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Research on Spatial Perception Enhancement Strategy of Tianjin Wudao Historical Block Based on Spatial Syntax

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Abstract: This article describes a quantitative analysis of new spatial perception construction methods from the perspective of tourists' perception using spatial syntax theory. This method explores the relationship between block spatial layout and perceptual practice, and is used for a detailed analysis based on tourists' visual and tactile perception, combined with historical spatial creation to generate spatial perception improvement strategies suitable for historical blocks under the current stock update background. Spatial syntax, through computer analysis and tourist simulation, can help obtain the most accurate spatial range and effective target areas for perceptual enhancement in historical districts. In this study, a detailed update method and related strategies for the construction of sustainable historical block cultural perception based on spatial syntax model were introduced. Specifically, taking a government key construction area in the Five Avenues Cultural and Historical District as an example, this study analyzes the tactile and motion perception, static visual perception, spatial use, and gathering situation of tourists in different travel situations within the area, and proposes a new perception construction strategy based on this area.

1. Research Overview

During the modern history of China, Tianjin was a well-known transportation center, commercial center, and military center in the north, forming a contemporary international metropolis characteristic culture represented by multiculturalism. The Tianjin Five Avenues Cultural and Historical Block embodies the century old history of Tianjin and is a famous tourist attraction in Tianjin. Wu Da Dao originated in the early 20th century and is located in the central area of Heping District, Tianjin. It includes six parallel streets, Machang Road, Munan Road, Dali Road, Chongqing Road, Changde Road, and Chengdu Road, as well as 22 intersecting roads such as Xinhua Road, Guilin Road, and Kunming Road. It is a famous historical and cultural district in Tianjin. With over 2000 garden style houses built in the 1920s and 1930s, it is known as the "World Architecture Expo Garden". The road network of the block is slightly curved, with buildings and walls of different styles forming a complete urban interface. The rich layers of greenery decorate the entire block, and the pleasant scale and beautiful environment form a unique and continuous landscape resource.

Against the backdrop of the current slowdown in urbanization and the gradual transformation of

urban construction models from incremental to stock models, with a greater emphasis on local cultural continuity, the Five Avenues Historic District, as a microcosm of Tianjin's urban culture, is an important force for urban revitalization and cultural construction[1]. Therefore, the spatial perception of the Five Avenues Historic District, which is closely related to the historical urban context, is crucial for maintaining the unique essence of the historic city. However, after 30 years of rapid economic growth and development in China, the Five Avenues historic district has gradually shown problems such as weak historical and cultural awareness, inadequate updates, traffic congestion, and unreasonable spatial layout. In order to further enhance the unique cultural perception of the Five Avenues, strengthen the public's perception and inheritance of the cultural heritage of the historic district, and further strengthen the cultural environment construction of the historic district, it is necessary to explore the perception construction of the historic district based on the spatial analysis results of the historic district and tourists' perception analysis of the historic district space.

This article describes a new spatial cultural perception construction method that quantitatively analyzes tourists' perception of spatial cognition from the perspective of spatial syntax theory. This method explores the relationship between block spatial layout and perception practice, and is used to generate cultural perception enhancement strategies for historical block updates based on detailed analysis of tourists' different perceptions and the creation of historical culture, applicable to the current stock update background. Spatial syntax, through computer analysis and tourist simulation, can help obtain the most accurate spatial range and effective target areas for perceptual enhancement in historical districts. Taking the key construction areas of the Tianjin government in the Five Avenues Cultural and Historical Block as an example (as shown in Figure 1): the "Gathering Anchor" area of the Five Avenues Cultural and Historical Block, with Minyuan, Xiannong Courtyard, Qingwang Mansion, and Minyuan Xili projects as the core[2], analyzed the tactile and motion perception of tourists in different travel situations, static visual perception, usage and gathering situation in this area, and proposed new cultural perception construction strategies based on this area.

