Journal of Digital Intelligence and Economic Growth
Website: https://www.jdieg.com
Vol. 1 No. 1, June 2024, 31-46

ISSN (Print): 3058-3535
ISSN (Online): 3058-6518
DOI: https://doi.org/10.63768/jdieg.v1i1.003

Research on Sustainable Development Design of Scenic Spaces Based on Tourists' Demands

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Abstract: The space resources of tourist attractions are limited, and how to make full use of them and solve the problems in resource allocation is one of the concerns in many disciplines. This study is expected to propose a sustainable development strategy from a designer's perspective that can achieve the full use of the scenic space in a scientific way as well as improve the visitor experience at the same time. Guided by the idea of speculative design, this study analyzes the needs of visitors in a scenic area and interprets the relation between the needs and space so as to develop optimal solutions for the sustainable development of the scenic areas. The open scenic area "Ten Mile Golden Beach" in Haikou, Hainan Province, China, was used as a case study, and the data was collected by means of a questionnaire survey. Using the program SPSS, we conducted an optimal scaling analysis of visitor demand, and the results of the graphical analysis confirmed that there is a contradictory and inclusive relationship between the demands of different visitors. The results of the analysis were interpreted by applying Speculative Design to develop an optimal solution for the sustainable development of the scenic space by way of dividing, merging and guiding demands. The study confirms that: 1. sustainable spatial planning requires full respect of tourists' demands; 2. sustainable spatial planning will alleviate conflicts in scenic areas; 3. planning service spaces according to tourists' demands will improve tourists' experience and promote the sustainable development of tourism spaces. Meanwhile, the results of this study show that: speculative design is an important way of sustainable design; data analysis technology can be a reliable means in visitor demand researches; visitor demand analysis plays an important guiding role and scientific value for the sustainable development of scenic space.

Keywords: Sustainable Development; Scenic Space; Speculative Design; Visitor Demand

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Received 30 April 2024, Revised 30 May 2024, Accepted 20 June 2024

1. Introduction

Open seaside tourist attractions are prevalent in seaside tourist cities, which are not only important links in the service system of tourist cities, but also a place for tourists to enjoy experiences and leisure during their sightseeing journeys (Kityuttachai et al., 2013). Cities rich in tourism resources are paying more and more attention to the construction of open scenic areas within them, which is important in building their city image and improving their visibility (Mahgoub, 2021). These scenic areas are created after scientific planning of urban space, making full use of natural resources and providing public places for leisure activities in the city (Zhang et al., 2020). Open scenic areas in tourist cities provide spaces for recreational and leisure activities for the neighborhood residents, as well as diversify scenic views for tourists (Rabbiosi et al., 2017). However, open scenic areas often bring many city problems due to the lack of systematic maintenance and management, which have a negative effect on the mood of tourists in the scenic area, such as: environmental cleanliness, facility maintenance, and vendor management and so on. These problems will affect the environment and services in the scenic area, causing a decline in the tourist experience and thus affecting the image and reputation of tourist cities (Wang, 2013). In view of this phenomenon, researchers in many disciplines hope to find effective ways to improve the problems that exist, but the result is that often solutions solved targeted issues as well as brought new problems, with sustainability (Camagni, 1998). This study expects to study the problems within the open scenic space with the help of sustainable development theories and propose management solutions to help the construction and maintenance of open scenic areas in the city in the future.

Haikou in Hainan Province, China, is a tourist city centered on seaside tourism and seaside culture, and there are many open seaside attractions along the coastline of the city. This study selected the representative "Ten Mile Golden Beach" in the city as the case, which has the spatial characteristics of a typical small open tourist attraction and deserves to be studied as a representative case (Long et al., 2022).

① The main road in the scenic area is distributed with public facilities as the center, in a "T" shape connecting the parking lots, the entrance, the restrooms and the main attractions.

② The scenic spot is located in the city function area, surrounded by hotels and residential apartments, and people who come to the scenic spot include both local residents and foreign tourists.

③ The scenic spot covers a small area, with limited space resources inside and arranged in compact layout.

④ The types of problems in this scenic spot are typical and can be used as a representative example of the similar scenic spots.

Existing studies on the planning of scenic space are usually based on the environmental factors within the space, dividing the space around the attractions and setting the public service facilities and the movement routes for visitors (Abe, 1992). Such traditional approaches often result in the clustering of crowds, and fail to give balanced play to the value of space, making it difficult to develop sustainable development (Healey, 2006). Another way of planning the scenic space is to use the services of functional areas to guide and distribute visitors according to the different functional services in the space (Zhang ang Moon, 2022). However, this approach does not pay enough attention to the association among tourists' needs, which causes mutual interference between functional areas and affect the feeling of tourists (Walker, 2019). Given the shortcomings in the above study, this research expects to analyze the relationship among visitors' needs and use it to develop optimized solutions to build sustainable space.

