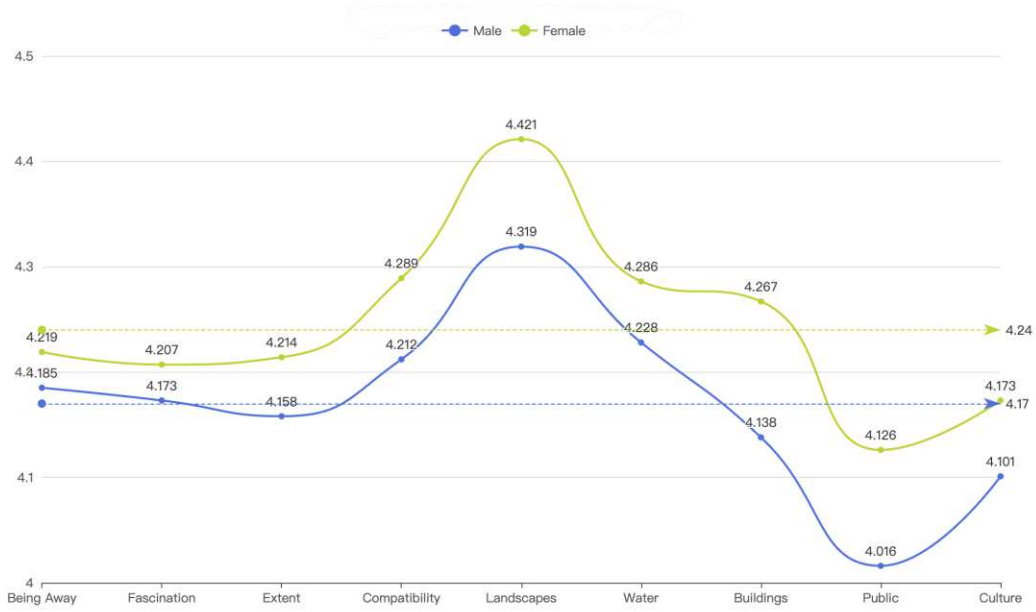


Fig. 3 Mean Scores of Each Dimension by Gender

Differences by education level

Table 11 shows that differences in ratings across educational groups do not reach statistical significance for any healing-experience dimension ($p > 0.05$), indicating that educational background has a relatively limited effect on overall healing-experience perception and that the evaluation structure is broadly consistent across groups.

Figure 4 shows that scores for most dimensions are concentrated in a relatively high range across all education groups, with only small intergroup gaps and no obvious divergence. In relative terms, the undergraduate group has slightly higher mean scores on multiple dimensions, whereas the master's degree or above group scores relatively lower on Public Spaces, indicating a modest directional difference.

Overall, perceptual patterns across all dimensions of healing experience are broadly consistent among education groups, with only slight level differences in a few dimensions.

Table 11. Dimension scores by education level

Variable	Education Level	N	M	SD	F	P
Being Away	High school or below	85	4.150	0.605	0.489	0.690
	Junior college	78	4.173	0.655		
	Undergraduate	179	4.240	0.611		
	Master's degree or above	73	4.209	0.604		
Fascination	High school or below	85	4.185	0.621	0.617	0.604
	Junior college	78	4.119	0.673		
	Undergraduate	179	4.232	0.619		
	Master's degree or above	73	4.178	0.588		
Extent	High school or below	85	4.208	0.688	0.151	0.929
	Junior college	78	4.218	0.708		
	Undergraduate	179	4.184	0.738		
	Master's degree or above	73	4.146	0.711		
Compatibility	High school or below	85	4.247	0.657	0.040	0.989
	Junior college	78	4.256	0.583		
	Undergraduate	179	4.264	0.589		
	Master's degree or above	73	4.237	0.600		
Natural Landscapes	High school or below	85	4.357	0.646	0.958	0.413
	Junior college	78	4.282	0.579		
	Undergraduate	179	4.417	0.624		
	Master's degree or above	73	4.397	0.538		
Water Systems	High school or below	85	4.218	0.861	0.332	0.802
	Junior college	78	4.212	0.719		
	Undergraduate	179	4.296	0.724		
	Master's degree or above	73	4.274	0.795		
Buildings and Street-alley Spaces	High school or below	85	4.173	0.616	0.139	0.936
	Junior college	78	4.218	0.607		
	Undergraduate	179	4.227	0.696		
	Master's degree or above	73	4.201	0.680		
Public Spaces	High school or below	85	4.129	0.821	1.491	0.216
	Junior college	78	4.128	0.736		
	Undergraduate	179	4.101	0.790		
	Master's degree or above	73	3.904	0.748		
Folk Culture	High school or below	85	4.141	0.754	0.135	0.939
	Junior college	78	4.179	0.781		
	Undergraduate	179	4.140	0.719		
	Master's degree or above	73	4.103	0.731		

Note: F and p report the between-group test for each dimension and are repeated across subgroup rows. M = mean; SD = standard deviation.

