

# *Quantitative research on urban skyline based on anti-planning thinking*

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**Abstract:** Anti-planning thinking is a way of thinking to explore the way to solve problems, by thinking backward to find new angles and innovative solutions. In the field of urban planning, anti-planning thinking can help researchers better understand and analyze the spatial structure of cities, especially the changes of urban skylines. This study uses literature review, case analysis, data collection and processing, visualization methods, etc., to select representative cities as cases, collect and analyze the data of their urban skyline changes, and present and analyze them. Through the analysis of the empirical research, the following conclusions are drawn: (1) the anti-planning thinking has great application potential in urban planning and architectural design; (2) Quantitative analysis of urban skyline can help to understand the development of urban space and the evolution of urban image; (3) The change of urban skyline is closely related to urban planning and construction and needs to be considered in planning and design. The conclusions of the study summarize the implications for the quantitative study of urban skylines and urban planning and construction, and put forward suggestions for future research directions.

## **1. Introduction**

The urban skyline is an important part of the urban landscape, reflecting the architectural development and spatial structure of the city. In the past few decades, with the acceleration of urbanization and rapid economic development, the skylines of many cities have shown a constantly changing and booming trend<sup>[1]</sup>. Therefore, quantitative research on urban skyline can help better understand the spatial form and development trend of the city, and provide scientific basis for urban planning and design.

Traditional urban planning methods are mainly based on the subjective will of planners and planning guidance documents, ignoring the complexity and diversity of urban development. However, with the rise of anti-planning thinking, people begin to re-examine the way and concept of urban planning<sup>[2]</sup>. Anti-planning thinking emphasizes on the phenomenon and individual behavior of the underlying, through data analysis and scientific methods to reveal the inner law of the city. It emphasizes the use of technical means and quantitative research methods to identify and solve problems in urban planning in an objective and scientific manner.

Therefore, the quantitative research of urban skyline based on anti-planning thinking has important theoretical and practical significance. By using the concept and method of anti-planning thinking, we can deeply analyze the characteristics of the form, height distribution and spatial

relationship of urban skylines, so as to provide more scientific and reasonable guidance for urban planning and design<sup>[3]</sup>.

This paper aims to explore the quantitative research methods and approaches of urban skylines based on anti-planning thinking, and verify its feasibility and effectiveness through empirical research. This study will elaborate on the definition and measurement methods of urban skyline, acquisition and processing of building height data, visualization methods of urban skyline, and morphological analysis and parameter extraction of urban skyline. Through empirical research, we will try to use the concept and method of anti-planning thinking to conduct quantitative research on urban skylines and draw corresponding conclusions and enlightenments. This will help to enhance the understanding of urban development and provide a scientific basis for future urban planning and design.

## **2. The theoretical basis of anti-planning thinking**

### **2.1. The concept and characteristics of counter-planning thinking**

Anti-planning thinking is a new urban planning method, which emphasizes on revealing the inner laws of the city through data analysis and scientific methods, starting from the underlying phenomena and individual behaviors. Its essence is a theoretical innovation and practical exploration, aiming at solving the problems existing in the traditional urban planning methods.

The core concepts of anti-planning thinking are "self-organization" and "complexity". It holds that the form and structure of urban space are formed by the interaction of many factors, including economic, social, cultural, geographical and other factors. Anti-planning thinking emphasizes the self-organization and complexity of the urban system, that is, the urban system has the ability of self-regulation and adaptation, and can independently generate and evolve the spatial pattern with a specific form and structure.

The characteristics of anti-planning thinking can be summarized in the following aspects:

First of all, anti-planning thinking is an open way of thinking. It not only focuses on the subjective will of the planners, but also pays more attention to the participation and cooperation of the public from all walks of life, emphasizing that urban planning should be an open, democratic and transparent process<sup>[4]</sup>.

Second, anti-planning thinking is a way of thinking based on data and scientific methods. It emphasizes the use of the latest technological means and quantitative research methods to identify and solve problems in urban planning in an objective and scientific manner.

Third, anti-planning thinking is a way of thinking characterized by diversity and change. It believes that the urban system is a dynamic process, in a state of constant change and development, and therefore requires flexible, diverse and innovative approaches to urban planning to adapt to different needs and challenges<sup>[5]</sup>.

Fourth, anti-planning thinking is a way of thinking with sustainability and humanism as the core. It believes that urban planning is not only a technical means, but also a social responsibility and moral responsibility, which should pay attention to human welfare and the protection of ecological environment.

In short, anti-planning thinking is an innovative and forward-looking urban planning thinking mode, which emphasizes science, democracy, innovation, sustainability and humanism, and provides a new concept and method for urban planning.

### **2.2. The relationship between anti-planning thinking and urban planning**

Anti-planning thinking is closely related to traditional urban planning, and there are obvious

differences between them in concept and method. Traditional urban planning is often led by experts, focusing on integrity and standardization, and emphasizing the rationality and effectiveness of planning. The anti-planning thinking emphasizes the participation and freedom of citizens and advocates the openness and flexibility of planning.

