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A City Is Born

An analytical investigation of Changsha's urban development in the recent 100 years

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ABSTRACT

In the past century, Changsha has experienced rapid urban growth with significant social changes. This study aims to understand how the historical evolution of the city and the spatial transformations it went through define temporal cause and causal relationships that can explain the urban form. The study uses structural changes in the Chinese political system as intervening variables and defines their social consequences under the view of Durkheimian solidarity. Through spatial analysis of historical and current maps in chosen periods, this paper suggests an interrelationship between top-down orders, social solidarities and economic movements which is dialogic and differentiated in different evolution stages. While arguing that the current Changsha's spatial form sees a compromise between political and economic factors, the study sets up the discussion which focuses on the historical aspects of the city core and provides recommendations about how to alleviate its pressures for the future historical protection.

KEYWORDS

Urban Expansion, Solidarity, Movement, Old City

1 INTRODUCTION

1.1 The history of Changsha in the recent 100 years

Since being established as the capital of Hunan Province in 1664, Changsha has played a prominent political and commercial role in south-central China (Figure 1.1). Based on the different characteristics of Changsha's spatial transformations, this study divides the development of the city in the past 100 years into three stages: Pre-foundation of People's Republic of China (PRC), First Expansion and Second Expansion (Figure 1.2).

Figure 1.1: The location of Changsha in China and its photograph

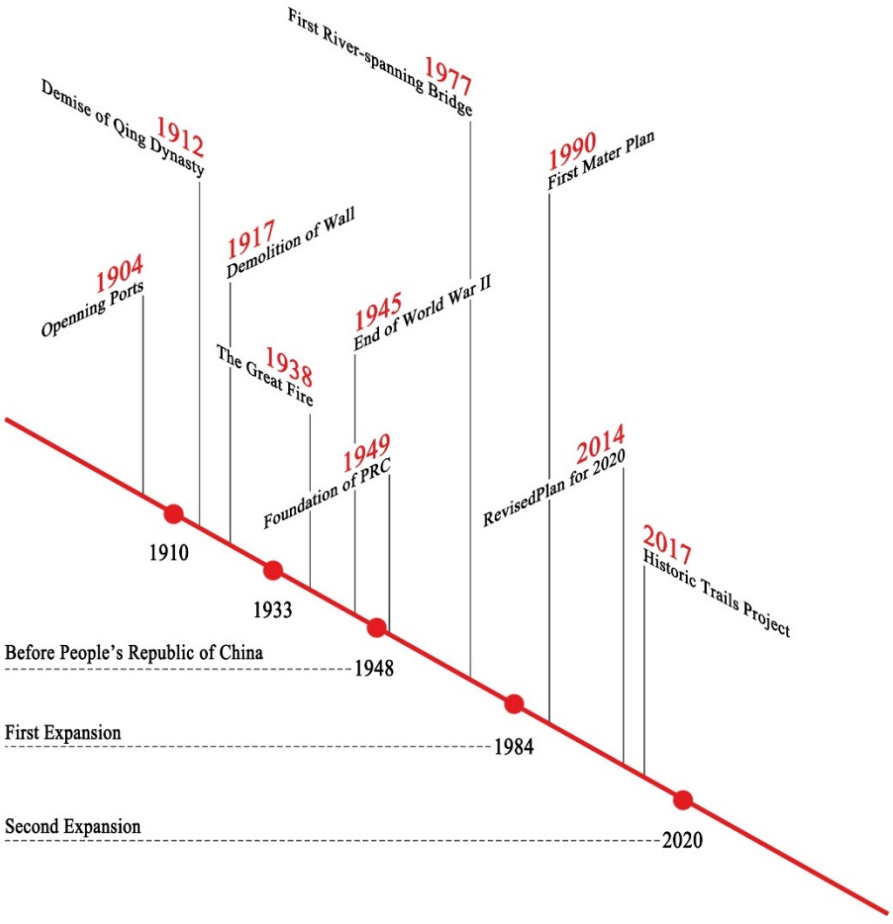


Figure 1.2: Timeline of changes happened in Changsha's history

Pre-foundation of PRC (1904-1948): In 1904, the opening of ports for trade in Changsha significantly promoted the city's economic development. It also encouraged the transformation of Changsha from a feudal imperialist city to a modern industrial city, in which the distribution of

land use is no longer determined by the authority but the economic need. The demise of the Qing Dynasty in 1911 further strengthened this transformation process.