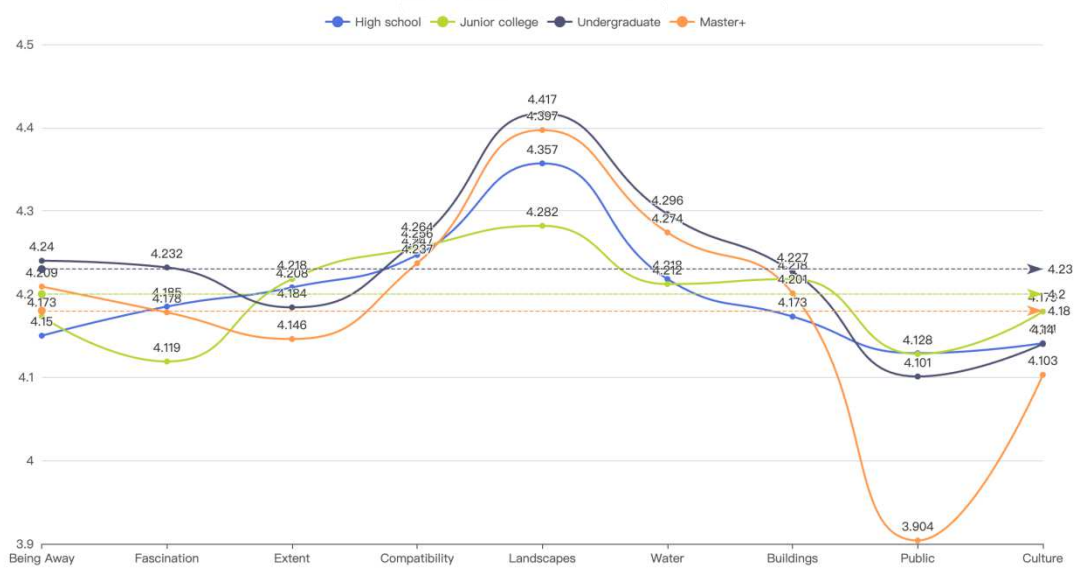


Fig. 4 Mean Scores of Each Dimension by Education Level

Differences by place of residence

Table 12 shows that for respondents from different places of residence, differences are not statistically significant on most healing-experience dimensions; only Being Away reaches significance ($p < 0.01$), while overall evaluations of the remaining dimensions are relatively consistent.

Figure 5 indicates that foreign visitors score noticeably higher on Being Away than other groups, followed by visitors from Cantonese-speaking areas of Guangdong, whereas visitors from other areas score relatively lower, forming a descriptive pattern of group means. By contrast, scores for Fascination, Natural Landscapes, Water Systems, Buildings and Street-alley Spaces, Public Spaces, and Folk Culture are highly overlapping across place-of-residence groups and remain generally high. Overall, residential differences are manifested mainly in perceptions of escape, whereas the perceptual structure of the other healing-experience factors is relatively stable.

Table 12. Dimension scores by place of residence

Variable	Place of residence	N	M	SD	F	P
Being Away	Cantonese-speaking Guangdong	265	4.236	0.620	4.509	0.004
	Other areas in Guangdong	73	4.021	0.625		
	Other provinces	66	4.201	0.567		
	Foreign countries	11	4.659	0.392		
Fascination	Cantonese-speaking Guangdong	265	4.226	0.641	2.080	0.102
	Other areas in Guangdong	73	4.079	0.621		
	Other provinces	66	4.129	0.562		

	Foreign countries	11	4.477	0.425		
Extent	Cantonese-speaking Guangdong	265	4.230	0.721	1.101	0.349
	Other areas in Guangdong	73	4.091	0.690		
	Other provinces	66	4.111	0.724		
	Foreign countries	11	4.303	0.674		
Compatibility	Cantonese-speaking Guangdong	265	4.270	0.615	0.574	0.633
	Other areas in Guangdong	73	4.174	0.572		
	Other provinces	66	4.268	0.574		
	Foreign countries	11	4.333	0.683		
Natural Landscapes	Cantonese-speaking Guangdong	265	4.394	0.579	1.135	0.334
	Other areas in Guangdong	73	4.269	0.704		
	Other provinces	66	4.394	0.619		
	Foreign countries	11	4.545	0.429		
Water Systems	Cantonese-speaking Guangdong	265	4.292	0.766	0.546	0.651
	Other areas in Guangdong	73	4.178	0.801		
	Other provinces	66	4.212	0.750		
	Foreign countries	11	4.318	0.513		
Buildings and Street-alley Spaces	Cantonese-speaking Guangdong	265	4.243	0.681	1.154	0.327
	Other areas in Guangdong	73	4.132	0.618		
	Other provinces	66	4.131	0.643		
	Foreign countries	11	4.394	0.417		
Public Spaces	Cantonese-speaking Guangdong	265	4.115	0.743	1.756	0.155
	Other areas in Guangdong	73	3.938	0.878		
	Other provinces	66	4.023	0.834		
	Foreign countries	11	4.409	0.539		
Folk Culture	Cantonese-speaking Guangdong	265	4.179	0.718	1.248	0.292
	Other areas in Guangdong	73	4.014	0.874		
	Other provinces	66	4.098	0.663		
	Foreign countries	11	4.318	0.603		

Note: F and p report the between-group test for each dimension and are repeated across subgroup rows. M = mean; SD = standard deviation.