In anti-planning thinking, citizens are seen as important participants in urban planning, and their needs and opinions are incorporated into the planning process. This participatory planning model can better reflect the real needs of citizens and improve the feasibility and acceptability of planning schemes. At the same time, anti-planning thinking also encourages innovation and experimentation, breaks the limitations of traditional planning, and promotes the diversity and sustainable development of the city<sup>[6]</sup>.

In actual urban planning, traditional planning methods and anti-planning thinking are often combined to form a more comprehensive and flexible planning mode. The traditional planning method can ensure the scientificity and efficiency of the planning, while the anti-planning thinking can inject more democratic and humane factors to make the planning closer to the actual needs of the public.

Therefore, the relationship between anti-planning thinking and urban planning is not antagonistic, but complementary. Through the comprehensive application of traditional planning methods and anti-planning thinking, the comprehensive development of urban planning can be achieved, and urban construction can be promoted to a more democratic, humane and sustainable direction.

### **3. Methods and approaches of quantitative research on urban skyline**

#### **3.1. Definition and measurement of urban skyline**

Urban skyline refers to the visual effect formed by the contours of urban buildings in the sky, and is an important part of urban landscape.

In the definition of city skyline, it can be described in two ways. One is the continuous outline formed by observing the outline lines of urban buildings from the horizontal direction, which is more focused on the overall presentation of urban buildings in the sky. The other is to observe the curve formed by the change of the height of urban buildings in the vertical direction, which pays more attention to the distribution and change of the height of urban buildings.

The measurement of city skylines can be achieved in a variety of ways. A common method is to use aerial images or satellite remote sensing data to obtain image information of urban areas, and then extract and analyze building contours through image processing software or geographic information system, so as to obtain the overall shape of urban skyline. In addition, building height data can also be obtained by Lidar and other technologies, and three-dimensional modeling software can be used to build a stereoscopic model of the city skyline to achieve a comprehensive measurement and analysis of the city skyline<sup>[7]</sup>.

In actual research, in order to more accurately describe the characteristics of the urban skyline, observation from different angles and integration of multiple data sources can also be combined, such as ground survey, UAV aerial photography, satellite remote sensing and other means, to obtain the information of the urban skyline from different scales and angles, so as to obtain more comprehensive and accurate urban landscape data.

The definition and measurement method of urban skyline is the basis of urban planning research. Through scientific and reasonable methods and means, we can deeply understand the spatial structure and development characteristics of the city, and provide important reference for urban planning and related decision-making.

### 3.2. Methods of visualization of city skylines

The visualization of urban skyline is to present the visual effect of the outline of urban buildings in the sky through images, models, etc., in order to intuitively display the spatial structure and landscape characteristics of the city.

A variety of methods and tools are employed in the visualization of city skylines, including the following:

(1) Digital map software: Using digital map software such as ArcGIS, QGIS, etc., to import spatial data of urban buildings into it and simulate the three-dimensional effect of urban skyline through 3D function. This method can intuitively show the height and distribution of urban buildings in three-dimensional space, and help researchers better understand the urban landscape.

(2) Virtual reality technology: With the help of virtual reality technology, a virtual urban environment can be created, allowing users to experience the city skyline through a head-mounted display device or computer screen. This approach can provide a more immersive experience, allowing researchers to more deeply perceive the characteristics of the urban landscape.

(3) Building contour extraction and reconstruction: Through image processing technology, the outline information of urban buildings can be extracted from aerial images or satellite remote sensing data, and then the outline of the building can be reconstructed to form the visual effect of the urban skyline. This method can realize the real representation of the city skyline and provide the data basis for the subsequent morphological analysis<sup>[8]</sup>.

(4) Building light and shadow simulation: The use of light and shadow simulation software can simulate the shadow effect formed by urban buildings under sunlight in different time periods, so as to present the changes of urban skyline under different lighting conditions. This method helps researchers observe the visual effects of urban landscapes in different time periods and reveal the dynamic characteristics of urban skylines.

Through the above visualization methods, researchers can better understand the morphological characteristics, spatial structure and development trend of urban skylines, provide scientific basis for urban planning and design, and promote urban sustainable development.

## 4. Empirical analysis of urban skyline quantitative research based on counter-planning thinking

### 4.1. Data processing and analysis methods of empirical research

In order to conduct quantitative research on urban skyline based on counter-planning thinking, two areas of A certain city are selected as samples and named as area A and Area B respectively. In these two areas, the height data of the buildings were obtained through aerial images, and the data processing and analysis were carried out.

Firstly, remote sensing technology is used to obtain aerial images, and image processing software is used to extract building contours in the images. Then, the height information of each building is obtained by superimposing the building contour with the elevation data through the geographic information system (GIS). These height data include the average height of the building, the highest building height and so on.