The requirement for a better transportation system caused by Changsha's economic growth urged the local government to demolish the city's wall (Figure 1.3) in 1917. A ring road was built on the original site of the city, which was the only vehicular road at that time. During 1937 to 1948, the urban development of Changsha stopped due to the outbreak of World War II and the following civil war. Although the general spatial form of the city had been preserved, the economy of Changsha was devastated by the war. It should be noted that although the city wall had been demolished, most of the changes of Changsha before 1948 still happened within the scope of the old city while the city did not see an apparent expansion in this stage.

Figure 1.3: The city wall of Changsha before demolishment
Source: https://m.sohu.com/a/198499198_390661

First Expansion (1949-1989): After the foundation of PRC, Changsha started its first expansion lead by the government. According to the data provided by the government, the urban area of the city increased from 6.9 km² in 1949 to 101 km² in 1989. Due to the limitation of the economy, the expansion heavily relied on the original city. While the old city served as a political and commercial core, newly built residential and industrial areas were arranged around the city. Another significant change at this stage is the construction of the cross-river bridge in 1977, which enabled the city to develop westward. However, until 1990, this newly developed western area did not have a clear impact on the city, while the main urban functions were still concentrated on the east side of the river.

Second Expansion (1990-2020): In 1990, the government of Changsha established its first master plan for the city's future urban development. The economic recovery brought by China's

'reform and opening' policy enabled the government to further accelerate the growth of the city and set up two sub-centres in the west and east of the original city centre. The urban area of Changsha is now 434 km² with the urban population increasing to 5.3 million.

1.2 Chosen Periods for Research

This study chooses five representative times based on historical events and researchable resource, which are 1910, 1933, 1948, 1984, and 2020 (Figure 1.4). The times are chosen based on the important events that happened in Changsha which are argued to have spatial consequences on the urban form, including the demolition of the wall, World War II, the foundation of PRC, the built of the first bridge, and the rapid urban development lead by the governmental master plan.

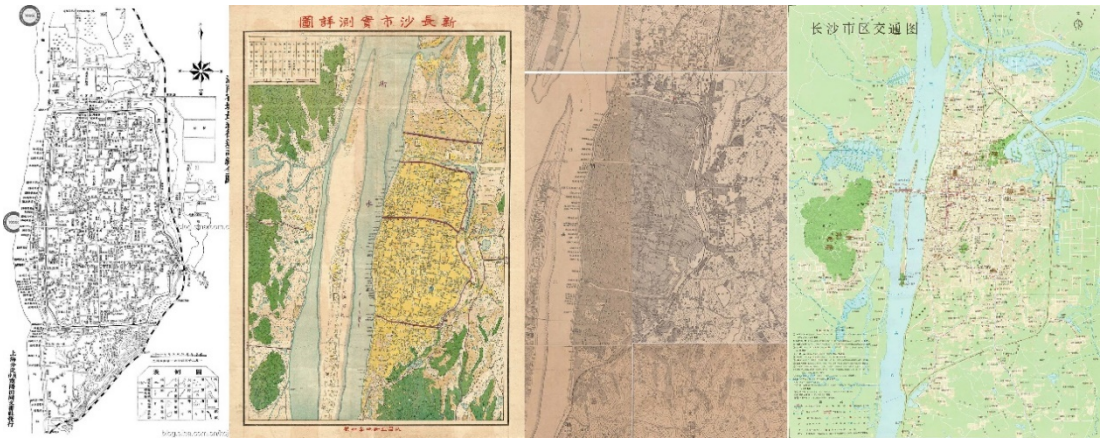


Figure 1.4: Historical Maps of Changsha in 1910, 1933, 1948, and 1984 (from left to right)

1.3 Research Aim

Unlike the development of most European historical cities, which tend to have more organic growth, the urban area of Changsha has expanded more than sixty times in the recent 100 years. This study asks how the socio-political changes interacted with changes in the urban form in the process of the city's evolution? Regarding the top-down master plan of Changsha, the study also analyses the temporal distribution of land use to see if the governmental orders have been applied as expected. If not, what is the reason? Based on the findings, the study then predicts the future condition of Changsha's historical area and discusses feasible ways for the protection of its historical form.

