Application of Space Syntax in Landscape Design

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Abstract: The space syntax proposed by Bill Hillier has attracted widespread attention in the academic community since it entered China in 2005, with its unique spatial description theory and methodology, which is comprehensive, rigorous, precise and scientific.This design approach not changes the way we look at urban space, but also redefines the approach to urban design. 'Configuration' in space syntax provide us with a new perspective on urban design.By quantitatively describing and comparing space, then adding the influencing factors of human activities and studying the interactions between space and human activities, the core concept of space syntax 'Configuration' is proposed, which confirmed that the complex relationship between spatial elements is the key factor for the development of economic activities. Based on the above research, space syntax puts forward a series of theoretical methods and frameworks for space analysis, which provides an important theoretical basis for urban design. With the progress of time and the development of science and technology, space syntax has received more technical support, such as big data and new technologies, which has gradually improved the analysis methods of space syntax. At present, the application and exploration of space syntax is mainly concentrated in architecture, urban planning and traffic design, while the application of the syntax of space in the field of landscape design is still on a relatively small scale. As a part of the urban fabric, landscape design has the necessity to explore its new methods with space syntax. The goal of this article is to explore the new ideas of landscape design by exploring the application of space syntax in the design phase, programme decision-making phase and the renewal phase. By deeply exploring the theory and method of space syntax, it can provide new perspectives and design tools for landscape design, and improve the quality of urban design and the quality of people's life.

1. Introduction

The concept of space syntax was first introduced in the early 1970s by Bill Hillier and his colleagues at the Bartlett School of Architecture, University College London.The content focuses on describing and investigating the relationships between space and society through mathematical means. In contrast to other techniques for the analysis of space, it combines tangible factors(movement and land use)with intangible factors(cognition and behavior),which provides a methodological basis for the study of the relationship between the built environment and space and society; provides theoretical concepts and explanations of how society is formed in space, and provides analytical methods and tools for social-space analysis through mathematics[1].In a broader sense, space syntax is a new language for describing spatial patterns in architecture and urban space, through the study of environment and behavior, space syntax has newer perspectives and higher horizons in describing behaviors and in dealing with the relationship of social, psychological, cultural, and space relations, and space in 'space syntax' is not only space defined by Euclidean geometry, but also topology and diversification .

Space syntax because of its effective spatial quantification theory and method has received widespread attention from the academic research community. At present, the application of space syntax is mainly concentrated in architecture, planning, and transportation majors. By applying GIS, depth map X software, space syntax can assist in designing buildings, planning, transportation and other design with the help of big data, virtual reality and other technologies. The main application content of the space syntax covers the integration, field of vision, axis, composition relationship,

traffic and other aspects, while the exploration in the application of landscape design is not heard much. Based on the theory and examples in the academic seminar on space syntax, this article publishes some views on the application of space syntax in landscape design, and explores the ideas and methods of space syntax in landscape design.

2. Application of space syntax in landscape design

During the construction process of urban systems, landscape design, as part of urban system, has a very important impact on improving the urban environment and promoting economic development. In order to better improve socioeconomic effects, it is necessary to start landscape design with the city's overall planning and architectural design together. Therefore, it is very necessary to explore the application of space syntax in landscape design. Using space syntax, we can start from the traffic flow, integration degree, axis, and line of sight in landscape design,thinking with the three stages of plan design, plan decision -making, and completion project update.

2.1. Programme design stage

"From data to knowledge, from knowledge to design creation", in the programme design stage through the use of space syntax to process and analyse existing data, designers can better understand the characteristics of the site and potential problems, so as to target the design. Space syntax can also help designers to assess the feasibility and perfection of the design scheme, and improve the feasibility of design ideas.

In the programme design stage, we applied depth map X software to analyse the traffic flow and functional layout of the design in various aspects, such as depth, connectivity, axis, visibility, etc. These analyses help us to better understand the way in which the space is used and the activity pattern of the people, as well as the interactions with the surrounding environment, etc. Through the above analysis, the basic scheme is examined multi -angle. Combined with the analysis results, the site content can be further optimized and adjusted, such as spatial structure, road path and spatial integration adjustment, and so on.

Through the analysis of road paths of multi -angle calculation methods, we not only ensure the rationality and diversity of path selection, provide more possibilities for the design of the venue, but also ensure the diversification of the venue division.Through the adjustment of spatial conformity and visibility analysis, it can guide the adjustment of landscape structure to create a highly noticeable, safe and experience-rich landscape space, and make landscape design from a more humane perspective to meet psychological and physiological needs and avoid hazardous situations where the environment, space and society are not sufficiently integrated .At the same time, through the space syntax, we focus on the relationship between the project site and the city's overall planning, neighbouring buildings and people, giving full play to spatial autonomy to ensure that smaller scale spaces are interspersed in the city's large grid, but still able to maintain consistency in the overall urban design.