In this paper, the optimal scale analysis is used to assess visitor demand. This approach allows simultaneous analysis of the relation among multiple categorical variables, which is presented visually by means of a graphical representation (Kazan and Karaman, 2019). The method was used to explore the correlation between tourists' needs and to apply scientific data to develop feasible optimized solutions for the sustainable development of tourism spaces (Moutinho, 1987). In this process, survey, generalization, questionnaire and data analysis were used to test the hypotheses and identify the characteristics of tourists' needs. Based on the findings, the analysis results are further interpreted by applying the theory of speculative design to develop detailed optimized strategies. The results of the analysis will guide the design practice to derive the optimal solution

for the sustainable development of tourism space.

This study aims to explore a method to optimize the space of open tourist attractions. Starting from the needs of tourists, the study addresses the current problems within the scenic areas by means of scenic space optimization to ensure the sustainable development of the open seaside scenic zones. Its main contributions are as follows:

① It proves that optimal scale analysis is a scientific and effective means to understand the characteristics of tourists' demand in the scenic area.

② With analysis of visitors' needs, this paper points out the ways to solve the current issues happening in the scenic space.

③ It establishes a more appropriate solution to optimize the scenic space and promote the sustainable development of the scenic space.

2. Literature Review

2.1. Spatial Sustainable Development

In the "2030 Agenda for Sustainable Development" adopted at the 70th session of the United Nations General Assembly in 2015, Article 11 "Make cities and human settlements inclusive, safe, resilient and sustainable." provides a direction for systematic use of land and urban spatial governance (Bloomfield et al., 2018). Since then, many scholars have conducted in-depth research along this direction, expecting to solve the difficulties in land resource allocation and development from the perspective of sustainable development, by scientific deployment of limited resources in human living space to manage the conflicts and problems in space, gradually forming the concept of spatial sustainable development (Surya et al., 2021). It has been proposed that the problem of population growth and space allocation can be solved through technology, relying on technology to achieve three-dimensional space expansion to increase the utilization of existing space resources, such as high-rise buildings and three-dimensional parking lots (Weifeng, 2015). The development of urbanization has led to a rapid rise in urban population forming denser crowdedness. The three-dimensional spatial expansion has solved the problem of basic distribution of living space but compressed the per capita occupancy of public space resources, and the crowding of public space has led to a decline in the quality of life (Chakraborty and Banerjee, 2020). In the context of social development and population growth, the use of space should not only be for the purpose of solving current problems that we are facing, but also with foresight to avoid future problems that may occur, and to improve the utilization of space through the coordinated solution of spatial resource allocation, and to develop in the direction of giving full play to the potential of resource value (Kutty et al., 2020).

The concept of spatial sustainable development is concerned with the problems of spatial allocation, coordinating the tension between population and spatial resources, by seeking scientific and sustainable ways to maintain long-term stable relationships between spatial resources in three dimensions: environmental, social, and economic spheres (Yang and Cormican, 2021). Simkin R.D. et al. (2021) argue that spatial resources have the inherent characteristics of immovability, territoriality, and finiteness. The increase of human dependence on them and their perpetual use is irreversible. Maintaining the basic balance between supply and demand is an important element of the stable development of human society (Simkin and Seto, 2019). This shows that spatial sustainable development is of great significance to the development of modern cities, and the application of sustainable concepts to guide the allocation and adjustment of space will play a positive role in improving the quality of life of residents.

2.2. Sustainable Design

Speculative design is an important representative approach to sustainable design today. It aims to look at future scenarios from a forward-looking perspective, to think outside the confines of inherently rigid ideas, and to reflect on today's social problems as a guide to a priori innovation or prevention (Lindley and Green, 2021). The approach was early proposed by Victor J. Papanek (2020) with the expectation to observe the surrounding environment and things through a critical lens and to realize social and ecological friendly design in responsible manner. Anthony Dunn and Fiona Raby (2019) refined this design approach

by applying the discursive theory of logic, proposing to expand the cognitive dimension and the margins of thinking, to go beyond short-term goals, to hold a long-term perspective, and to develop pioneering systems and prototypes for future possibilities, so as to achieve "to build a vision of potential problems in future scenarios, designing for alternative ways of living, and reconfiguring the relationship between humans and reality". In Hartmut Eislinger's Design Forward (2020): Creative Strategies for Sustainable Change, it is clarified that speculative design is an important tool for achieving sustainable development goals.

Speculative design can be used to transform social ethics and to address deep social problems from a long-term and macroscopic perspective (Eislins, 2020). In applied research on design methods, it has been shown that speculative design can help reshape the normative order of society by avoiding potential pitfalls in future scenarios. Irwin T., et al. (2020) believe that design should not be limited by existing conditions and design for the positive, but should also consider negative scenarios, such as "bad actors" in the social system, to provide solutions to systemic problems in society and make design sustainable. These studies suggest that speculative design is an important sustainable approach of design that can provide a scientific means to solve the spatial allocation problems in today's society.

2.3. Optimal Scaling Analysis

Optimal scale analysis is a data analysis technique that studies the relationship among variables. Based on the association of the data itself, it transforms the variables into numerical values and transforms the relationship between the variables into a linear graphics for analysis (Song et al., 2013). Optimal scaling analysis simplifies the data and extracts them to present the results visually (Markos, 2010).