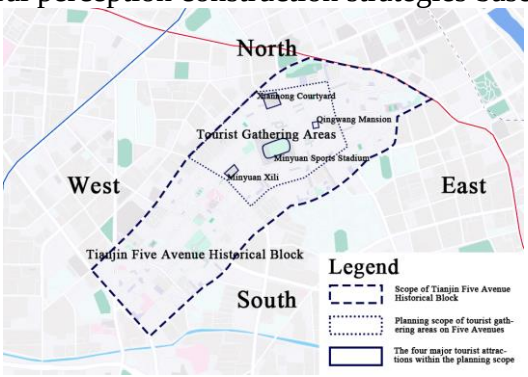

Figure 1: Scope of the study area

2. Research methods

2.1. Spatial Syntax Theory

Spatial syntax is a method of describing and analyzing the relationship between urban area space and buildings. Since Bill Hillier proposed the concept of spatial syntax in the late 1970s, this model has been widely used as a social logic language to understand urban or architectural spaces[4]. Bill Hillier believes that spatial syntax can quantitatively analyze space and also analyze the relationship between people and space[3]. Spatial syntactic theorists refer to the set of simulated relationships between spaces as "configuration" or "reachability", which are used as a way to describe the intrinsic properties of space as they understand it. Analysis based on spatial syntax uses three types of distance

metrics [5] topology (minimum turning path); Geometry (minimum angle change path); And the metric system (shortest physical path). Then, spatial syntax calculates the street network configuration at different scales based on the size of the research area. Global scale analysis measures the average depth of an axis or line segment relative to all other axes or line segments in the entire street network, while local scale analysis calculates within a finite radius [6]. Turner et al. conducted extensive research on the comparison and relationship between spatial syntactic models, spatial images, and cognitive maps, and concluded that there is a certain relationship between isoviews and visibility maps, which can be used for the study of spatial cognition [7]. Shokouhi believes that by comparing the spatial syntactic analysis and image maps of different cities, the coherent structure composed of prominent urban elements, the organic organization of buildings, and the continuity between landmark visual domains are the key to interpreting cities [8]. Tao combines axis maps with image maps to explore the spatial form of villages [9]. Spatial features directly affect people's cognition. Lynch mentioned that different environments are easier to understand and discover because different parts are clearer and easier for people to remember. In addition, differentiation creates better landmarks and urban spaces[10]. The research proposed in this article aims to promote the study of spatial syntax. It will provide a visual and quantitative method for the tourism field of historic districts by understanding the characteristics of urban form and tourist preferences.

2.2. Application of DepthMap software

This study used the spatial syntax analysis software DepthMap (software version: DepthMapX 0.8.0) to analyze the axis analysis model and visual analysis model of existing blocks drawn by AutoCAD (software version: AutoCAD 2024) software, and conducted axis quantification analysis, visual analysis of visual perception, and 3D pedestrian simulation analysis. The road network data is sourced from the Baidu Maps open platform.

2.3. Indicators of Spatial Syntax Theory

This article takes the perceived space of the Minyuan and surrounding areas in the historic district of Tianjin Wudao as the research object, and selects four indicators in spatial syntax theory, namely depth value, connection value, comprehensibility, and visibility, for quantitative analysis of spatial perception. The depth value represents the reachability from one node to another in spatial topology operations, where the shortest topological distance between two nodes is the depth value [11]. The connectivity value can reflect the accessibility level of the road network and directly reflect the topological connectivity level of the road axis in spatial topological operations [12]. Understandability refers to a person's level of understanding of a space, and the higher the comprehensibility, the easier it is for people to perceive and understand the space. Visibility is used in spatial topology operations to express the degree of spatial visual visibility in threshold analysis. The higher the visibility, the easier it is for tourists to visually perceive the area.

3. Spatial Perception Analysis of "Gathering Anchor" Planning Area Based on Spatial Syntax

3.1. Analysis of the Axis of the Five Avenues Historical Block

3.1.1. Depth of the Five Avenues Historic District

As shown in Figure 2A and Table 1, the overall color of the axis of the Five Avenues Historic District is cool tones, with an average depth value of 4.14. The overall depth value of the block is relatively low, indicating strong accessibility. The color of the road axis near the boundary in the

northeast corner of the Wudao Historic District is slightly warm, and the depth value is larger compared to the overall area, resulting in lower accessibility. The overall color of the axis in the planning area of "Juke Anchorage" is a cool tone, with an average depth value of 3.71, which is lower than the average depth value of the Five Avenue Historical Block. This indicates that the axis depth in the planning area of "Juke Anchorage" within the Five Avenue Historical Block is relatively small, and the accessibility is strong. During the on-site investigation, it was found that the roads in the historic district of Wudao are relatively narrow, and the main mode of internal tourism in the district is walking. Especially during the peak tourist season, reasonable restrictions on the passage of vehicles and bicycles in the district can effectively improve accessibility and expand the walking space for tourists.

