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Quantification Is Not Enough: The Analysis of The Complexity and Uncertainty of Urban Form Evolution

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Abstract

M.R.G.Conzen has implied that quantification, as a purely methodological approach, is not a methodology. It means quantitative approaches can be used as auxiliary means to study urban morphology, but it is not decisive. Thus, integrated method is more comprehensive and effective to analysis the complex influential factors of urban form. Therefore, the purpose of this paper is to prove this idea above through analyzing the complexity and uncertainty of urban form evolution, used by real examples of the burgage cycle. The evidences for choosing this outline are, firstly, the burgage cycle that M.R.G.Conzen proposed has demonstrated the complexity of the urban form evolution, and it still be used to research today. Second, these realistic cases can proved clearly that the determination and the value of the "climax" in the cycle is far from being decided and measured by purely quantitative methods, because many uncertain internal and external factors are able to influence it.

Keyword: *urban form, quantification, the burgage cycle, complexity, uncertainty*

Background

A Brief Review: Quantitative studies of urban morphology

Urban morphology can be utilized as a tool to understand the existing settlement via decomposing the city components (Oliveira,2015). Researchers have mentioned "it should be acknowledged that quantification, in terms of measurement, has been central to 'traditional' morphological approaches" (J.Sheppard 1974; TR.Slater 1981;A.Siksna,1997; P.J.Larkham,2019). With the development and maturity of technology, computer-aided quantitative analysis has become the main tool for macro and micro urban morphology research (Tao L,2014; Ye Y.et al.,2014; Irem E.et al.,2017; Tan W et al.,2021)， and the "New Urban Morphology"[1] is also explored by scholars continually (P.J.Larkham, 2019) and some of them argue that urban form can be measurable, including the analysis of the components of form and the space-time relationships (Alessandro A.et al.,2017).

For specific methods, the main quantitative categories of configurational analysis or geoprocessing and spatial analysis (Irem E.et al.,2017) that used by scholars, currently, are Fractals, Cellular automata

(H.Couclelis, 1997), urban spatial network, the degrees of wholeness and multi-scalar clustering (Luca D.et al.,2019). The relevant methods to use needs to be distinguished by research elements (Yu Y et al.,2014). The Space Syntax (Hillier,1996), Spacematrix and MXI, use GIS and GPS as aids (Gil et al.,2012; Jiang et al.,2000; Marcus 2010; Pinho and Oliveira,2009), are the most popular methods often selected by scholars when conducting studies of single element (Irem E.et al.,2017; P.J.Larkham, 2019). And some scholars have also developed systematic quantitative methods to try to identify the links between urban form and society (Ye Y.et al.,2014; V.Oliveira, 2012; V. Oliveira et al., 2016; A.Venerandi et al.,2014,2017).

Critically, rethinking about the influence of "quantitative revolution" since 1970s [2], it is necessary for us to realize that the townscape analysis must go beyond “quantifying and describing" today. Researchers aware that, due to the complexity and uncertainty of townscapes, using quantitative methods purely cannot draw a complete picture of building environment. Thus, combining quantitative with other methodologies in urban morphology would be a more robust and comprehensive way to understanding the evolution of urban landscape (P.J.Larkham, 2019).

Quantification is not enough ：Based on the historical-geographical perspective

The origin of urban morphology can be traced back to the German geography at the late 19th and the early 20th century when Otto Schlütter, Fritz, Ratzel and others laid the foundation for the study of European townscapes (J.W.R.Whitehand,2009; Irem E.et al.,2017). After the WW2, urban morphology started to develop in Britain, Italy, France and other European Countries, with the formation of Conzenian school, Typolocical school and Versailles school and so on (J.W.R.Whitehand,2009; K.Kropf,1993; P.J.Larkham,2019; I.Samuel,2005).

As the geographical origin (I. Samuels,2005), the complexity and uncertainty of urban form evolution has become a common sense and a long-term subject. Complexity is the main cause of the elements of urban form, also as the result of factors’ mixture, social impacts, morphological phases and its contiguity. There is one issue of concern: If pure quantitative analysis will be constrained by the limited information that data provided? Because it’s difficult to take all possibilities into account and judge what happened in townscape actually.