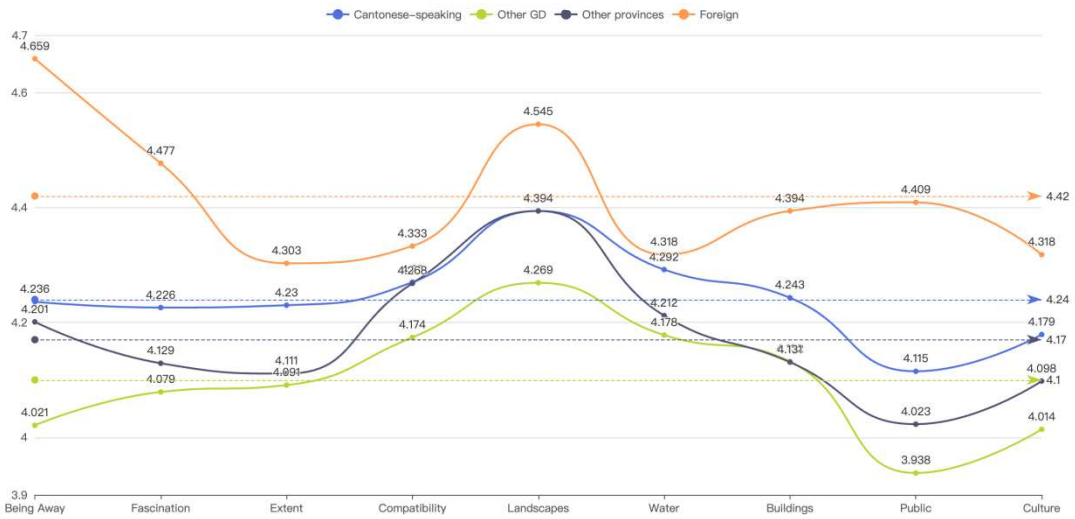


Fig. 5 Mean Scores of Each Dimension by Place of Residence

Landscape characteristics and perceived restoration

Model structure

To analyze the mechanisms and differences through which various landscape characteristics of Lingnan water villages affect the healing value of villages, this study adopts structural equation modeling (SEM) and conducts quantitative analysis using AMOS.

On the left side of the model are the independent variables, namely the landscape characteristics of traditional Lingnan water villages, including five latent variables: Natural Landscapes, Water Systems, Buildings and Street-alley Spaces, Public Spaces, and Folk Culture. Each latent variable is composed of 2 to 3 measurement indicators (observed variables).

On the right side of the model are the dependent variables, namely the four psychological restorative dimensions constituting the healing value of traditional villages: Being Away, Fascination, Extent, and Compatibility. Each dimension is likewise composed of 3 to 4 observed indicators. The models hypothesize positive associations between the landscape variables and the restorative dimensions (Figure 6).

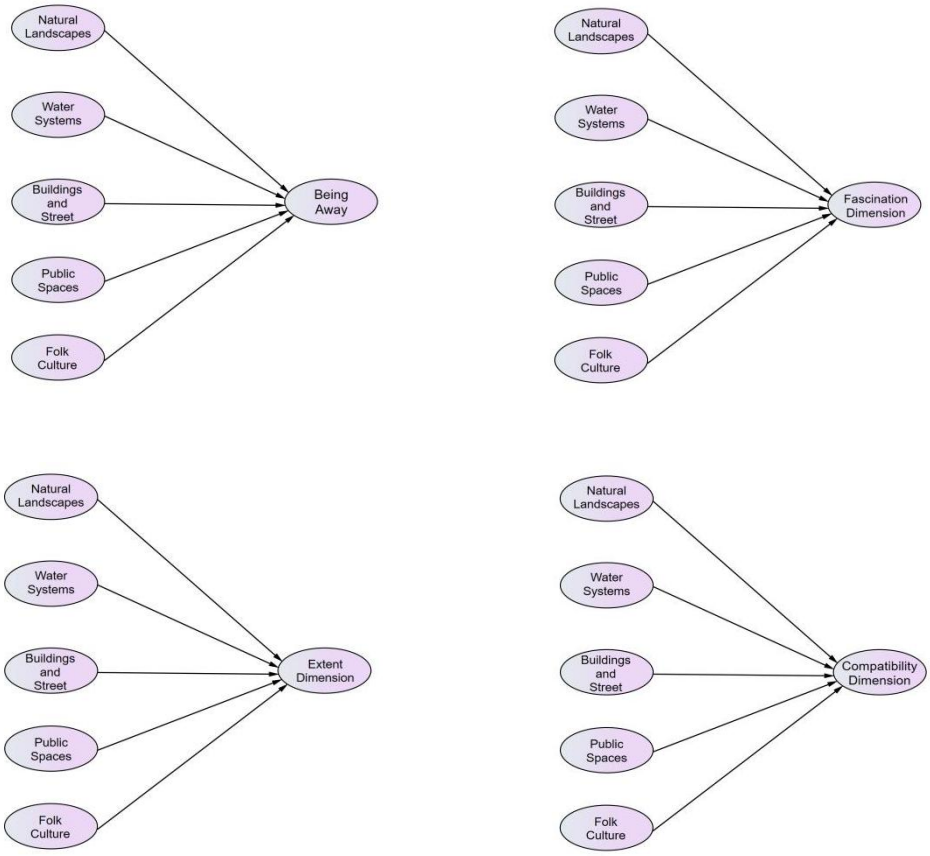


Fig. 6 AMOS Model Diagram

Structural equation model results

Model fit

Using AMOS, this study establishes structural equation models for the four restorative dimensions (Being Away, Fascination, Extent, and Compatibility) based on N=415. The reported fit indices range from 1.926 to 2.907 for chi-square/df (CMIN/DF), from 0.946 to 0.975 for CFI, and from 0.047 to 0.068 for RMSEA (Table 13).