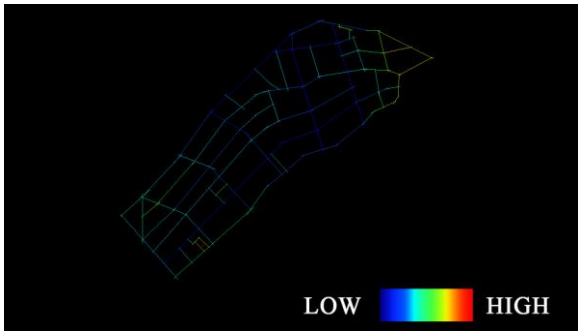

Figure 2: Analysis of Depth Values of Five Avenues (A)

Table 1: Analysis of Depth and Connection Values of Five Avenues

Instruction Name	Depth value	Connection value
Average value	4.14	4.07
Maximum value	3.59	2
Minimum value	6.23	10
Standard deviation	0.66	1.89

3.1.2. Connection with the Five Avenues Historic District

As shown in Figure 2B and Table 1, the average spatial connection of the Five Avenues historic block is 4.07, and the axis is mostly warm colored because the layout of the block's road space in the Five Avenues network format connects the roads within the block. The roads in the planned area of the "Gathering Customer Anchorage", especially the four streets of Chengdu Road, Luoyang Road, Xinhua Road, and Hebei Road, have a warm axis with a connection value of 8-10, which is higher than the average connection value of the historical block of Wudao. Among them, Xinhua Road has the highest connection value within the Five Avenues Historic District, with a value of 10, and is the main road connecting the Five Avenues Historic District and the "Gathering Anchor" planning area. These streets with high connectivity indicate a closer connection between the planned area of the "Gathering Anchor" and the historic district of Wudao.

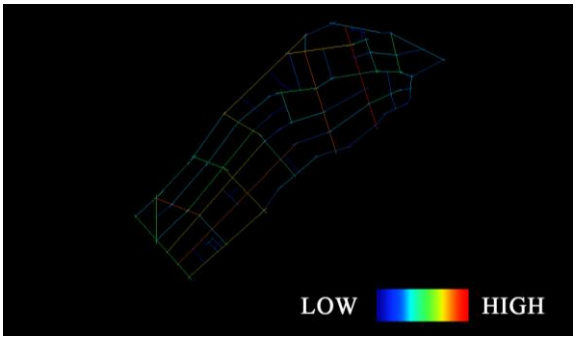

Figure 2: Analysis of Depth Values of Five Avenues (B)

3.2. Analysis of Spatial Tactile Perception in the Planning Area of "Gathering Passenger Anchorage"

3.2.1. Depth of Axis in the Planning Area of "Gathering Passenger Anchorage"

As shown in Figure 3A and Table 2, the depth of the regional axis is 2.71, which is lower than the average depth value of the historic district of Wudao. The block axis has a warm color tone, indicating that the road network depth in the planned area of the "gathering anchor" is relatively deep, and the spatial accessibility of some roads is weak. Hebei Road, as the main street, has a cool axis with a depth value of 2.08, making it a street with strong accessibility in the region. Other streets have relatively low accessibility due to more turns and higher depth values. Meanwhile, through on-site research, it was found that Hebei Road is the main thoroughfare in the region with relatively high traffic volume. However, due to its important transportation location on Fifth Avenue, it is not possible to prohibit vehicle traffic during peak tourist seasons, resulting in limited walking space for tourists and residents in some areas of Hebei Road. Tourists and residents are more willing to use Hebei Road to enter streets with relatively fewer or prohibited vehicles for sightseeing.

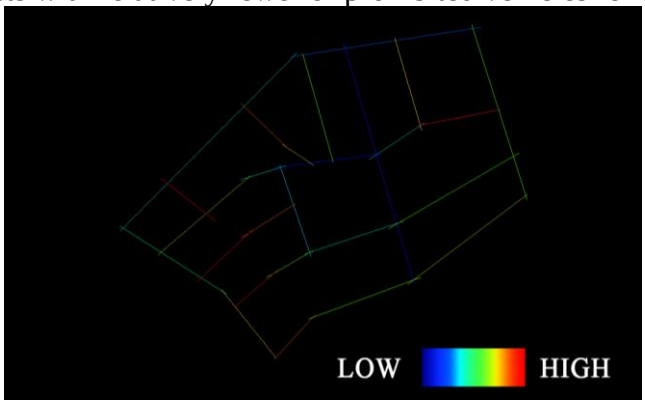

Figure 3: Analysis of Depth Values in the Planning Area of "Gathering Passenger Anchorage" (A)