2 LITERATURE REVIEW

2.1 Chinese Transformation of Mechanic and Organic Solidarities

In The Division of Labour in Society, Emil Durkheim sets out the distinct types of social solidarity that pre-modern and modern societies have: the 'mechanic solidarity' and the 'organic solidarity'. While proposing a transition of social solidarities being from mechanic to organic, his study differentiates between the two solidarities through the degree of societies' division of labour (Durkheim, 1893/ 1964). According to the succinct summary from Liebst and Griffiths's

work, individuals in the mechanic solidarity lack the feeling of oneness among the society for the reason that there are many resemblance points connecting the individual to the society. In mechanical solidarity, collectivity dominates individuals with an emphasis on shared value. In contrast, organic solidarity sees the growth of interdependences among differentiated individuals (Liebst and Griffiths, 2020).

With the demise of the Qing Dynasty, in the early twentieth century, Chinese society experienced the transformation from mechanic solidarity to organic solidarity. Instead of being progressively transformed, Chinese historian Zhu suggests that this process is by the cultural invasion from the Western world. His study proposes both the advantages and disadvantages of this change. In the positive aspect, the transition of social solidarity encouraged the market economy as the local authority lost its dominant power. However, Zhu points out that the gap between upper classes and lower classes was winded up due to the unequal distribution of limited social resources (Zhu, 2003).

After the foundation of People's Republic of China, based on president Mao's ideologies of uniformity and standardization, the Chinese social solidarity was politically controlled to be mechanical. Mason and Li's study on the Chinese work-unit presents the characteristics of this period and the social transformation afterwards through the investigation of the evolution of the connection between the work-unit and society (Manson and Li, 2019). In the mid-20th century, the Chinese government centralized management and gave orders to various work-units. As a socialist production machine, the Chinese work-unit negated inequality by providing their employees with all the living resources in exchange for their labour force. Mason and Li describe this particular socio-spatial form as a micro-society, which also reflects Hanson's definition of mechanic solidarity: "the social takes precedence over the individual" (Manson and Li, 2019; Hanson, 1976).

Manson and Li then suggest there has been an organic transition of Chinese solidarity starting from the late 20th century due to the change of Chinese lead governmental policy from planned economy to market economy. Their study finds that social facilities such as hospitals and schools in the work-unit have moved out from the boundary. Although the organizational structure still exits and is now appreciated as a guarantee of stability, the emphasis of work-unit employees on the distinction between individual choices is suggested to be an indicator of organic solidarity. Therefore, the current Chinese society is argued to be a hybrid system in which individuals are mechanically united but also organically divided. (Manson and Li, 2019).

In conclusion, the social solidarity of China was partly transformed to be organic in the early 20th century before the foundation of PRC. Chinese society got set back to mechanical solidarity under the government's ideology of planned economy. After the change of leading policy and the recovery of the Chinese economy, the society went on the progress of organic transition in the

late 20th century (Figure 2). This paper suggests that the three stages of Changsha's urban development are differentiated by these structural changes.

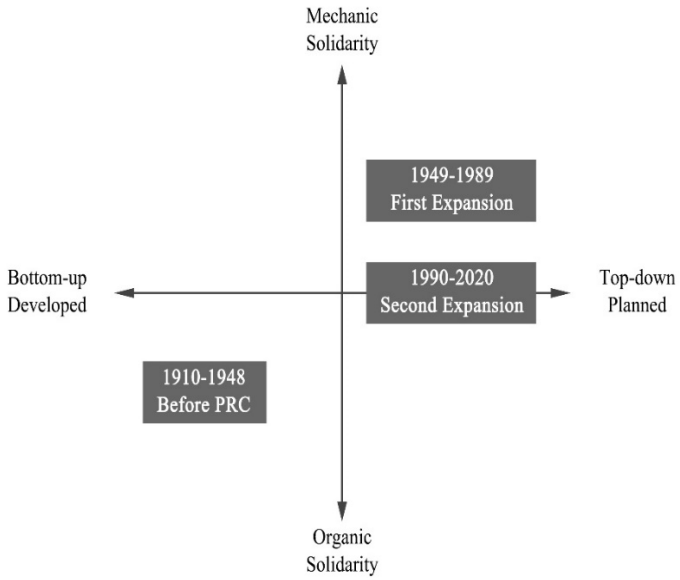


Figure 2: Characteristics of Changsha's evolution in different stages

2.2 The Master Plan of Changsha

In 1990, the Chinese government promulgated the City Planning Act to guide the urban development of Chinese cities. Since then, the master plan has been used by the government of Changsha to forecast the size of urban area and population in the next 20 years and designate general land use types for the urban areas, such as commercial, residential and industrial. Tian and Shen suggest that the emergence of this state-led growth form is due to the substantial control that the Chinese government has over land supply as the owner of all urban land of the state (Tian and Shen, 2010). They describe the nature of the master plan as top-down and criticize it because of its ignorance of social and financial factors. Their study on the application of Guangzhou's master plan shows that although it could be even illegal for individual investors to violate the master plan, in practice, the operation of economy is rarely constrained by the original plan.