Table 13. Reported model fit indices for the four restorative dimensions (N = 415)

Dimension	CMIN/DF	CFI	RMSEA	Fit Assessment
Being Away	2.096	0.966	0.051	Meets the threshold; close fit
Fascination	2.820	0.946	0.066	Meets the threshold (acceptable/good), not close fit
Extent	2.907	0.953	0.068	Meets the threshold (acceptable/good), not close fit
Compatibility	1.926	0.975	0.047	Good fit, close fit

Differentiated pattern of associations

The effects of traditional-village landscape characteristics on different healing factors exhibit a clearly differentiated structure rather than universal dominance by a single element. Overall, Buildings and Street-alley Spaces and Natural Landscapes show relatively strong and stable explanatory power across the four healing factors and therefore constitute two core landscape foundations supporting the formation of healing value in traditional villages. By contrast, Water Systems, Public Spaces, and Folk Culture display stronger dimensional selectivity, with the direction and intensity of their effects

varying according to specific healing goals. This indicates that the healing effect of traditional villages is not determined directly by any single independent landscape element, but rather emerges from a composite perception jointly shaped by natural environment, spatial form, and cultural context.

Estimated path coefficients for each dimension

For Being Away, Folk Culture has the largest estimated path coefficient (0.48), followed by Natural Landscapes (0.31), while the estimated coefficients of the remaining factors are relatively small. This suggests that local rituals, everyday memory, and cultural symbolism embedded in traditional villages more readily enable visitors to detach psychologically from the rhythms and pressures of daily urban life. At the same time, open natural environments, rural waterscape imagery, and lower-intensity environmental stimuli provide a stable background for this psychological transition away from reality. In other words, the formation of Being Away depends more on the superimposition of cultural-context activation and atmospheric natural settings than on the mere provision of spatial facilities.

For Fascination, the estimated coefficients for landscape elements are relatively balanced, but Natural Landscapes (0.25), Buildings and Street-alley Spaces (0.23), and Folk Culture (0.22) contribute at nearly the same level and jointly form the principal sources of attention capture. By contrast, the coefficient for Water Systems is lower (0.10), and Public Spaces has a small estimated coefficient (0.01). This structure suggests that the mechanism through which visitors are attracted by traditional villages stems first from distinctive landscape imagery and spatial interfaces rich in detail and variation, such as continuous alleyways, traditional architectural facades, vegetation, and culturally specific displays. Public space in itself, if lacking embedded content and scene-making, has relatively limited independent appeal.

For Extent and Compatibility, two dimensions more closely related to spatial use and activity organization, Buildings and Street-alley Spaces have the largest estimated path coefficients of 0.34 and 0.36, respectively. Natural Landscapes contribute 0.13 and 0.29, while Public Spaces contribute 0.11 and 0.14, acting as auxiliary supports. Notably, Water Systems shows a slight negative coefficient on Compatibility (-0.02), and Folk Culture also has a small negative estimated coefficient for Extent (-0.08), indicating that some landscape resources may strengthen image recognition or emotional activation but do not necessarily translate directly into perceived spatial continuity and activity fit. This pattern suggests that perceived continuity and activity fit may be associated with the integrity of the traditional street pattern, the clarity of pedestrian organization, and the continuity of spatial sequence (Figure 7).

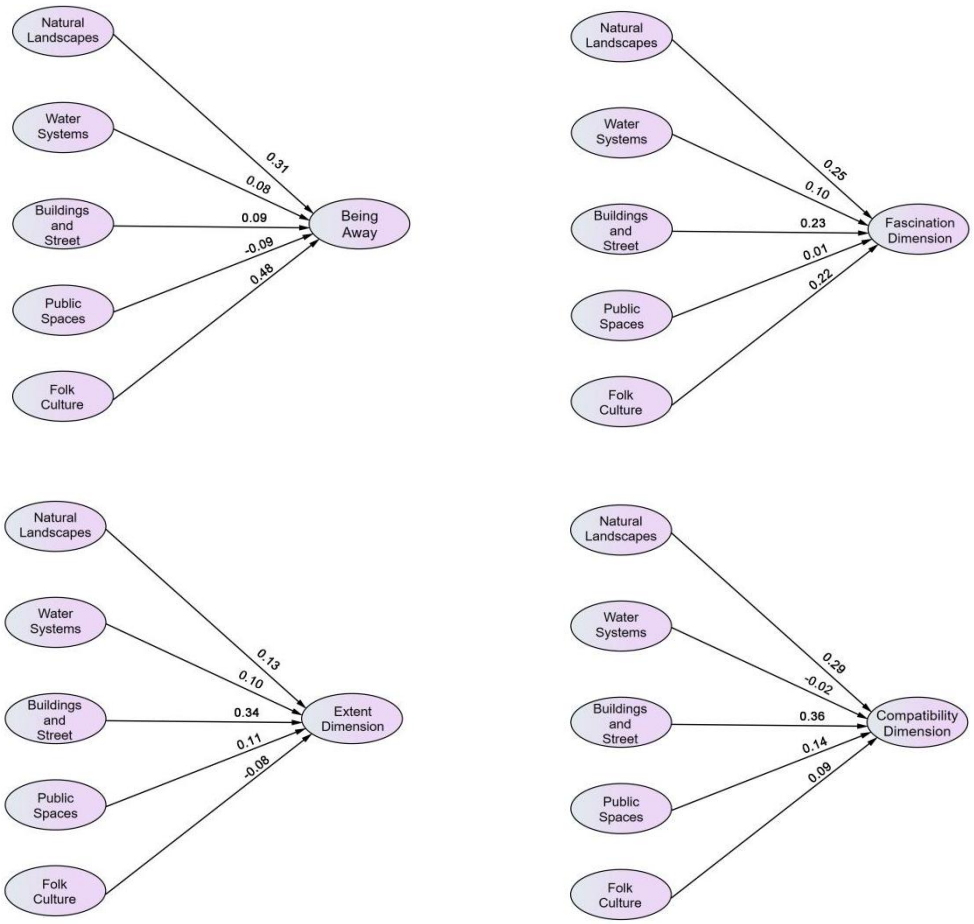


Fig. 7 AMOS Diagram of the Strength of Landscape Effects on Different Healing Factors in Traditional Villages