Table 2: Axis Analysis of Depth and Connection Values in the Planning Area of "Gathering Passenger Anchorage"

Instruction Name	Depth value	Connection value
Average value	2.71	3.31
Maximum value	2.08	2
Minimum value	3.16	7
Standard deviation	0.31	1.32

3.2.2. Axis Connection in the Planning Area of "Gathering Passenger Anchorage"

As shown in Figure 3B and Table 2, the average connection value of the "Gathering Anchor" planning area is 3.31, and the color distribution of the axis in the area is relatively reasonable. Hebei Road, as the main street of the area, has a connection value of 7 and has already connected most of the main street spaces in the region. Chongqing Road, Dali Road, and Munan Road are the main pedestrian and tourist spaces within the area, with a connection value range of 2-6. All three streets are closely connected to Hebei Road. Through field research, it has been proven that Hebei Road Street is the highest and most important street for both vehicular and pedestrian traffic. The reason is that Hebei Road Street is relatively spacious compared to other streets, and it also connects to an important tourist attraction: Minyuan Square. A large amount of pedestrian traffic will be dispersed through Hebei Road to Chongqing Road, Dali Road, Munan Road, and other pedestrian spaces. However, due to the high traffic volume on Hebei Road, the road length is relatively short compared to other roads, and some famous attractions, such as celebrity residences and seasonal attractions, are also relatively few and scattered on other streets.

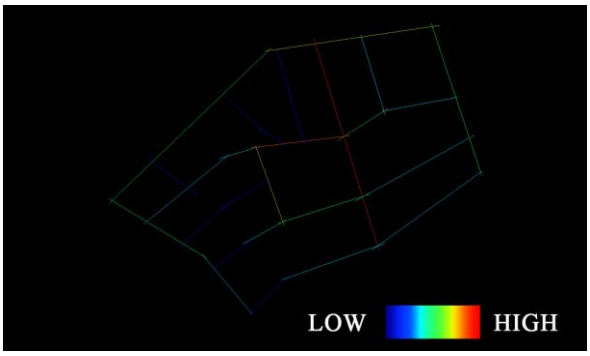

Figure 3: Analysis of Depth Values in the Planning Area of "Gathering Passenger Anchorage" (B)

3.2.3. Analysis of the comprehensibility of the axis line in the planning area of the "Gathering Passenger Anchorage"

Axis comprehensibility analysis is the correlation between local parameters and global parameters. The higher the synergy between local integration and global integration, the better tourists can perceive and understand the space. In terms of comprehensibility, the global integration degree Rn is taken as the X-axis, and the local integration degree R3 is taken as the Y-axis. Calculate the synergy between the X and Y axes in the comprehensibility analysis graph through regression analysis of R^2. If R^2 is closer to 1, it indicates a higher synergy between the X and Y axes and a higher comprehensibility of the area. According to Figure 3C, it can be seen that R^2 is 0.95, which is close to 1, indicating a high degree of synergy between local and global integration in the area. Tourists can easily understand and perceive the road space in the planned area of the "gathering anchor".

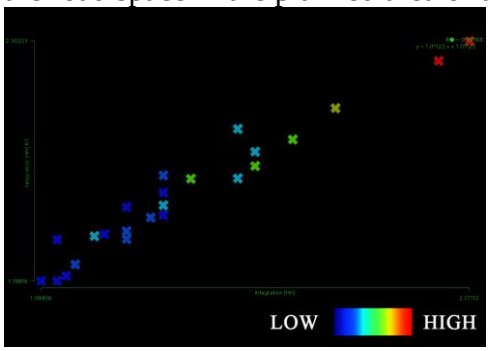

Figure 3: Analysis of Depth Values in the Planning Area of "Gathering Passenger Anchorage" (C)