This approach is good at organizing the relationships between multiple variables and is frequently used by analysts in market analysis and research. The method has been widely used in the study of consumer confidence index by Didow N.M. et al. (1983), in the study of biological environmental protection by Ciruna, K.A. (1999), and in the study of movie recommendations by Jayalakshmi, S. et al. (2022). This study expects to apply optimal scaling analysis in the research on tourist spaces to analyze tourist demand and use the results to guide the development of optimized solutions for open tourist spaces.

3. Methodology

3.1. Purpose and Methods

3.1.1. Purpose of the Study

This research is designed to study the demand of tourists in the scenic area by means of survey and analysis, interpret the connection between demand and space, and use it as a guide to propose a sustainable plan for the development of scenic area space; to understand and explain the human-land system relationship between tourists and scenic space from the perspective of tourists' needs. In this study, the first step is to obtain information about tourists' needs and scenic spaces by asking tourists in the field through a questionnaire, and use optimal scaling analysis to process the data, followed by interpreting the analysis results to help formulate an optimized plan.

3.1.2. Research Methods

Questionnaire survey was used in this study to collect information directly from the respondent group, and after ensuring the return rate and response quality, objective scientific analysis will be conducted to process the data. In the today's research on tourists' needs, this method is commonly used in the analysis of tourists' feelings, feelings, and tourists' attitudes (Stefanovic, 2017). This approach was used by López-Sanz J.M. et al. (2021) to study the factors influencing tourists' behavior, and by Szymańska E.J. et al. (2021) to study the relationship between traffic environment and tourists' satisfaction in scenic areas. In view of the experience of related studies, the research in this thesis was carried out from the perspective of tourists' needs, and allows us to collect accurate research data from tourists' questionnaires.

3.2. Hypothesis

The following hypotheses are proposed based on the relationship between visitor demand and space of scenic attractions.

H1: There is a contradictory relationship among visitor demands.

When different tourists' demands adversely affect each other in a limited space and lead to a decrease in demand satisfaction, it can be assumed that there is contradictory relationship among tourists' demands. The different needs of tourists in the scenic area have different requirements for the spatial environment, so keeping the distance between tourists with different needs and dividing the independent space can effectively alleviate the conflict between them (Schmidhauser et al., 1989).

H2: The different needs of visitors are inclusive of each other.

Inclusive relationship between visitors' demands means that different visitors' demands do not interfere with each other in a limited space and do not bring about a decrease in demand satisfaction. In an open space, tourists with different needs can be active at the same time, and the different needs of tourists can be satisfied in the same space, and even the communication between tourists will improve their satisfaction, thus becoming an effective way to achieve a rich tourism experience (Radnić, 1992).

H3: There are both contradictory and inclusive relationships among tourists' needs.

Different visitors have different needs, so they need to be treated differently. The coexistence of some needs can have a negative impact on visitor satisfaction, but some do not. This complex relationship has both contradictory and inclusive relations. In a limited space, visitors with different needs are guided to gather in their respective areas according to the different characteristics of their needs to avoid the influence of each other and ensure that the satisfaction of all visitors' needs will be met (Song et al., 2019).

3.3. Structure of the Questionnaire

The questionnaire is divided into four parts: the first part is the statistical characteristics of the respondents, the second part is the aim of the respondents to visit the scenic spot, the third part is the current problematic status of the scenic spot, and the fourth part is the demand preference of the respondents. All questions are in the form of multiple choice questions for the respondents to answer. These four parts have consulted papers such as "The Moderating Effects of Tourist Characteristics and Novelty Seeking on the Relationships between Satisfaction" by Mahasuweerachai P. et al. (2011); "Exploring destination image, familiarity, information search behavior, involvement and travel motivation as influencers of ecotourists' destination loyalty" by Yu J. et al. (2020); "Controllable drivers that influence tourists' satisfaction and revisit intention to Semenggoh Nature Reserve: the moderating impact of destination image" by Chan W.C. et al. (2021); "Tourist preferences influence of unconscious needs. Annals of Tourism Research" by Tran X. et al. (2006); "Travel motivation and choice of destination attributes: Empirical evidence based on tourist perceptions" by Pawaskar P. et al. (2020). The questions were formulated, and the definitions are shown in Table 1.

Table1 Composition of the Questionnaire

Question Contents	Question Category	Definition	Bibliography
Sex Age Identity	Statistical Characteristics	Investigate background information that is relevant to the needs of visitors.	Mahasuweerachai, P., & Qu, H. (2011).
Visitor Status Fundamental Purpose	Aim of Trip	Investigate the main aims of visitors in the scenic area and their conditions.	Yu, J., Kasim, A., Sreenivasan, J., Dzakiria, H., & Ul Haq Magray, A. (2020).
Major Issues in the Space Desired improvement	Current Issues of Scenic Area	Analyze visitors' attitudes and expectations towards issues in the scenic space.	Chan, W.C., Wan Ibrahim, W.H., Lo, M., Mohamad, A.A., Ramayah, T., & Chin, C. (2021).
Preference for the space environment during sightseeing Preference for the space environment during leisure time Preference for the space environment during sports and exercises	Demand Preference	Visitors on different conditions have different requirements and preferences for the spatial environment. Analyze the differences through the three main kinds of activities.	Tran, X., & Ralston, L.S. (2006). Pawaskar, P., Mekoth, N., & Thomson, A.R. (2020).