Overall, Figure 8 reveals that the formation of healing value in traditional villages exhibits a pronounced pattern of structural differentiation: Being Away is more strongly driven by the joint action of culture and nature; Fascination depends on the combined attraction of landscape imagery and cultural scenes; Extent and Compatibility are more strongly constrained by spatial form and use organization. These results imply that conservation and renewal practice in traditional villages should avoid relying on any single factor as a substitute for systemic construction. Instead, intervention should proceed from the synergy among natural substrate, street-space structure, and cultural context, so as to respond separately to healing needs at the levels of psychological detachment, attention capture, activity unfolding, and behavioral fit, thereby integrating landscape conservation, cultural transmission, and experience optimization.

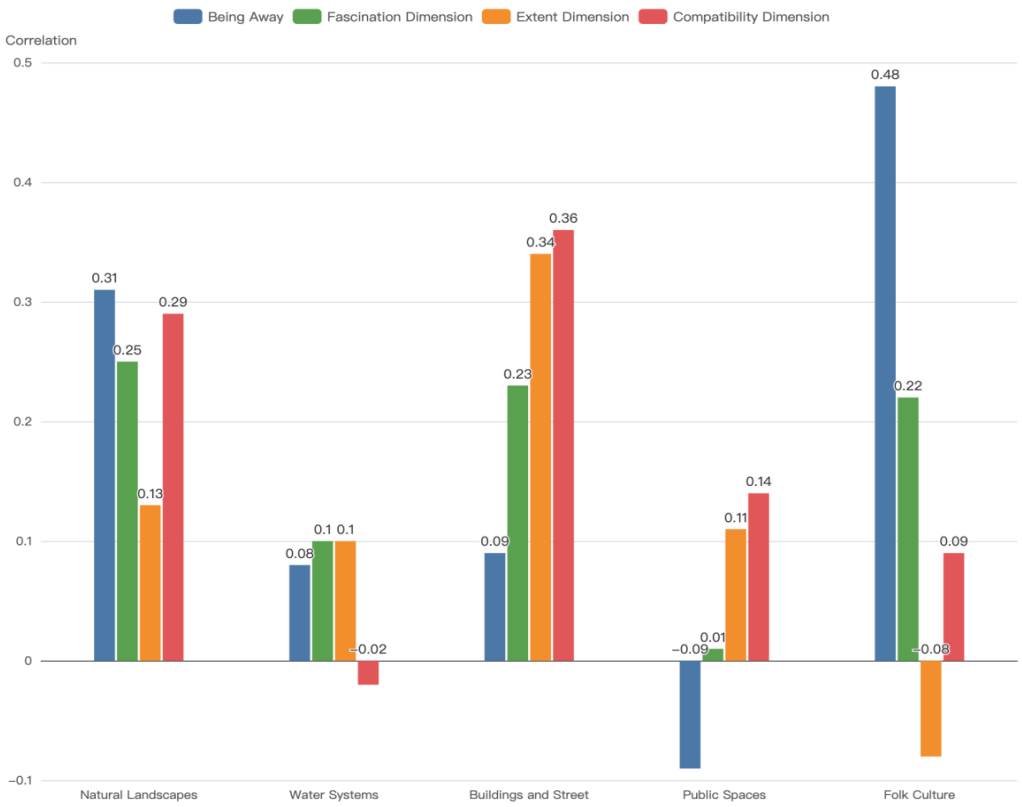


Figure 8. Data Plot of the Strength of Landscape Effects on Different Healing Factors in Traditional Villages

Discussion

Dual foundation of healing: natural landscapes and built heritage

The structural-model results indicate that the healing value of traditional Lingnan villages is built first upon a dual foundation of Natural Landscapes and Buildings and Street-alley Spaces. Natural Landscapes has positive estimated coefficients across all four healing factors, while Buildings and Street-alley Spaces has the strongest explanatory power for Extent and Compatibility, indicating that the former mainly provides the basic support for environmental restoration and psychological adjustment, whereas the latter is associated with visitors' perceptions of spatial continuity and activity fit.

These results indicate that the healing effect of traditional villages does not derive from a single landscape image. Rather, the natural substrate provides a soothing, low-stimulation perceptual background, while the street-space fabric transforms this perceptual advantage into a sustainable recreational experience through continuous, accessible, and legible spatial order. Accordingly, conservation and renewal should avoid treating natural environments and settlement space in isolation. Instead, natural elements such as canals, shade trees, waterfronts, and cultivated landscapes should be incorporated together with alley networks, interface scale, and nodal order into an

integrated framework of improvement, so as to strengthen environmental continuity and spatial integrity (Völker and Kistemann, 2011; Gascon et al., 2017). At the same time, micro-renewal should improve shading, lighting, accessibility, and rest facilities in order to enhance the comfort and willingness to stay among different age groups within traditional street spaces (Ulrich, 1984; Xing and Leng, 2024).