Figure 3 presents the expected urban structure of Changsha in 2020 as a part of the master plan established by the local government in 2014. The red circle represents the main city centre of Changsha, which is still located in the old city part. Two pink circles in the east and west of the main centre represent subcentres of the city while blue and purple circles mains the suburban centres. The blue arrows indicate the directions of the city's future development. The plan shows the intention of Changsha's government to develop a dual-centres urban system which could ease the pressure of the old city by separating its functions to subcentres.

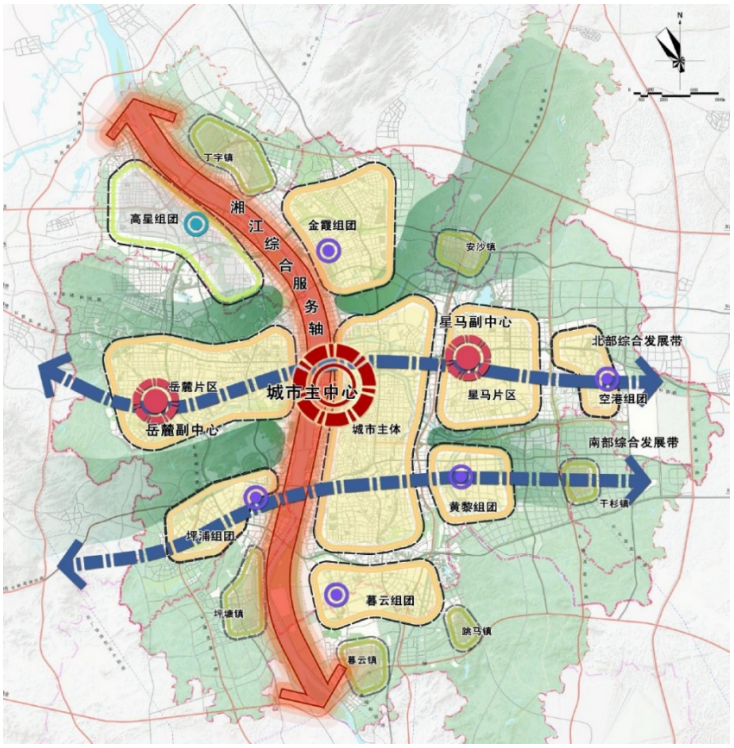


Figure 3: Planned Urban Structure of Changsha in 2020 by the Local Government

2.3 Discourse of Space Syntax Theory

Through major publications such as Hillier and Hanson's The Social Logic of Space proposing to regard space as an independent component in social studies, the space syntax theory argues that space is a 'social fact' which gives expression to social meanings (Hillier and Hanson, 1984). Hillier's theory of centrality as a process further explores the interaction between the spatial form of town centres and functional requirements occurred in the urban evolution process (Hillier, 1999). The theory proposes a dynamic two-way interaction between spatial and functional factors in the process of evolution. From Hillier's argument, land-use choices are influenced by the spatial character of centres, but they also lead to the modification of spatial configuration. The main contribution of their findings to this paper is a theoretical background for this study's comparison of social and spatial variables.

However, as Hillier emphasises that the primary research objects in his study of spatial sustainability are self-organised cities, the interrelationship of spatial configuration and social consequences is not universal. Ortiz-Chao and Hillier's study of Mexico City provides a comparative reference for the analysis of the rapid growth of Changsha. The authors discover the opposite effect of the grid intensification in Mexico City compared with Hillier's previous studies in cities which had a more organic grown process. Their study suggests that the situation in Mexico City might be explained by the uncontrolled growth of the city, which is roughly expanded to satisfy the growing demands of people instead of naturally developed (Ortiz-Chao and Hillier, 2007).