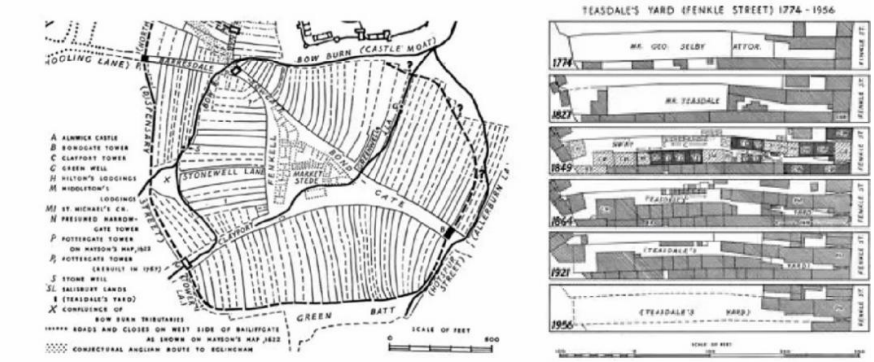
Conzen (2014) has implied that quantification, as a purely methodological approach, is not a methodology [3]. That means quantitative approach can be used as an auxiliary means to the study of urban morphology and is not decisive. Due to the conservative use of quantitative tools, the town-plan analysis approach and thoughts, founded by M.R.G.Conzen (1960), based on the historical-geographical perspective, use the method of Morphogenesis to take evolution periods, social background, physical elements and its complexes into account. This approach which has spread to many countries can evaluate the complexity and uncertainty of urban form more accurately and prove that the study of urban form evolution cannot rely on quantitative

purely. This idea can be shown by using a simple case, the Burgage Cycle, proposed by Conzen in the case study of the Alnwick (M.R.G.Conzen, 1960).

Introduction

About the burgage cycle definition

Illustrated by Figure 1， Burgage Cycle is one of the most important ideas developed by M.R.G.Conzen in the town plan analysis of Alnwicks in 1960 (M.R.G.Conzem,1960;J.R.Whitehand,2001;Bernard G., 2004; M.P.Conzen,2018). It reveals a general pattern of urban form evolution at the micro-plot scale.



a The old town (kernel) of Alnwick (M.R.G.Conzen, 1960)

b The evolution of Teasdale's Yard (M.R.G.Conzen, 1960)

Figure 1. The presentation of the burgage cycle in the case study of the Alnwicks (M.R.G.Conzen, 1960)

Figure 1. *The presentation of the burgage cycle in the case study of the Alnwicks(M.R.G.Conzen,1960)*

A whole cycle include 5 phases (see Figure 2), it expresses a whole progressive plot evolution with buildings from filling-in to clearing-off(J.W.R.Whitehand, 2001) . During the process of building filling, especially in the repletion and the recession, there are physical phenomena of adaptation and replacement， which co-explain the complexity of urban form.

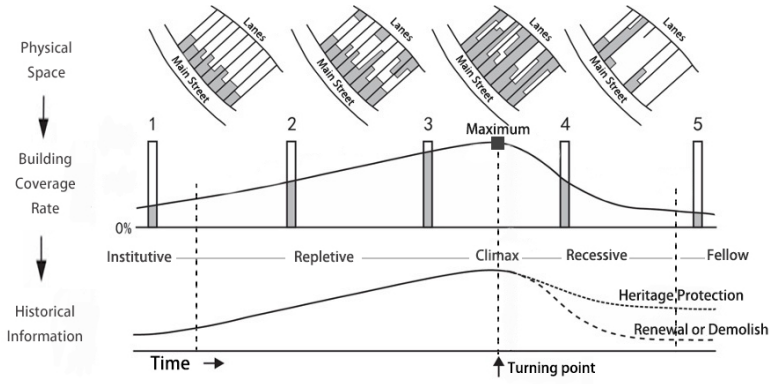


Figure 2. Informations presented by burgage cycle in different dimensions

Figure 2. *Information presented by burgage cycle in different dimensions*

In the Burgage Cycle model (Figure 2), the climax phase represents the moment when the building coverage rate is as its maximum, or something may turn for a change. It might be so interesting to argue for the determination of the “Climax”. Usually, there is a tendency to conclude that the burgage (or plot) would start recessive when it building density have reached a specific number, and the confirmation of the Climax seems to be decided by a value. This is a common idea when scholars use data and other mathematic tools to study the the morphological elements and its evolutionary process in a specific period.