Enhancing compatibility: space, user groups, and activities

Compatibility reflects not only the coordination between environment and individual activities but also emotional resonance and recreational attraction. The results show a relatively high mean score for Compatibility (M=4.255), indicating that visitors generally evaluate the fit between activities and environment positively. Significant differences across age groups are observed for this dimension (F=2.493, p=0.031), suggesting that compatibility experience varies to some extent by user group and still requires optimization oriented toward different modes of use. Combined with the structural-path results, the key factors affecting Compatibility are Buildings and Street-alley Spaces (coefficient = 0.36) and Natural Landscapes (coefficient = 0.29), while Public Spaces acts as an auxiliary support (coefficient = 0.14) and Water Systems does not form a clear positive effect.

First, at the spatial level, priority should be given to high-frequency walking and stopping needs. In response to the relative insufficiency of some dimensions for older groups, continuous shading, denser resting points, improved pedestrian connectivity, better barrier-free access, and clear wayfinding systems can reduce detours and inconveniences in stopping, thereby enhancing accessibility and safety throughout the visit. Existing studies also show that the restorative effects of natural environments depend on actual accessibility and conditions of use, while spatial organization and facility comfort significantly affect the quality of stay and restorative benefit (Twohig-Bennett and Jones, 2018; Hartig et al., 2014).

Second, at the facility level, limited renewal resources should be directed first to high-frequency nodes and key service interfaces, such as toilets, drinking-water points, seating, nighttime lighting, and emergency contact points, so as to reduce experiential friction and improve behavioral continuity. Relevant studies indicate that incremental renewal of public spaces in traditional villages can enhance everyday usability while maintaining traditional urban grain (Mu et al., 2023; Xing and Leng, 2024).

Third, at the activity level, Folk Culture should be translated more fully into stable participatory resources. Although its direct effect on Compatibility is not prominent, it has comparatively large estimated path coefficients for Being Away and Fascination, and is therefore better positioned as a supporting force that enhances situational immersion and activity attraction rather than as the sole carrier of spatial fit.

Accordingly, folk activities can be moderately extended from festival-centered viewing to lightweight forms of everyday participation, such as intangible-heritage crafts, local food experiences, scheduled performances, village narrative tours, and interpretive storytelling. Cultural nodes can also

be embedded into street spaces and public spaces to form repeatable “cultural routes,” thereby enhancing visitors' sense of participation and psychological fit within space (Fancourt and Steptoe, 2019; Fancourt and Tymoszuk, 2019; Bygren et al., 1996).

In terms of activity organization, a dual system of “festival intensification + everyday normalization” may be adopted: at the festival level, key occasions such as the Dragon Boat Festival and the Spring Festival can be used to construct ritual experiences that are legible, participatory, and memorable; at the everyday level, festival resources can be translated into low-threshold and sustainable micro-activities so as to extend duration of stay and improve the continuity of cultural experience (Cuypers et al., 2012; Tymoszuk et al., 2020; Daniel et al., 2012).

The gender-difference analysis shows a statistically significant difference only for Buildings and Street-alley Spaces, with women reporting higher mean scores than men, while the remaining dimensions do not reach significance. This result supports a difference in ratings of this combined dimension; it does not establish which specific spatial features explain the difference.

Accordingly, rather than pursuing overly strong gender-targeted design, it is preferable to improve universal spatial qualities—such as photography stopping points, nighttime lighting, interface tidiness, visibility of activities, and resting friendliness—without altering the traditional layout, so that different visitors can obtain a more stable experience of compatibility within traditional street spaces.

Overall, the key to enhancing Compatibility does not lie in adding any single facility in isolation, but in coordinating street-order optimization, public-service improvement, and cultural-participation organization, so that visitors move from merely “being able to see” to “being able to walk through, stop comfortably, and participate willingly.”

Protecting the natural environment: ecology, culture, and experience

The results show that Natural Landscapes receives the highest mean score (M=4.376), while Water Systems also scores highly (M=4.260), indicating that the natural substrate is an important source of healing experience in Lingnan water villages. However, the structural model suggests that the two operate differently. Natural Landscapes has positive estimated coefficients for all four healing factors and is therefore the most universal source of healing support. By contrast, the direct effect of Water Systems varies by dimension and does not show equal strength across all restorative dimensions.

Accordingly, protection of the natural environment should be elevated to the level of integrated protection of the broader mountain-water landscape pattern. Practices that separate mountains, farmland, and water-network systems and protect only village dwellings and street spaces should be opposed, because they risk damaging the continuity and restorability of the waterscape system (Ulrich, 1984; Twohig-Bennett and Jones, 2018; Hartig et al., 2014). Enhancing Compatibility should not be understood simply as adding facilities; rather, it should be organized around a complete

experiential chain of accessibility, stayability, and participation (Wu et al., 2025), so that cultural participation, nature experience, and street-space organization are jointly translated into stable environmental fit and psychological attunement (Fancourt and Steptoe, 2019; Scannell and Gifford, 2010; Daniel et al., 2012).

In terms of governance priorities, emphasis should be placed on improving canal water quality, dredging waterways, and ecological treatment of shorelines, while maintaining vegetation structure and habitat continuity and avoiding ecological degradation caused by hard engineering. Relevant studies indicate that the health and well-being effects of water are highly correlated with water quality, accessibility, and conditions for staying; the mere presence of water does not necessarily mean it is effective. Priority should therefore be given to protecting the continuity of the "banyan tree-canal" network and the ecological shoreline interface, while incorporating water-quality maintenance into routine governance mechanisms (Völker and Kistemann, 2011; Gascon et al., 2017). At the same time, vulnerability drivers in the combined natural and cultural heritage system should be identified so that tourism development and construction renewal do not weaken ecological stability or landscape integrity.