3.3. Visual Perception Analysis of the Space in the Planning Area of "Gathering Passenger Anchorage"

Equal perspective connectivity analysis refers to the total number of perspective blocks that pedestrians perceive in their spatial visual perception in a static state. This value can reflect the visibility of people to the surrounding space in a static state. As shown in Table 3 and Figure 4, the average visual connection is 7403.46. The neighborhood, especially the residential areas and some street turns, have a cool color tone, with a connection of 4-6500, which is lower than the average value. Due to the dense buildings in the residential areas, pedestrians at the turning points of the street have limited visual perception in a static state, and there is less content that can be visually perceived by pedestrians, resulting in lower visibility of these spaces. At the intersection of Hebei Road and Chongqing Road, the intersection of Hebei Road and Dali Road, and the northwest side of Minyuan Square, there is a warm color visual field with a connection value of 18300-35428, far higher than the average. This is because the roads intersecting in these places are relatively straight, and the northwest side of Minyuan Square is the intersection of multiple streets with fewer building obstacles. Pedestrians can perceive more visual content in a static state, and the visibility of the space is strong. In field research, it was found that the street wall decorations within the static visual hot zone range have problems such as aging and damage, homogenization of updated content, and even detachment from the cultural history of the block.

Table 3: Analysis of Connection Values in the Planning Area of "Gathering Passenger Anchorage" from Different Perspectives

Instruction Name	Connection value
Average value	7403.46
Maximum value	4
Minimum value	35428
Standard deviation	7276.88

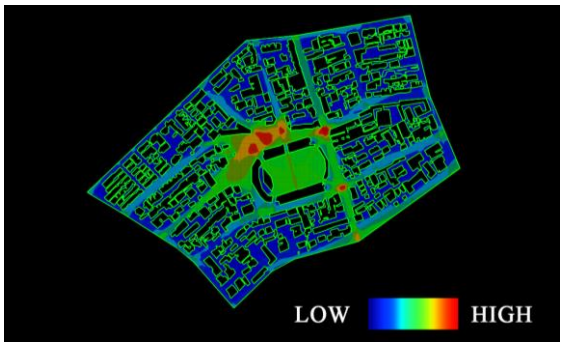

Figure 4: Analysis of the planning area of the "Gathering Anchorage" from an equal perspective

3.4. 3D perspective simulation analysis of pedestrian flow in the planning area of the "Gathering Anchor"

3D perspective pedestrian flow simulation analysis simulates the state of tourists entering the block by randomly placing simulated people at the entrance of the area, recording the movement trajectory and gathering situation of pedestrian flow. It can intuitively represent the usage level of the population in the area. By randomly placing 1000 pedestrian models at the entrances and turning points of 15 blocks in the "Gathering Anchor" planning area, we simulate the movement and gathering behavior of tourists entering the area. As shown in Figure 5, the hotspots of pedestrian flow in the streets are

distributed at the intersection of Chongqing Road West, Dali Road East and West, and Minyuan Square Northwest, indicating that these areas have strong accessibility to the streets and are prone to gathering large crowds. Through actual research, it has been found that some architectural complexes are residential areas without tourism value, while others belong to celebrity residences. Although they have tourism value, they are still in an unopened state. By appropriately screening and opening celebrity residences, tourists can enrich their perception space and content.

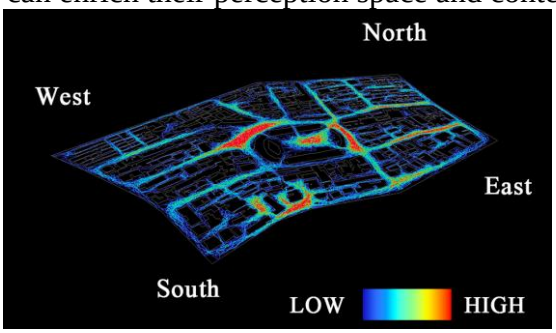

Figure 5: Simulation analysis of pedestrian flow in the planning area of "Gathering Passenger Anchorage"

4. Strategies for Enhancing Spatial Perception of the Five Avenues Historical Block

4.1. Principles for Optimizing the Space of Historical Blocks

4.1.1. Principle of sustainable development of material space environment

For the material spatial environment of historical districts, it is not easy to damage the original architectural style and block layout during development and construction. Therefore, building updates and street optimization in the planned area of the "Gathering Customer Anchorage" can be achieved through micro updates to enhance the protection of existing material spaces while preserving the "authenticity" and "integrity" of the block.

4.1.2. Principles of Cultural Sustainable Development

The improvement and optimization of historical districts should pay attention to the characteristics, historical memory, and cultural inheritance of historical districts. Based on this, it is necessary to deeply explore the cultural connotations within the block, display and interpret the historical and cultural resources within the planned area of the "Gathering Anchor", and enable the sustainable development and enhancement of historical and cultural resources in a way that is easy for tourists to perceive and remember.