The Relevance in Chinese Context

In reality, this is not the case. After the economic reform and opening up, China's policy system, economic model, society have all undergone a transformation. It would be noticed that, within the development of China’s cities, the urban form evolution usually carries, to a greater extent, a shift in value judgement. Today, accretion means “increment” and rigid demand, and replacement sometimes implies“inventory”, which refer to the adaptive change excited by internal and external forces. This requires taking the humanity’s “demand” intervention and the “necessity” intervention (social development and policy change) into account, and these interventions seem to be unmeasurable with quantitative methods only. Thus, the conclusion of the complexity and uncertainty of townscape evolution cannot judge by purely quantitative approaches, can be explained.

The combination of the above factors may interference the cycle and the determination of the Climax, reflected in the material space, the complex and diverse Chinese townscape is the result.

Illustrated by the examples of Burgage Cycle

The process of entering the recessive phase from the Climax in the cycle is precisely an important turning point for judging urban heritage values. The intervention of heritage protection identity is also one of the factors affecting the burgage cycle.

In this regard, we may take several real cases into account to analysis the burgage cycle’s changes after the building density has reached the Climax. Although such examples cannot appropriate with the definition of plots by Conzen (Dai.Y.et al.,2016). Although it is difficult to totally match to Conzen's definition of plots and boundaries (Dai Ying et al., 2016), in the view of the fact that China faced currently, the early stage of the socialist system and the land policies implemented, the corresponding management of construction is still a unity. Therefore, it is still applicable to analyze the complexity and uncertainty of the urban form evolution with the burgage cycle. From the perspective of historic townscape evolution and heritage protection, three examples are sufficient to prove this.

The rectification of a restaurant in Beijing Fangjia Hutong

Beijing's Hutong is a typical neighborhood with historical and cultural characteristics. In recent years, the incompatible buildings and illegal construction behaviors (e.g., si da luan jian, qin jie and po qiang kai dian) has increased. In order to restore the historic urban landscape of the old town, the government has started the effective “rectification action”. Take Fangjia Hutong as an example (Figure 3), there were serious illegal and private construction behaviors before the government action. When the rectification has been done in 2017, all of the incompatible phenomena have been solved and the valuable historic buildings have been saved in a long-term. See Figure 4, the top left picture is a restaurant that before the rectification. Its owner had added a modern style building which looks like a container, to the original old one. It seemed so incongruous and has a strong contrast on the overall appearance. The top right one shows the newly built part has been demolished and all dining activities were returned to the old building. In this case, the start of the rectification marked the beginning of the Climax phase of this restaurant and its located plot, and it was a "sudden" factor in the cycle. Correspondingly, although the building coverage rate has changed from αto βduring this process, the related Time Point “n” (the turning point) and the number of building coverage rate of the plot at that time is "indeterminable", i.e., it is not possible to determine the Climax phase exactly by purely quantification methods, due to the HUL protection decisions made by policies, market, local community and so on.