The structural-path results show that Natural Landscapes has comparatively large estimated coefficients for Being Away (coefficient = 0.31) and Compatibility (coefficient = 0.29), while also providing stable support for Fascination (coefficient = 0.25) and Extent (coefficient = 0.13), indicating that quietness, comfort, and continuous natural interfaces are important preconditions for experience formation (Twohig-Bennett and Jones, 2018; Hartig et al., 2014). At the same time, elements with both ecological and mnemonic functions—such as stone bridges, water landings, and ancestral halls—should be incorporated into integrated protection units, and their recognizability and contextual continuity should be maintained through minimal-intervention repair and environmental improvement so as to provide stable support for local meaning and emotional attachment within healing experience (Daniel et al., 2012; Chen et al., 2020).

More broadly, for natural advantages to be translated into restorative benefits, they must also be organized through experience pathways. Continuous arrangements of shaded trails, waterfront stopping points, scenic corridors, and rest nodes can increase the accessibility of nature exposure and the quality of staying, while low-disturbance waterside experiences, slow-mobility strolling, and small-scale stopping facilities can be provided under ecological constraints and carrying-capacity control (Bratman et al., 2015; White et al., 2013).

This also means that nature protection and tourism use are not in simple opposition. As long as the continuous landscape system of banyan trees, canals, streets, and nodes is maintained through minimal intervention under an ecological bottom line, the natural environment can preserve heritage authenticity while continuously supporting visitors' restorative experience.

Tourism development guided by differentiated healing value

In recent years, under the continued promotion of China's Rural Revitalization Strategy and cultural-heritage protection policies, tourism in traditional villages has achieved significant growth in visitor flow and broad social attention. At the same time, it also faces structural problems, including concentration of traffic in a small number of "model villages," increasing product imitation, and growing homogenization of local expression. In this context, identifying and cultivating healing value offers a new differentiated development path for villages whose architectural resources may not be the most prominent. Research in revolutionary heritage destinations has linked cultural identity and perceived environmental restorativeness with visitors' post-visit behavioral intentions (Chen and Lai, 2026). Work on cultural tourism and rural resilience (Gocer et al., 2024), alongside research on the social aspects of rural built environments (Giannakopoulou and Kaliampakos, 2016), provides complementary context for considering a shift from "sightseeing display" to "experiential restoration". From the perspective of rural studies, this shift should also be understood through the production and governance of rural cultural space: tourism may strengthen cultural vitality and resilience, but it may also produce gentrified, image-based, or homogenized rural space if everyday community life is excluded (Ye et al., 2020; Kan, 2021).

Compared with a development logic that emphasizes check-in sightseeing alone, a healing-oriented approach focuses more on how villages can form perceptible, stayable, and participatory environments of physical and mental experience through spatial structure, ecological contact, local rituals, and the atmosphere of everyday life. Studies of public-space form (Zhao et al., 2025) and rural revitalization potential (Zhang et al., 2024) provide context for considering spatial organization within broader village transformation. In light of the present findings, an integrated approach to ecology, culture, heritage stewardship, and perceived restoration may help translate natural landscapes, street organization, and folk culture into visitor appeal. Therefore, healing-oriented tourism should not merely package the village as a consumable rural image; it should construct a co-created place experience that sustains cultural meaning, community resilience, and everyday rurality (Gocer et al., 2024; Ye et al., 2020).

According to this study, such a differentiated path does not mean that all villages should replicate a single "wellness tourism" template. Rather, development should be typologically tailored to each village's own advantage structure: villages with stronger natural-landscape and water-system foundations may emphasize slow mobility, waterside contact, and quiet restorative experience; villages with intact street fabric and vernacular heritage resources may highlight continuous visitation, spatial immersion, and locally grounded stewardship; and villages with vibrant living folk culture may strengthen attraction and Being Away through festivals, craft practices, and local storytelling. These are proposed practical directions. Their implementation should take account of resident perspectives and potential tourism conflicts (Li et al., 2024), as well as experience from community-oriented creative practices (Lu and Qian, 2023).

For Lingnan water villages, the natural environment remains the foundation of healing experience and should be enhanced through waterside spaces, slow-mobility systems, vegetation restoration, and ecological greening to improve accessibility and comfort (Wu et al., 2025). At the same time, the cultural landscape is also an important driver, but its value lies more in strengthening local identity, contextual attraction, and participatory memory, and should not be reduced to performative and one-off consumption packaging (Zhao et al., 2025; Chen et al., 2021).

Accordingly, future tourism-making should avoid one-sided development logics that "emphasize activities over environment" or "emphasize landscape over use." Instead, it should form a more sustainable experiential supply around the synergy among ecological protection, spatial compatibility, community-oriented participation, and cultural continuity (Gocer et al., 2024; Zollet and Qu, 2024).

Overall, the differentiated tourism development of Lingnan water villages should not be built only on visible heritage images, but more importantly on an overall sense of place that is restorative, participatory, and memorable. Only by jointly translating natural substrate, street order, and folk culture into stable healing value can traditional villages achieve more resilient revitalization through conservation (Zhang et al., 2022; Wilson et al., 2018).

Conclusion

The study shows that traditional Lingnan water villages possess a relatively clear and structurally differentiated healing value. Based on 415 valid samples and scale testing, the mean scores of all nine experiential dimensions exceed 4.0, indicating that respondents generally perceive their restorative potential positively. Among them, Natural Landscapes scores highest, whereas Public Spaces scores lowest and shows relatively high dispersion, indicating that Lingnan water villages already possess a solid natural restorative foundation but that public services and stay experience remain critical bottlenecks constraining overall healing perception. Combined with the SEM results, the healing effects of traditional villages are not dominated by a single landscape element, but instead display a markedly differentiated effect pattern: Folk Culture has the strongest explanatory power for Being Away and also plays an important role in Fascination; Natural Landscapes has positive estimated coefficients across all four healing dimensions; and Buildings and Street-alley Spaces provides core support for Extent and Compatibility.