4.1.3. Principles of sustainable economic and social development

Historic districts are an important part of urban economic development [13], and the optimization of historic districts requires attention to the sustainable development of commerce within them. Therefore, by relying on the cultural resources within the block and combining them with commercial formats, a commercial space with historical and cultural characteristics of the block can be created to promote the economic income of the block. On the basis of protecting the characteristics of historical and cultural blocks, activate the development vitality of historical and cultural blocks through rich commercial forms.

4.2. Strategy for optimizing the perception of cultural space in scenic areas

4.2.1. Optimization Strategy for Traffic Space Perception

The transportation space is the main space for tourists to perceive the cultural atmosphere of the historical district. The main modes of transportation within the "Gathering Anchor" planning area include walking, cycling, and cycling. The pedestrian space is an important area for tourists to perceive and experience the culture of the neighborhood. According to the analysis, optimize the traffic space by selecting streets with deeper connectivity and lower selectivity, as shown in Figure 6A. These roads and streets are relatively narrow, which can easily cause vehicle congestion during the hot tourist season, insufficient pedestrian safety for tourists, and emotional tension that affects their perception and experience of the neighborhood.

4.2.1.1. Pedestrian and vehicle diversion strategy for the block

Except for Hebei Road and Xinhua Road, which can carry a large amount of traffic and pedestrian flow in the area, other street spaces are prone to block congestion, making them more suitable for tourists to perceive and experience on foot during the tourist hot season. Therefore, based on the protection of the characteristics of the historical district, the existing traffic space will be optimized for pedestrian and vehicle separation according to the axis analysis results and the tourist flow during the peak tourist season. During the peak tourism season, all streets except for the sections of Hebei Road and Xinhua Road will be restricted to cars and bicycles, and planned as pedestrian perception areas, freeing up sufficient pedestrian perception space for tourists and local residents, reducing traffic pressure on the streets, and improving tourist safety and experience perception.

4.2.1.2. Perception optimization strategy for pedestrian space in the block

The pedestrian space within the planned area of the "Gathering Anchor" is an important perceptual space for tourists to perceive the historical and cultural characteristics of the block. We should focus on enhancing the historical and cultural perception experience of pedestrian spaces in streets. Therefore, it is possible to restore the cultural style of historical buildings and street facing walls on both sides of the street as much as possible, and combine the architectural features to decorate and visually enhance the cultural style on both sides of the street. By designing and establishing public facilities and services with cultural and historical features and experiences, the historical and cultural perception content and fun of the pedestrian perception space in the area can be strengthened.

4.2.1.3. Improvement of street connectivity among the four major scenic spots

The transportation space within the planned area of "Juke Anchorage" connects the four major attractions of "Juke Anchorage": Minyuan, Xiannong Courtyard, Qingwang Mansion, and Minyuan Xili. Minyuan and Xiannong Dayuan are connected by the main road Hebei Road, while Minyuan and Qingwang Mansion are connected by Chongqing Road. The degree of choice and integration between the two streets is relatively high in this area. Although Minyuan Xili is relatively close to Minyuan, its location is relatively remote, and the selectivity and integration of Munan Road are low, with a high depth value, making it difficult for tourists to discover. Therefore, in order to enhance tourists' overall perception and understanding of the four major scenic spots in the region, clear visual signs and series of cultural decorations should be set up at the relevant nodes of Hebei Road, Chongqing Road, and Changde Road respectively to strengthen the transportation connectivity of the four major scenic spots and tourists' memory, guiding tourists to perceive and experience them.

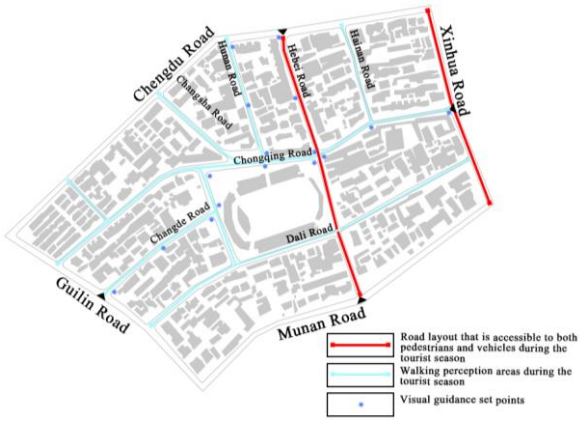

Figure 6: Optimization of Cultural Perception in the Planning Area of "Gathering Customer Anchorage" (A)