3.4. Data Collection

The questionnaire was placed on March 15, 2022 at the Ten Mile Golden Beach seaside tourist attraction in Haikou City, Hainan Province, and the objectives and contents of the questionnaire were explained to the respondents. Ten questions were asked, and all of them were multiple choice questions. 87 questionnaires were actually sent out, and 85 valid questionnaires were returned after screening, with an efficiency rate of 97.70%, which meets the requirements of the number needed for analysis.

4. Data Analysis

4.1. Descriptive Analysis

After processing the contents of the questionnaire, the statistics of the final results were shown in Table 2.

Table2 Summary of Questionnaire Collected Information

No.	Dimension	Questions	Answer Item	Percentage		
Q1	Statistical Characteristics	Sex	2	Male 68.3	Female 31.7	
Q2		Age	3	Below 30 25	30 to 60 61.5	Below 30 25
Q3		Identity	2	Foreign Tourists 37.5	Local Residents 62.5	
Q4	Aim of Trip	Visitor Status	3	Travel alone 13.5	Family Outing 57.7	Travel alone 13.5
Q5		Fundamental Purpose	3	Sightseeing 21.1	Leisure and Relaxation 62.7	Sightseeing 21.1
Q6	Current Issues of Scenic Area	Major Issues in the Space	3	Environmental Cleanliness 42.8	Public Facilities 21.5	Environmental Cleanliness 42.8
Q7		Expected improvements	3	Modes of Consumption 37.1	Public Facilities 29.1	Modes of Consumption 37.1
Q8	Demand Preference	Preference for the space environment during sightseeing	3	Quiet and Private Space 18.7	Lively and Open Space 30.6	Quiet and Private Space 18.7
Q9		Preference for the space environment during leisure time	3	Quiet and Private Space 21.8	Lively and Open Space 43.2	Quiet and Private Space 21.8
Q10		Preference for the space environment during sports and exercises	3	Quiet and Private Space 63.4	Lively and Open Space 11.7	Quiet and Private Space 63.4

4.2. Visual analysis

Optimal scaling analysis was performed by using SPSS to statistically analyze the information collected via the 10 questions from 4 dimensions designed in the questionnaire. Through data dimension reduction, relationships were analyzed and presented in visual numeric diagram, as shown in Figure 1 and Figure 2.

4.3. Hypothesis Testing

From the optimal scaling identification scale, it is seen that the three indicators around tourists' demand preferences are sightseeing, leisure and relaxation, and sports and exercise. The small angle between indicators of sports and exercise and relaxation and leisure indicates that they are closely related, which means that there is a certain similarity and correlation between the two demand preferences, so they have a close connection. The relatively isolated sightseeing indicator shows that there is relatively less close connection between it and leisure and relaxation or sports and exercise indicators, which means that there is no similarity and correlation between it and the other two demand preferences, so there is a contradictory relationship of difference.

This proves that hypothesis **H3** is valid, and there is both contradictory and inclusive relationship between tourists' demands