Hillier's and Vaughan's proposition about the formation of a generic dual-network of cities helps to understand Changsha's spatial transformation. In the global scale, the need of bringing people together in cities orders space in a way that optimises movement and copresence. Such micro-economic activity gives rise to the global similarity of a foreground network between cities. In the local scale, the variety of residential cultures leads to the differences of the underlying local form, which is the background network of cities. (Hillier and Vaughan, 2007). Building on the dual-network theory, Psarra's The Venice Variations examines Venice's canal system separately from as well as together with the street system to demonstrate the dominant role of the canals as the foreground network of the city and illustrate how canals interact with the street system (Psarra, 2018).

Hillier, Yang and Turner's spatial analysis of another top-down developed Chinese city, Beijing, suggests that the urban grids of this type of cities are more likely to relate to the spatialization of governments' social order instead of economic activity. In comparison to organic cities, they suggest that the foreground grid isolates the background areas of Beijing from each other. As a result, the background network of this city is broken up into discontinuous sub-areas while there is a clear hierarchy between the two parts of the dual-network (Hillier, Yang and Turner, 2012).

3 DATASETS AND METHODS

To facilitate a greater understanding of the city's spatial transformation, the study digitizes the historical and current maps of Changsha for quantitative spatial analysis. The result of analysis will be used for the definition of causal relationships between social and spatial variables.

The principle methodological approaches are as follows:

- NACH&NAIN: Normalised values of choice and integration of spatial configuration are examined to have the feasibility of being compared among different urban forms (Hillier, Yang and Turner, 2012). This paper analysis the NACH and NAIN of Changsha's spatial configuration in different periods to investigate the changes in its urban form. Also, by pointing out the roads with higher spatial value, the city's foreground network is distinguished for further comparison.

- Star Model: As the star models of cities indicate the continuity of the urban structure as well as the ease of accessibility in the dual-network (Hillier, Yang and Turner, 2012; Psarra, 2018), this study uses star models to compare the differences of spatial performance of Changsha's urban networks throughout the periods. The study also compares Changsha with other cities, including Beijing, Shanghai and Manhattan, for a better understanding of the way Changsha has developed in its second expansion.

- Statistical Comparison: This paper separates the historical part of the city, which used to be surrounded by the walls, and makes statistical comparisons of NACH and NAIN values

between the old city and the whole city in 1984 and 2020. The differences between the two periods are then suggested to present the different degree of reliance on the old city, which also shows the particular characteristics of the city's first and second expansions.

- Catchment Analysis: The study uses catchment analysis to examine the actual usage of the city by analysing current distributions of retails and public transport stations. Based on the segment map of Changsha in 2020, the distance from each street segment with given distances to each of the point-based origins is calculated. The catchment distances for different origins are given based on the planning specification provided by the Chinese government. For instance, the catchment distance for business centres is 2000m while the figure for bus station is 800m.

4 RESULTS

4.1 Changsha's Urban Development Before the Foundation of PRC

According to Hu's research on the historical changes of Changsha's cultural environment in the early 20th century, most of the people living in this city had no choice but communicating by walking in their daily life (Hu, 2016). Therefore, this study chooses 800m as the most representative radius distance for spatial analysis on the local scale.