4.2.2. Strategy for optimizing the perception of cultural space in scenic areas

The perception space of the "Gathering Guests Anchorage" planning area mainly perceives landscape nodes such as Minyuan, Xiannong Courtyard, Qingwang Mansion, and Minyuan Xili, as well as various cultural buildings and celebrity residences in the block, which together constitute the cultural perception content of the area. Figure 6B optimizes the perception space based on the visual field analysis graph and the simulation graph of pedestrian flow, focusing on the spatial nodes with good visibility and those that are prone to crowd flow. By optimizing tourists' visual perception content, perception methods, and landscape space, the perception experience of tourists in the neighborhood can be enhanced.

4.2.2.1. Visual Perception Content Enhancement of Scenic Spots

Hebei Road, Minyuan Square, and their surrounding road spaces are areas where tourists have a strong visual perception and are prone to gathering crowds, making them more attractive to consumers. According to actual research, it has been found that there are still problems such as building damage, monotonous and repetitive visual decorations, and a lack of coherence between the newly added promotional content in the block and the historical atmosphere of the block. It is difficult to provide tourists with memorable and high-quality visual cultural perception content. At the same time, the visual experience content of the four major scenic spots within the planned area is relatively single, making it difficult to attract tourists to enjoy and feel the attractions for a long time. Based on this, on the one hand, it is suggested to restore cultural and historical buildings in the overall area and within the four major scenic spots by combining spaces with strong visual cultural perception, and enhancing visual content based on architectural features to strengthen the original cultural characteristics of the area. On the other hand, designers further enhance the cultural and visual perception experience content within the four major scenic spots. By exploring the historical features of the four major scenic spots and using micro renewal design methods, visual floor paving decorations and interesting micro landscape viewing content are created using historical decorations and wall shapes, providing tourists with sustainable and easily perceptible cultural content of the scenic spots.

4.2.2.2. Rich Perception Modes of Scenic Area Culture

The cultural perception content of the planned area of "Gathering Guests Anchorage" consists of street space and scenic spot space. Except for Hebei Road, Minyuan and its surrounding road spaces,

other spaces are narrow streets and alleys with relatively narrow visual visibility. These spaces have high depth values and low selectivity, and belong to the cold zone of tourists' visual perception. Therefore, in these spaces, it is easy to highlight the characteristics of the building's night view by deploying lights, playing music that fits the block to render the cultural atmosphere of the streets and alleys, and planting aromatic plants along the street to create a spatial atmosphere. At the same time, by combining dynamic installation art, flower mirror art, and humanistic environmental art, a cultural perception landscape with interactivity, fun, and humanistic care can be created. Designers create unique cultural perception content for the community by fully mobilizing tourists' visual, auditory, and olfactory senses, activating tourists' deep cultural perception of the community.

4.2.2.3. Expansion of Cultural Perception Resources in Scenic Spots

Among the four major scenic spots within the "Gathering Anchor" planning area, only Prince Qing's Mansion is a celebrity's former residence. Although other celebrity's former residence buildings account for a relatively large proportion, most of them are still in an unopened state, and there are relatively few cultural attractions that tourists can visit. Therefore, based on the dynamic and static analysis diagram and the pedestrian flow simulation diagram, it is recommended to open up Nathan's former residence to the public, as shown in Figure 6B. In the pedestrian flow simulation analysis diagram, Nathan's former residence belongs to a space that is easy to gather tourists, and in the planning area, it belongs to a space with high tourist selection, accessibility, and visibility. By excavating the historical stories within cultural residences, the cultural and historical connotations can be interpreted through modern digital means and traditional display methods to enrich the cultural perception and attraction within the planned area of the "Gathering Anchor".