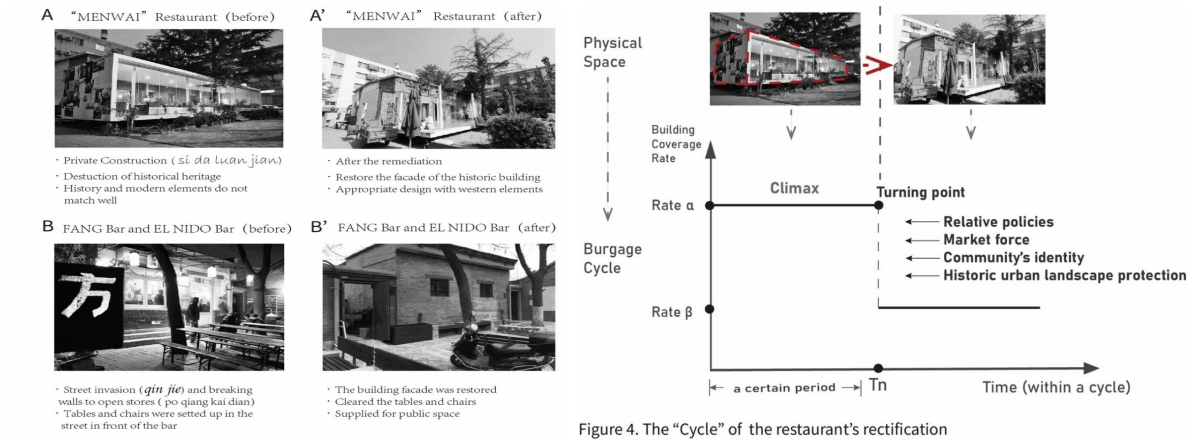


Figure 4. The “Cycle” of the restaurant’s rectification

Figure 3&4. *Illustrations of the rectification of Fangjia Hutong*

The Evolution and Heritage Protection of Beijing’s Central Axis

In the case of the Beijing Central Axis, for example, China has carried out the nomination work for world heritage, and it is planned to complete the rectification of the historical urban landscape within the buffer zone in the next ten years.

See Figure 5, Qianmen Street, as an important commercial and marketing region in Beijing since the Ming and Qing dynasties. Nowadays, it is a component of the Central Axis and it has undergone several historical processes of the evolution of urban form. In the modern period, the government and heritage managers has made the decision to rectify this region, marking this region has entered the Climax phase, and its building

coverage rate has been changed from αin historical period to β today. Clearly, the Rate α and Rate β can be measured directly with quantitative tools. But after the completion of the later rectification in the next 10 years, and during the future World Heritage management, the building coverage Rate γ is variable but unknown, and many factors to be considered by the governance and heritage nomination are also uncertain and unmeasured. Thus, under the intervention of these factors, the variation of the urban form in this region is "complex" and "uncertain".

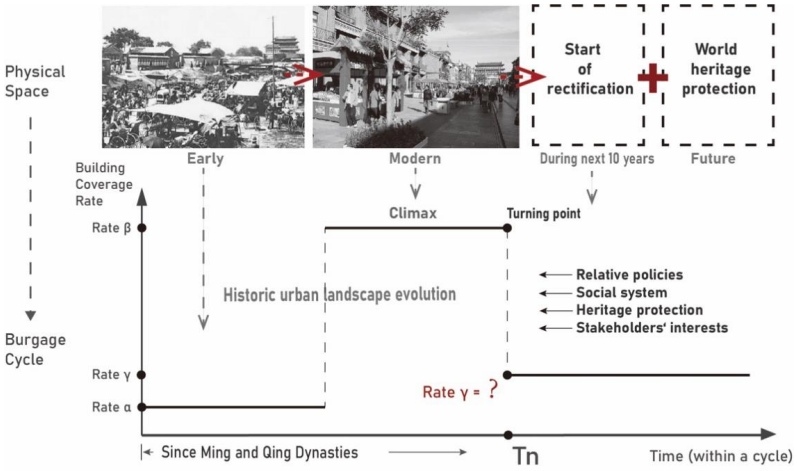


Figure 5. The "Cycle" of the evolution of Beijing's Central Axis

Figure 5. *The "Cycle" of the evolution of Beijing's Central Axis*

The Evolution and Future Decision-making of the Baiwanzhuang Neighborhood

Due to the needs of rapid urbanization and the "inventory planning", some of China's old neighborhoods with important heritage values are currently facing a choice of future development model. For example, the Beijing Baiwanzhuang Neighborhood provides a unique evidence to the initial exploration of living space planning in early socialist China, and it has undergone a long-term repletion (Figure 6). Nowadays, it is at a "fork in the road" of future development, which is still being discussed by stakeholders.