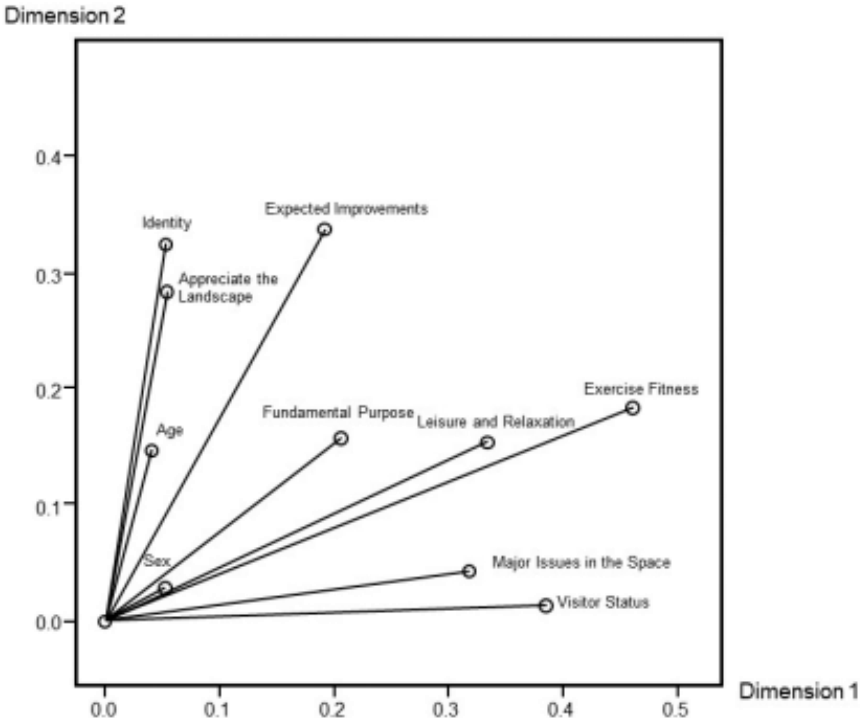

Figure 1. Optimal Scaling Identification Scale

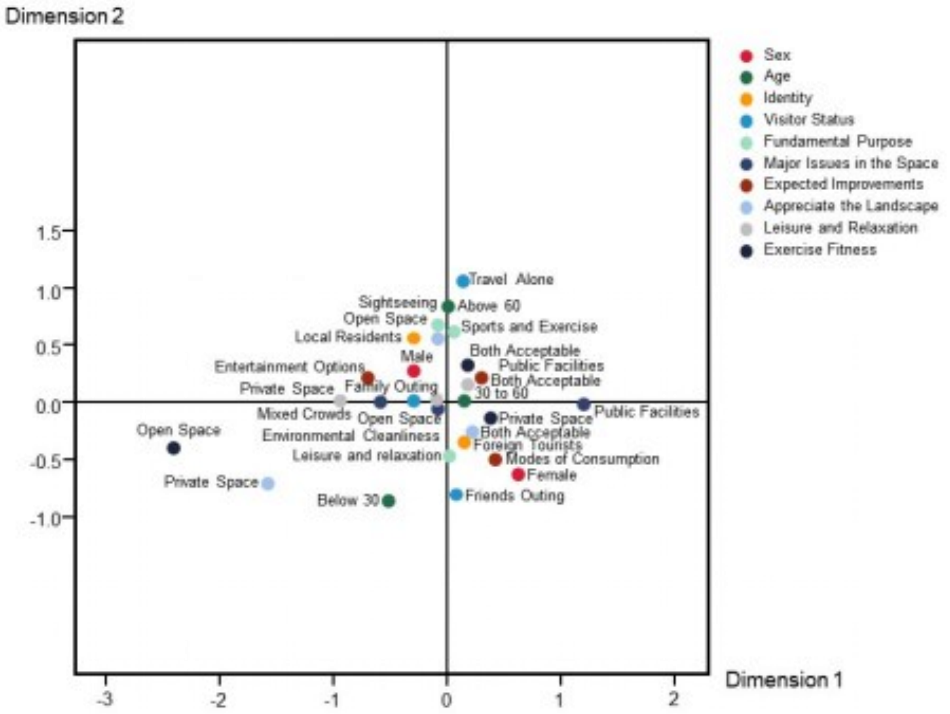

Figure 2. Optimal Scaling Analytical Quadrant Diagram

5. Results

5.1. Qualitative Result

The study obtained visual and scientific results from the analysis of the optimal scale of tourist demand. The results show that among the ten indicators, the gender indicator is closer to the origin, which indicates that the interpretation of the g ender

variable with the optimal scale analysis is not particularly reliable and that this variable can be ignored in the assessment. The rest nine variables have analytical and assessment value.

The information in the Figure indicates that the demand to sightseeing and the indicators of visitor identity and age are closely related to each other as with a small angle. From this, we can get that the dimensions of tourists' statistical chara cteristics are closely related to the demand for sightseeing, indicating that there is a guiding correlation between the background characteristics of the visitors and the demand for sightseeing. At the same time, the angle between the indicators of leisure and relaxation and sports and exercise is small while its angle with the indicators of sightseeing is large. This indicates that the re is strong connection and certain similarity between the demand for leisure and relaxation and the demand for sports and exercise, but there is significant difference between these them and the demand for sightseeing, so their correlation is not significan t. From the diagram, we can also see that the indicators closer to the demand for leisure and relaxation and sports and fitness are the main purpose and the main problem, which indicates that there is a link between the two dimensions, aim of trip and the current issues of the scenic area and the two demands.

Summarizing the results of above analysis we can get:

① There is some connection among all four measured dimensions of the study, indicating that the findings are scientifically informative.

② There are different relationships between different tourist needs, both contradictory and inclusive.

③ The relationships between the three measured dimensions of tourist statistical characteristics, aim of trip and scenic spot issues and different tourists' demand preferences are significantly different and deserve further in-depth research and analysis.

5.2. Optimization Strategy

By observing the quadrant diagram of optimal scale analysis, we can classify the analysis information, to further interpret the visitor needs in detail, so to guide the formulation of optimized strategies for spatial development with the help of specula tive design. The specific observation and ideas are shown in Figure 3 (Paik and Genç, 2020).