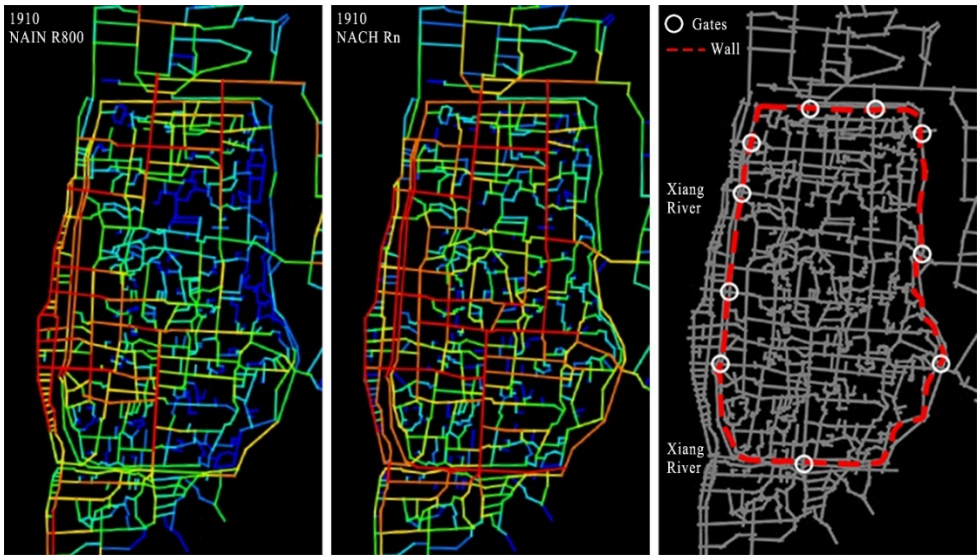


Figure 4.1: Spatial analysis of 1910 Changsha

Six years after the opening of ports, the spatial form of Changsha in 1910 showed a tendency towards port trade (Figure 4.1). The west side of the city along Xiang River was highly integrated on the local scale while the eastern Changsha was locally isolated. According to Hu's study, western Changsha has been a historically traditional upper-class area. Therefore, the unequal spatial distribution of the two sides reflects the considerable class difference, which is argued to be the characteristics of Changsha in this period (Hu, 2016). Inside the wall, Beizheng Street, Nanzheng Street and Xiangchun Street, as the three north-south roads connecting the gates had the highest value of global choice. East-west roads with high choice value only appeared on the

west side of the city, including Ximen Street and Chaozong Street. Interestingly, most of these streets' names have the meaning related to the direction and the gates in Chinese.

Through the comparison of NACH analysis of Changsha in three periods (Figure 4.2), the demolition of the city wall did not have significant effect on the spatial form. Although the wall had been torn down, roads connecting the original gates were still most likely chosen by people in 1933 and 1948. Notably, roads behind the west wall saw an increase of choice value after the wall's demolition. Most of these roads are now high-rent commercial streets with many historical interests.