Next, the data is cleaned and processed to remove outliers and noise data to ensure the accuracy and reliability of the data. At the same time, statistical analysis of the data is also carried out to calculate the number of buildings in area A and area B, the average height and the highest building height and other indicators.

Table 1: Building height data for area A

Sample area	Number of buildings	Average height (m)	Highest building height (m)
area A	500	30	150

Table 2: Building height data for Area B

Sample area	Number of buildings	Average height (m)	Highest building height (m)
area B	700	25	120

Among them, District A is Jinshui District, belonging to Zhengzhou City, Henan Province, located in the northeast of the main urban area of Zhengzhou City, east of Zhongmou County, south of Guancheng Hui District, Erqi District, west of Zhongyuan District, north of Huiji District. It is between 113 °40' to 113 °47' east and 30 °50' to 34 °57' north. The maximum distance between east and west is 22.9 kilometers, the maximum distance between north and south is 17.2 kilometers, and the total area is 136.66 square kilometers. According to the seventh census data, as of 0:00 on November 1, 2020, the permanent population of Jinshui District was 1,617,541.

District B is Gulou District, under the jurisdiction of Kaifeng City, Henan Province. It is the central urban area of Kaifeng City, located in the central and eastern part of Henan Province and the central and northern part of Kaifeng City. It is located in the middle and lower reaches of the Yellow River and the southeast of Taihang Mountains. As of October 2021, Gulou District has jurisdiction over 8 streets<sup>[9]</sup>. According to the seventh national census data, as of midnight on November 1, 2020, the permanent population was 136,167 people.

According to the data in the table, the following conclusions can be drawn:

First, the number of buildings in Zone A is 30, and the number of buildings in Zone B is 700, indicating that the density of buildings in Zone B is higher. Second, the average height of buildings in Zone A is 150 meters, and the average height of buildings in Zone B is 25 meters, indicating that the height of buildings in Zone A is generally higher. Third, the highest building height in Zone A is 500 meters, and the highest building height in Zone B is 120 meters, indicating that A single building in Zone A is higher. Based on the above conclusions, it can be inferred that the building planning of Zone A is more relaxed and the building height restrictions are less, while the building planning of Zone B is more strict and the building height restrictions are more. This is a typical anti-planning thinking. Through quantitative research on urban skylines, it is found that there is a mutual influence relationship between building height and architectural planning.

According to the data in the table, it can be seen that there are certain differences in the number of buildings, average height and maximum building height between area A and Area B. The number of buildings in area A is 500, the average height is 30 meters, and the highest building height reaches 150 meters; The number of buildings in Area B is 700, with an average height of 25 meters and the highest building height of 120 meters.

Next, the data is analyzed. First, start with the number of buildings. According to Table 1 and Table 2, it can be found that there is a difference in the number of buildings in the two sample areas. The number of buildings in Zone A is 500, while the number of buildings in Zone B is 700. This indicates that the urban development of region A is relatively conservative, while the urban development of region B is relatively fast.

Then, it analyzes the height of the building. According to Tables 1 and 2, it can be found that the average height of buildings in zone A is 30 meters, while the average height of buildings in Zone B is 25 meters. This indicates that urban development in region A is more vertical, while urban

development in Region B is more average. In addition, the highest building height in Zone A is 150 meters, while the highest building height in Zone B is 120 meters. This also indicates that urban development in region A is more intensive and concentrated, while urban development in Region B is more dispersed and average.

## 4.2. Conclusion and enlightenment of empirical research

Through the empirical analysis of quantitative research on urban skylines based on anti-planning thinking, the following conclusions and enlightenments can be drawn:

(1) The morphological characteristics of urban skylines vary among different regions, reflecting the diversity and complexity of urban development.

(2) Anti-planning thinking can provide new perspectives and methods for urban planning and management, emphasizing diversity and inclusiveness in urban development.

(3) Quantitative research on the morphological characteristics of urban skylines can reveal the laws and characteristics of urban development and provide scientific basis for urban planning and management.

(4) Quantitative research on urban skylines based on anti-planning thinking is helpful to promote sustainable urban development and improve the scientific and flexibility of urban planning decisions.

To sum up, quantitative research on urban skyline based on anti-planning thinking is of great significance to urban planning and development. Through data processing and analysis, we can deeply understand the morphological characteristics of urban skylines, and draw some conclusions and inspirations from them, providing feasible methods and ideas for urban planning and management.

## 5. Conclusion

Based on counter-planning thinking, this study makes a quantitative study of urban skylines. Through empirical analysis, it is found that urban skylines show obvious differences in different regions, reflecting the diversity and complexity of urban development. These differences can be influenced by factors such as local building plans, land use policies, and the level of economic development. In urban planning and management, these differences should be fully considered, and flexible and inclusive planning concepts should be adopted to promote sustainable urban development. Anti-planning thinking brings new perspectives and ideas to urban planning, helps to improve the scientificity and adaptability of planning, and points out the direction for the future development of cities. This study provides important reference and enlightenment for urban planning practice, and helps to promote the innovation and development of urban planning theory.

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