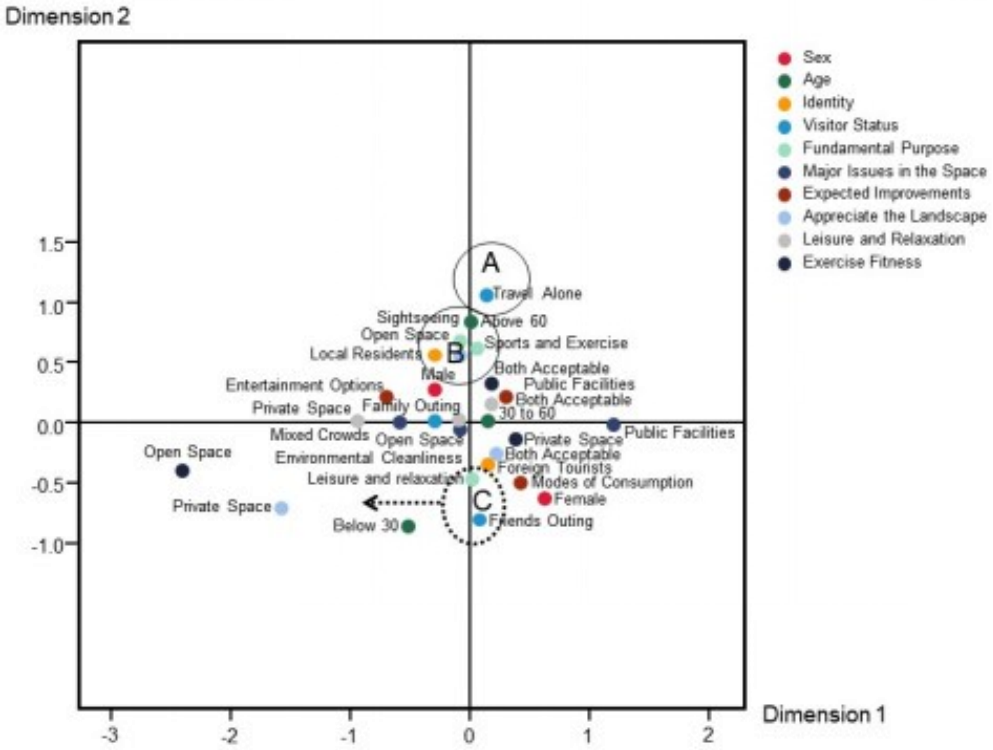

Figure 3. Interpreting the Quadrant diagram

5.2.1. Dividing Demands

Dividing demands is a way to divorce specific visitor needs from the general demand and focus on them by means of design and facilitate space optimization. To analyze the distinctive options in the diagram, the options that are far from the origin tend to have a strong distinctiveness and are different from the group of options under each quadrant, so can be focused on through design after being separated from the general demand (Khalid, 2004). For example, the option "travel alone" in the A area in Figure 3 has certain particularity.

When conducting design research on how to divide needs, a directed design approach can be used to carry out spatial design in accordance with the characteristics of personalized options (Marin and De Meulder, 2018). Directed design is an approach that purposely addresses the design of a specific group of problems (Zikirov et al., 2021). Directed design focuses on individual options, considers the characteristics of the options as the characteristics of the potential group to carry out design, and takes care of the needs of the group's characteristics in spatial optimization, for example, for people who travel alone, they can be linked to the information of the surrounding options, thus changing the isolation of the target. In this case, the aims of the tour, to enjoy the landscape and sports and exercise, are relatively close to the characteristics of the solo travelers, so the space can be optimally configured according to these characteristics (Simeone and Corubolo, 2011). The use of the directed design approach to divide visitor demands can clarify and refine the design goals and carry out the design with a purpose.

5.2.2. Merging Demands

Merging demands means to group demands that have certain association so to guide the subsequent space optimization. The closer points in the diagram can be classified to form information clusters to merging demands; the closer information points often have certain commonalities and connections, and the observation and evaluation of several options as similar information can effectively help to learn the characteristics of the group (Ylirisku et al., 2016). The clusters' feature options of interest are shown in the B Area in Figure 3.

For data of demands that are merged in a clustered manner, the integrated design method is employed to guide space optimization design. The integrated design method is a systematic design approach that identifies a variety of fragmented information to help make a general judgment on the issues (O'Keefe and Rottenberg, 2017). After integrating the information in area B, we learn that: this group of visitors are local residents aged 60 or above, who come to the scenic area mainly to enjoy the scenery and do sports and exercise, and expect to have relatively open space when enjoying the scenery. The integrated information can clarify the target group and its preference characteristics, which can help guide the optimal design of space (Devanathan et al., 2010). The integrated design method can be used to merge demand to clarify the target group, and improve the efficiency of space utilization by focusing on the differences between characteristics of groups to develop a solution that meets the demand.

5.2.3. Guide Demands

To guide demand means to pay attention to a specific demand and steer it to the appropriate area in a scientific way. The analysis of the diagram shows an unbalanced distribution of indicators, and a balanced and harmonious state of development can be achieved if the demand is steered with the purpose of a balanced distribution of information on indicators (Langdon et al., 2012). The information in the C Area in Figure 3 has the potential to be directed to the left quadrant so as to achieve a balanced amount of information in the left and right quadrants.

The objective-led design approach can be used to purposefully guide the demands during the design for a space development. Objective-led design means having a clear goal at the beginning of the design phase and further directing all aspects of the design to ultimately achieve the goal (Venkatesh et al., 2012). For example, the group of tourists in C area is characterized as visitors traveling with friends to enter the scenic area for leisure and relaxation, and there are only two options of tourists' demand preference and one option of age characteristic index in the left quadrant of this area. Leading the visitors in Area C to the left quadrant can cultivate new demand preferences and guide visitors to identify their needs in the area for a better travel experience. The objective-led design is able to focus on cultivating tourists' demand preferences and behavioral habits, fully and equally applying spaces that normally do not receive attention, and exploiting the value of space resources in

a balanced way (Moore, 2020).