The healing mechanism of traditional Lingnan water villages may be summarized as a threefold coupling of ecology, space, and culture: natural landscapes provide a low-stimulation and restorative environmental background; the street-space fabric converts perceptual advantages into continuous experiences of walking, staying, and activity unfolding; and folk culture strengthens psychological Being Away and attention attraction through local memory, ritual atmosphere, and participatory scenes. This finding indicates that conservation and renewal should not treat natural environment, spatial organization, and cultural activities in isolation, but should coordinate intervention around the formation logic of different healing dimensions. Concretely, priority may be given to improving the

accessibility, stayability, and facility friendliness of streets and public spaces, maintaining the ecological continuity of natural and waterfront environments, and transforming folk culture from festival-display resources into more everyday participatory experiential content, so as to realize the coordinated integration of conservation, transmission, and revitalized use.

Enhancing healing landscapes is highly consistent with China's Rural Revitalization Strategy. This strategy emphasizes ecological livability and cultural revitalization, thereby providing a policy foundation for constructing healing-oriented rural spaces. Compared with development approaches centered on single sightseeing resources or image packaging, a renewal approach based on healing value places greater emphasis on the making of holistic place experience: it strengthens spatial compatibility under the premise of ecological protection, deepens participation while preserving the continuity of local culture, and identifies the differentiated advantage structures of each village in terms of natural landscapes, street pattern, and folk culture so as to form more sustainable revitalization strategies. This not only accords with the goals of ecological livability, cultural continuity, and living utilization under the Rural Revitalization Strategy, but also offers a new theoretical perspective and practical pathway for the conservation renewal and differentiated tourism development of traditional Lingnan water villages. In this sense, healing-oriented renewal can be interpreted as a neo-endogenous rural development process in which external professional support, newcomer resources, residents' knowledge, everyday practices, and long-term community collaboration should be integrated (Zhang et al., 2022; Zollet and Qu, 2024).

Limitations and future work

The data in this study are derived mainly from face-to-face questionnaire surveys using intercept sampling. Although this approach can directly capture visitors' immediate perceptions and subjective evaluations, the sample may still be affected by survey timing, visitor composition, and respondents' expectations before touring, resulting in certain limitations in sample representativeness and response stability. In addition, the study covers only six representative Lingnan water villages. While this helps ensure case typicality and comparability, Lingnan water villages remain heterogeneous in water-network density, tourism-development intensity, community vitality, and landscape integrity. The applicability of the conclusions to a wider range of village types therefore still requires testing through expanded sampling and cross-type comparison. The cross-sectional, self-reported data support associations among perceived landscape characteristics and restorative dimensions but do not establish causal effects. The proposed synergy among ecology, space, and culture is an interpretation of the pattern of associations; interaction effects were not separately reported.

The research team plans to expand the sample at the spatial scale to include more Lingnan water villages with different levels of development intensity, different water-network configurations, and different degrees of living cultural continuity, thereby forming a more representative sample system and enabling cross-village comparison and typological analysis to improve the robustness and

generalizability of the conclusions. In terms of data methods, future work also intends to incorporate multi-source data such as online reviews, tourism-platform texts, and social-media narratives in order to obtain more continuous, broader-coverage experiential materials that are closer to natural behavioral expression. In conservation and renewal practice, UAV remote sensing offers a basis for documenting and analyzing village landscape patterns (Liu et al., 2020). Future studies could extend this approach to repeated monitoring of spatial texture and architectural character. Machine-learning-based assessment of human settlement suitability offers another methodological reference (Zhong et al., 2025). Building on these approaches, further research could examine how building repair, functional insertion, local leadership, and tourism development relate to the structural integrity and experiential quality of traditional villages.

Supplementary information The Supplementary information contains the questionnaire in Chinese and English, including demographic questions.

Author contributions Li Yan: investigation (questionnaire survey), methodology, formal analysis, visualization, writing—original draft, writing—review and editing. Dan Chen: methodology, formal analysis, project administration, writing—review and editing.

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Data availability The questionnaire data are available from the corresponding author, Dan Chen (jzchendan@gdut.edu.cn), on request for academic research purposes. The questionnaire instrument is provided in the Supplementary information.

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Competing interests The authors declare no competing interests.

Ethical approval All research was performed in accordance with relevant guidelines and regulations of China. According to Article 32 of the National Guidelines for Scientific Research Ethics Review (https://www.gov.cn/zhengce/zhengceku/2023-02/28/content_5743658.htm), research that involves human data or anonymized information—where there is no harm to participants, no sensitive personal information or commercial interests, and no relevance to life science or medical topics—is eligible for exemption from ethical review. This study is in full compliance with this criterion, as it utilizes on - site, face - to - face questionnaire surveys in public settings, gathering data solely regarding visitors' perceptions of the therapeutic value of the village, without collecting personally identifiable information or engaging in interventions that could pose risks to participants. Considering the nature of the study, no formal review or exemption was requested from an institutional review board.

Informed consent The informed consent form was placed at the beginning of the questionnaire, clearly delineating the purpose, content, and format of the survey. It underscored that participants had the right to withdraw at any time, elucidated the anonymity of the process, and stipulated that the collected data would be used exclusively for scientific research and educational purpose.

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