Through the space syntax analysis in the programme design stage, it provides more calculation methods for the reasonable division of space and scientific design, so that the design is not only limited to form, order and beauty, but also a carrier that can be better combined with social activities .

In summary, through the space syntax analysis, we can better understand the way of space use and people's activity behaviour, so as to adjust the design scheme and improve the accessibility of the site, the rationality of the path selection and the safety of space use. At the same time, we can also better integrate the design with social activities to make the design more practical, efficient and in line with people's needs.

2.2. Decision-making stage of the programme

Through the use of space syntax to analyse and compare multiple design options, the advantages, disadvantages and characteristics of each option can be assessed more objectively, providing a

scientific basis for decision-makers to choose the option and evaluate the effect of each plan.At the same time, space syntax can also help decision-makers to take a comprehensive view of urban master planning, architectural design and other aspects to ensure the continuity and coherence of the city.

Before we proceed to the description of the example, we introduce a core concept of space syntax - configuration. Configuration is the cornerstone of Space Syntax theory, and Hillier defines it as a set of relations, any one of which depends on all the other relations associated with it. Various "Space Syntax" techniques are examples of " configuration analysis". In 'Space is the Machine', Hillier presents a case for design with a focus on configuration. In his study of cities as complex systems evolving through dynamical mechanisms, he believes that design is a composition process, and local changes will cause the overall change[2].Configuration can be simply understood as deconstructionism. In the programme decision-making stage, we need to evaluate the advantages and disadvantages of each plan in a quantitative and comparative manner in order to select the optimal design. For example, if we add demand factors, engineering factors, development factors, cost factors, environmental factors and other parameters to the evaluation of the project in equal quantities, we can evaluate each plan more objectively.This also illustrates the important impact of the rationality, equivalent and homogeneity of assignment on the evaluation of the scheme[3].

Taking axis and spatial relationship as an example, different axis design will have a certain impact on the vitality of the surrounding serviceable population and the business format of the merchants. A reasonable structural relationship can promote the development of the region. Since the scale of landscape design is generally small, we can analyse the integration of small-scale urban landscape design through the line segment model, and evaluate the better design scheme by adding other important urban design elements such as traffic, humanities, nature, etc., and combining them with the overall spatial structure of the city.

Through quantitative comparison, we can more intuitively and objectively assess the advantages and disadvantages of each design plan, and this method can enhance the contribution of landscape design to user experience, environmental creation and the social economy.It can also help us to better understand how space is used and people's activity behaviour, providing more inspiration and reference for future landscape design.

2.3. Renewal phase of completed projects

In the renewal phase of completed projects, space syntax is a powerful analysis method that is used to collect and analyze the extensive and in -depth data of the built projects, it can identify the deficiencies of the projects that need to be improved. Through space syntax, we can understand and interpret the relationship and laws of space, further clarify the focus and direction of the renewal, and provide direction guidance and design basis for the rectification of the project, it also can provide scientific analysis methods and technical support for the project. Nowadays, many colleges and universities have applied space syntax in urban building facade renovation, cultural heritage protection, public facilities siting, park views, etc., which is a reference for the subsequent urban design work[4].

The space syntax in the renewal phase of the built project combines big data information collection technology in the process of status quo analysis, such as the use of Internet LBS data user composition and use of demand data, street view image data and target detection technology, perception measurement technology, etc. The use of these data can improve the efficiency of data collection, reveal the focus of renewal and reconstruction, and then carry out accurate landscape renewal design, so that the design and the urban construction can better intertwined.

3. Conclusion

The above three reflections are my understanding and thoughts on the application of space syntax in landscape design. Since the 21st century, with the development of science and technology, the speed of data collection has been greatly accelerated, and the information has increased in index levels, which has provided a solid practical foundation for the research and the application of space

syntax. In the current background of the times, multidisciplinary intermingling, big data and technology combined with the design system has begun to see the scale, space syntax as the carrier of spatial design will certainly become an important means in the future urban design field, and data mining and analyzing data methods, processes, algorithms, etc., the scientific nature of the design is also a very important position[5]. Space Syntax reveals a new chapter in urban design. Landscape design, as part of urban design, keep up with the footsteps of the times, and use a wider design perspective to explore the relationship between urban landscape design and urban design, and through more scientific spatial configurations, it has a positive impact on the social economy, social patterns and urban development. In the torrent of the times, we need more active learning and thinking   to cope with the arrival of the new design era and prepare for the innovation of design technology.

At the advent of the intelligent era, the social economy, the level of scientific and technological development, the industrial structure and the labor structure will also affect the adjustment and change of disciplines. While high education enjoying these intelligent results brought by technological progress, it is also facing the new challenges. As the cradle of talents in colleges and universities, at the moment when the new design idea of space syntax is ushered in, we should work as pioneers to learn the new design ideas and contribute to cultivating talents in the intelligent era. The combination of teaching and space syntax, transforming knowledge into practice, and feed the theory on the basis of practice, will promote the construction of higher education disciplines that adapt to the development of the intelligent era.

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