5.3. Design Practice

5.3.1. Major Issues

Interpreting the distribution and use of space within the existing scenic area as shown in Figure 4, the main problems exist as follows:

① The visitors' area of activities is rather limited, the main activity space is the place near the intersection of the only bathroom in the scenic area and the public beach, and the second activity space is the rest promenade between the public beach and the reef area.

② Various kinds of vendors are concentrated around the restrooms in the scenic area, and this is also the area where sanitation problems are prevalent in the scenic area.

③ The sunrise view area and the reef area are located at the far end of the left and right sides of the scenic area, which are less frequented by tourists and have a lower rate of utilization.

④ The public beach area has a variety of visitor entertainment, such as beach games, swimming, walking, barbecue, etc. The density of visitors is high, and the layout of the space is more disordered.

Figure 4. Distribution of Scenic Area

5.3.2. Space Planning

Based on the results of the optimal scaling analysis of visitor demand, we summarize the characteristics of space demand in the scenic area, as shown in Table 3.

Table3 Analysis Table of the Characteristics of the Spatial Demand for Scenic Spots

Characteristics of space demand	Private Space	Mingling Space
Demographic characteristics	Individual, lovers, couples	Family, friends
Characteristics of space	Strong sense of distance, quiet space, privacy requirements	Weak sense of distance, room for interaction, open space for activities
Main activities	Resting, walking, running, sea fishing, etc.	Swimming, beach sports, group activities, etc.
Length of stay	Shorter	Longer
Waste generation	few	More
Use of public facilities	few	More

This optimization plan is made based on the demand of visitors and the number of groups of visitors as the principle to ensure that the space resources are allocated in a comprehensive scientific way so as to realize the sustainable development of the space, and the space optimization plan is shown in Figure 5. The space is divided into three areas from west to east, and the number of active groups in each area gradually increases, which are 1~2 people, 2~5 people and more than 5 people. At the same time, the characteristics of the spatial environment of the three areas go from quiet to noisy to ensure that the demand preferences of different visitors are met.

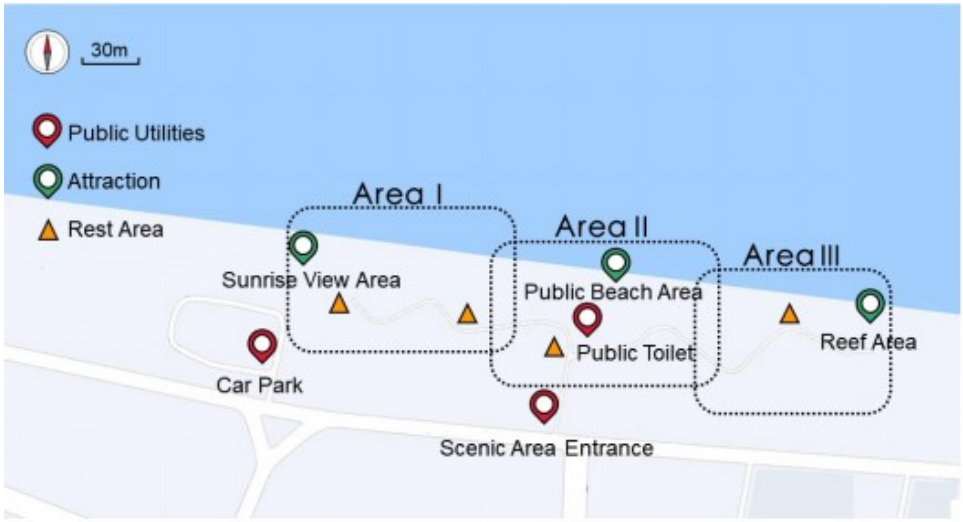

Figure 5. Schematic Diagram of Optimized Solution

Area I: This area is located between the sunrise viewing area and the public beach, which was relatively quiet with few visitors before. After optimization, the space serves for 1~2 groups of visitors, with the passageway as the central movement line, suitable for walking, running and other sports, which still maintains a relatively quiet space. The movement line is dotted with many a stopping space for rest to enjoy the scenery, so that visitors can keep a certain distance from each other to protect their privacy.

Area II: This area is located in the center of the scenic area, near the public beach and restrooms, and is formerly the main activity area of visitors in the scenic space. After optimization, this space is still the activity space for most of the visitors, and the space provides a place for beach entertainment activities, suitable for friends meeting and family functions, and is expected to serve mainly for 2~5 groups of visitors. The space is wide open and has a high density of visitors, so it is less prone to accidental and dangerous happenings during beach activities. At the same time, it is close to the bathroom, which is convenient for visitors' cleaning when they are engaged in beach sports.

Area III: This area is located between the public beach and the reef area, with a relatively small space for beachfront activities, which was formerly a second area for visitor activities in the scenic area. After optimization, it is set as the main area for group activities, mainly serving groups of 5 or more visitors. The area is relatively separate and open, and the lively environment is less likely to affect leisure and sightseeing visitors when having group functions such as barbecue and group building.