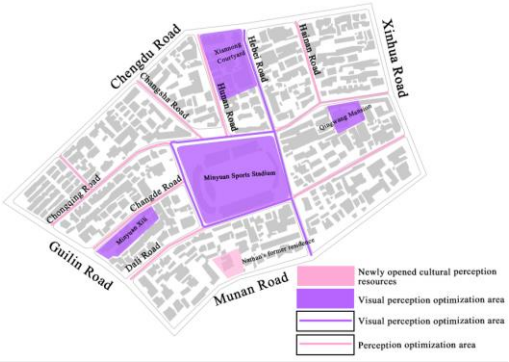

Figure 6: Optimization of Cultural Perception in the Planning Area of "Gathering Customer Anchorage" (B)

5. Conclusion

Historical and cultural blocks inherit urban memory, participate in urban economic development, and are an important component of sustainable heritage tourism. The cultural perception of historical districts affects the sustainable development of urban culture and economy. The spatial optimization and improvement of historical districts should be based on the protection of material space, the inheritance of cultural resources, and the activation of economic and cultural vitality. Based on this, combined with spatial syntax analysis, the following spatial perception enhancement strategies are proposed for tourists' tactile and visual perception: on the one hand, while maintaining the original planning of the historical district, according to the accessibility and spatial layout relationship of the transportation space, a pedestrian and vehicle diversion strategy is adopted for the street during the tourist hot season; Maintain and enhance the architectural landscape on both sides of the street, increase public cultural facilities, and enhance spatial cultural perception; Set up visual signs and

cultural decorations in the transportation space between the four major landscapes to enhance their traffic connectivity. On the other hand, based on the static spatial visibility and utilization of tourists, micro landscape design methods are used to create micro landscapes, with a focus on enhancing the visual cultural content of landscape spaces; By combining lighting, music, aromatic flowers, dynamic installation art, flower mirror art, and humanistic environment art, fully mobilize tourists' cultural perception methods; Open the former residence of Nathan to tourists to enrich the cultural experience within the planned area and achieve sustainable cultural development of the historic district.

In summary, the enhancement of cultural perception in historical and cultural districts requires a balance between sustainable development and spatial layout. Studying tourists' perception of spatial perception in historical and cultural districts is of great significance for the sustainable development of historical districts and cities. Using spatial syntax to design and study the spatial layout of historical and cultural blocks will be beneficial for enhancing tourists' perception and experience of historical block culture, and promoting the sustainable development of historical block economy and culture.

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References

[1] Lih Rong Chiou. The Representation of Taiwan's Aboriginal Architectural Heritage Visual and Non visual Presentation in Cultural Villages [J]. Journal of Geography, 2010 (60): 103-131

[2] Li Xue, Hong Zaisheng. Research on the effect of Tianjin Minyuan renovation based on crowd recreational behavior [C]// 2017 China Urban Planning Annual Conference. [2400-06-01]

[3] Edited by Duan Jin: "Spatial Syntax and Urban Planning", Nanjing: Southeast University Press, 2007, pages 38-46

[4] Bill Hillier, Space is the Machine: A Configurational Theory of Architecture, Art, 1996.

[5] Turner, Alasdair , A. Penn , and B. Hillier , "An Algorithmic Definition of the Axial Map", Environment & Planning B Planning & Design, 2005, vol.32.3, pp.425-444.

[6] Rahman, Jannahtul Izzati , H. N. Ismail , and L. W. Chau , "Inquiry into tourists' movement flow pattern in the Melaka world heritage site: a space syntactic analysis." APSA Congress, Universiti Teknologi Malaysia: Johor, Malaysia, 2011.

[7] Turner, Alasdair, Doxa, and Maria, "From isovists to visibility graphs: a methodology for the analysis of architectural space", Environment & Planning B: Planning & Design, 2001, vol.28.1, pp.103.

[8] Shokouhi, Mahshid, "Legible cities: The role of visual clues and pathway configuration in legibility of", In Proceedings of the 4th International Space Syntax Symposium, 2013, pp.17-19.

[9] Tao, Yang, "Digital City And Space Syntax:A Digital Planning Approach", Planners, 2012, pp.24-29.

[10] Lynch, K, Cambridge Painting, The Image of the City, 1960.

[11] He Xiaxuan, Mo Xianfa, Pan Yining, etc. Analysis of Dong Ethnic Traditional Residential Buildings and Regional Culture Based on Spatial Syntax [J]. Industrial Building, 2023, 53 (03): 105-114. DOI: 10.13204/j.gyjzg22082104

[12] Cha Kaili, Peng Mingjun, Liu Yanfang, etc. The spatiotemporal evolution and correlation analysis of road network accessibility and economic connections in the Wuhan urban agglomeration. Economic Geography, 2017, 37 (12): 74-81+210. DOI: 0.15957/j.cnki.jjdl.2017.12.010

[13] Zhao Ziyou, Li Zheng. Various forms of street life: research on the construction of healing places in historical districts in urban renewal [J]. Art and Design Research, 2024 (01): 88-93+121.