First of all, as illustrated in Figure 6, the building coverage rate of this neighborhood may still change from the current time to the future time when the decision is implemented, and it cannot to calculate the accurate number, either increases or decrease cannot be predicted. Then, if the neighborhood is going to Chaiqian (be demolished) by internal and external forces represented by the government and the market, in order to meets the redeveloping demand and improves the living quality of local residents. Once this intervention takes place, the building density in this neighborhood will be reduced from previous unknown value to zero, and a new cycle of plots will begin (Figure 6-b).

In the alternative, where multiple stakeholders including government, market, heritage experts and the public are going to recognize the heritage value of the neighborhood. Therefore, this region will be protected as a significant urban heritage after the rectification. At that moment, the coverage of buildings in this region

is Rate θ (Figure 6-a), which is also unpredict and unmeasurable because its determination involves multiple proposals and complex factors in the evolution of the urban form.

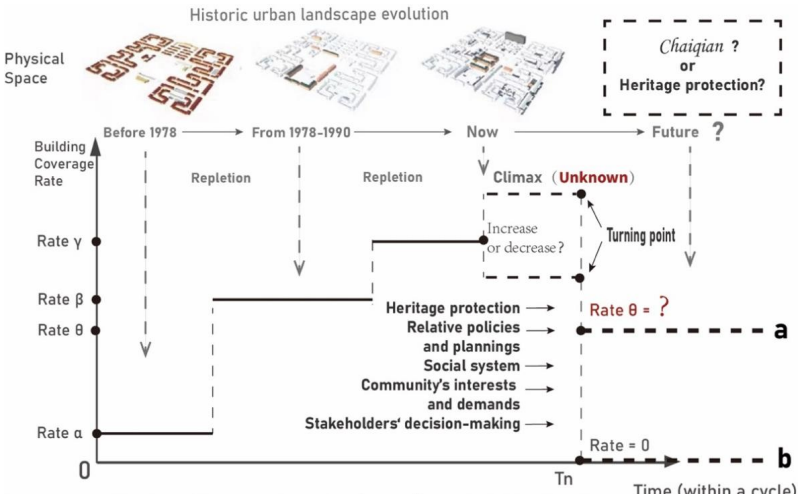


Figure 6. The "Cycle" of the evolution of *Baiwanzhuang* Neighborhood

Figure 6. *The "Cycle" of the evolution of Baiwanzhuang Neighborhood*

Conclusions

The analysis of the above cases which are happened in China, provides sufficient evidence that purely quantification is not enough to study the complexity and uncertainty of urban form evolution precisely. It is more comprehensive and effective for urban morphology research to integrate various methods, and quantification, as a methodological approach, can be used as an auxiliary tool for urban morphology research.

A fact should be reflected on that, when researchers analyze the evolutionary process of urban form, it's accustomed to judge the urban physical environment and evolutionary characteristics based on the retrospective perspectives. When they look back at the past, it is obvious that the corresponding values of its urban form evolution are more striking. However, as M.R.G.Conzen(1985) said, in studying morphological processes influencing one such plot type, one needs to consider such intricate correlates as the persistence factors. And the reconstruction of detailed burgage plot histories is a desirable research tool [4]. Thus, researchers may not to weaken the analysis of the fundamental motivating factors which cause the complexity and uncertainty of urban form evolution[5].

Acknowledgements

[1] The "new urban morphology" is in developing more robust and comprehensive approaches to understanding urban form. (P.J.Larkham, 2019)
[2] Although the "quantitative revolution"began in the 1950s, until after the 1970s, there was a tendency of purely pursuit of quantification and misuse of mathematical formulas in geography research.
[3]M.R.G.Conzen, A Needed Re-Orientation in Urban Geography, published in Thinking About Urban Form.
[4] Morphogenesis and Structure of the Historic Townscape in Britain (M.R.G.Conzen,1985), first published in Thinking About Urban Form.

[5] This article is dedicated to the memory of J.W.R.Whitehand. Although I'll never have an opportunity to ask him for a guidance, his significant academic achievements will always be a beacon of my life.

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