5.3.3. Redirection tourists

After optimizing the design of the scenic space, it is necessary to redirect tourists into their own suitable space. In this design, visitors are redirected through small public facilities, such as sharing products, vending machines and sports and exercise equipment. Visitors can choose to use the facilities according to their own needs, which not only with increase the satisfaction of their demand and improve the tourism experience, but also can effectively prevent the vendors from operating recklessly and play a positive role in the management of the scenic spot and the maintenance of sanitation (Evans, 2015).

Diverting crowds through public facilities is a scientifically effective way. In a study by Dewey P. et al. (2020) it was pointed out that controlling visitors flow by arranging public facilities is an acceptable management method for tourists. Likewise, Barua Z. et al. (2018) have pointed out that in the future, the services of self-service facilities will replace the traditional way of human service, and the quality and value of services will be easier to manage in a standardized way. Placing public facilities in scenic areas can provide convenience to visitors, increase the profitability of the area, and provide for the sustainable development and operation and maintenance of the area.

6. Discussion

In this paper, we use the optimal scale analysis method to study the demand of visitors, explore ways to improve the efficiency of the use of space resources in scenic areas, and propose a sustainable space optimization strategy to ensure the full use of space in scenic areas in a scientific way and improve the experience of visitors. With the guidance of relevant literature, this study focuses on the analysis of factors related to visitors' needs, and based on the analysis results, spatial optimization solutions around visitors' needs are developed. The study applies the concept of speculative design to divide, merge and steer visitors' needs, so as to finally propose a spatial optimization plan for the case studied.

This study conducted an optimal scale analysis in terms of visitor demand, and combined the information points that are often focused on in previous studies in the process of studying the dimensionality of information for a comprehensive analysis. The study confirms that there is a correlation between visitor demand and scenic space, and the relationship between the two characteristics is verified by tested hypothesis. In the study, the dimensional analysis table and metric table from optimal scaling analysis were used to evaluate different information items, and each information item was reduced in dimensionality, and the characteristic attributes of the factors were identified through a two-dimensional icon matrix to explain the location relationship between the factors. Meanwhile, the results of the analysis are applied by using the speculative design method, and a scientific space optimization strategy is developed by selecting the appropriate design method with the focus on the needs of visitors, which will provide a direction for the sustainable development of the scenic space.

The study confirms the research of related scholars on space utilization and land planning. For example, Klaučo M. et al. (2017) argue that sustainable planning of tourism with emphasis on land resources can ensure both normal human activities and protection of existing natural environmental resources; Robert S. et al. (2015) argue that scientific and rational spatial and land planning can contribute to the future urbanization of coastal cities; Lopes E. et al. (2022) argue that joint planning of tourism and land in natural spaces is important for the sustainable economic and natural. The views of Lopes E. et al. (2022) that tourism and land co-planning in natural spaces are important for sustainable economic and natural development are scientifically confirmed.

The sustainable space optimization strategy proposed in this study provides a direction for the future balanced and efficient sustainable development of space. To achieve sustainable spatial development requires attention to the balanced use of space, and comprehensive and balanced development is conducive to the equal transformation of resource values, thus forming a healthy development dynamic. The efficient utilization of space resources also helps to achieve sustainable development of space. In-depth exploration of the value of space resources and finding a balance between consumption and profit is an important driving force for long-term sustainable development.

7. Conclusions

This study discussed the strategy of sustainable development of scenic space based on tourists' needs. In the context of today's increasing concern for the construction of public green spaces in cities, the sustainable development strategy of scenic spaces proposed in this study has certain instructive significance. The study proposes measures to address the allocation of public space resources from the perspective of tourists' demand, and illustrates the value and feasibility of the study through the case of an open seaside scenic area. The study applies the optimal scaling analysis method to interpret visitor demand to lead the formulation of sustainable spatial optimization solutions, and provides scientific research ideas for the allocation of tourism space resources. Meanwhile, the study adopts the idea of speculative design to select appropriate design methods to achieve the goal of sustainable space development, and proposes a feasible path of thinking according to the development trend of visitors' demands.

The case of "Ten Mile Golden Beach" is representative of the study. After the data analysis, an optimization plan was developed to solve the problems in the scenic area, which will provide a reference for future studies of similar cases. The methods of data analysis and the interpretation and application of the results used in the study have been proved to be scientifically effective, and the approach is worthy of reference for future research on sustainable spatial development and spatial optimization design.

In summary, this study, as an attempt to apply data analysis technology in the field of spatial development planning, has certain scientific guidance. The data analysis method and perspective of research adopted in this study are helpful for solving the current problems in spatial resource allocation. At the same time, the study adopts the concept of speculative design to develop sustainable spatial optimization solutions, which also provides a practical reference for sustainable design and provides information for the rest of the design sector in sustainable design research.

There are some limitations in this research. First, the sample size is limited. Increasing the number of experimental research subjects can improve the accuracy and objectivity of this study. Moreover, there are limitations in the data used on in the study. In addition to tourists' background, motivation and behavioral habits there are many dimensions of data worthy of in-depth analysis and exploration, such as: cultural connotation of scenic spots, health concept, sustainable consumption, and tourism culture and communication. In future studies, the researcher will try to use more systematic methods for data collection and more data analysis platforms and methods to find more dimensions of data to direct the design and analysis of sustainable development and to improve the objectivity, accuracy and scientific of the study.

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