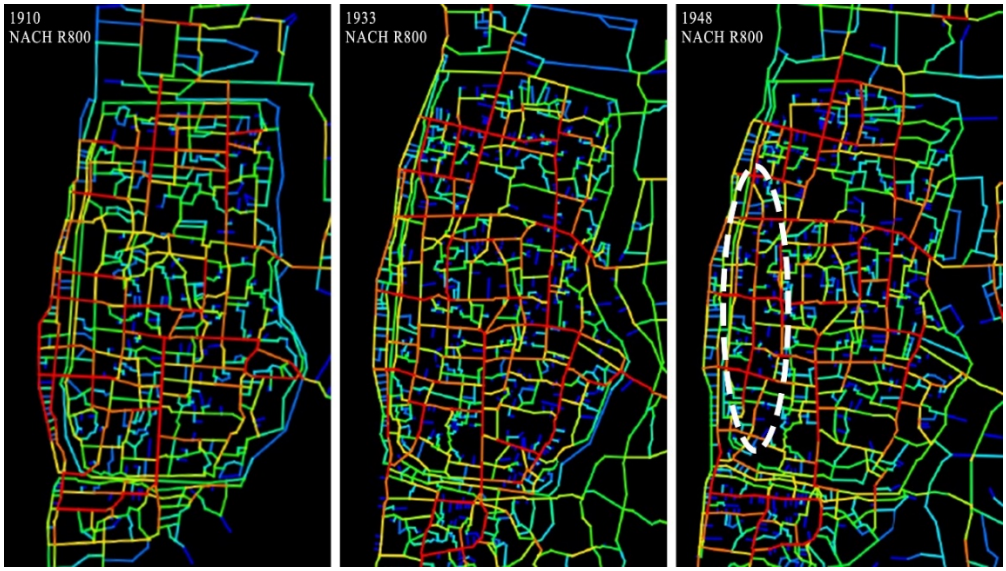


Figure 4.2: NACH R800 analysis of Changsha in 1910, 1933 and 1948

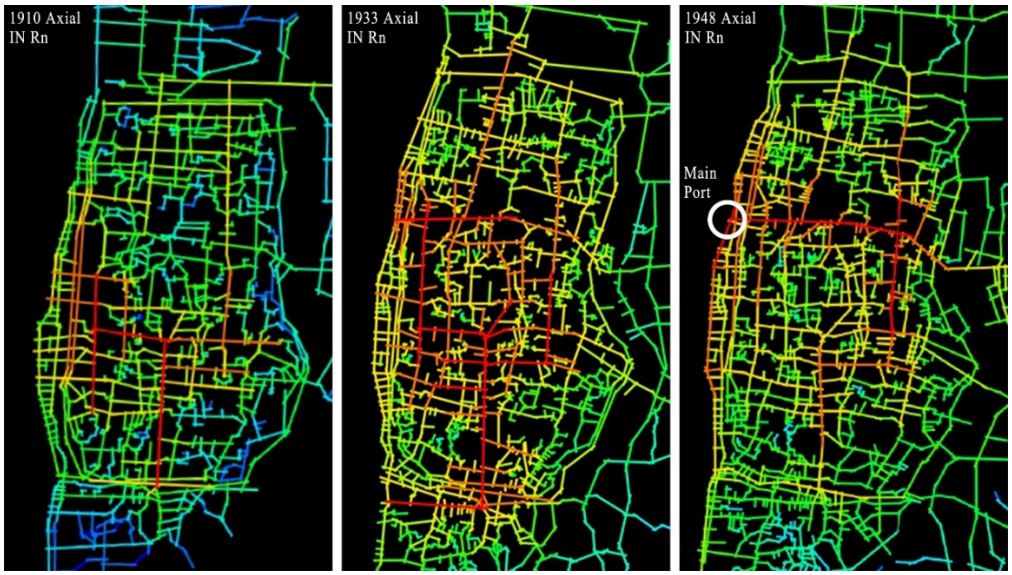


Figure 4.3: Axial Integration Rn analysis of Changsha in 1910, 1933 and 1948

Figure 4.3 presents the change of integration core of Changsha from 1910 to 1948. Influenced by the port trade, the integration core gradually moved from the south to the north where the main

port was located. In the main time, the major direction of highly integrated roads also saw a change from north-south in 1910, to east-west in 1948 due to the same reason. Since no effective governmental plan was established because of the endless war during this period, this paper suggests that the evolution of Changsha's spatial form before the foundation of PRC shows a self-organized trend which reflects Hillier's *movement economy* theory.

4.2 Changsha's Urban Development During the First Expansion

With the cross-river bridge connecting the city to the west, in 1984, a grid-like foreground network started to appear in the city (Figure 5.1). In contrast to the structure of the city in 1948, the majority of highly integrated roads was east-west while Wuyi Avenue, which had the highest integration value, linked all the other integration cores. Compared with 1948, the decline of east-west spatial axes in 1984 also reflected on the local scale (Figure 5.2). Zhongshan Road, as the most integrated east-west road linking the main port in 1948, lost its dominant spatial role to Wuyi Avenue, which was the only connector to the west side of the city in 1984. Besides, a clear deintensification of the urban grid happened in the city's first expansion. A lot of short trails disappeared, which made the organic spatial pattern of Changsha partly ruined.

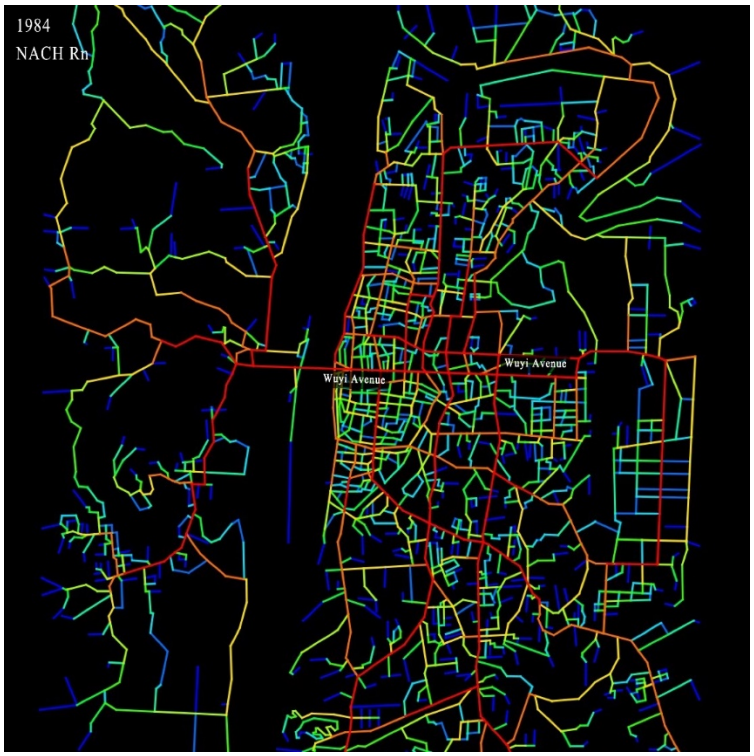


Figure 5.1: NACH Rn analysis of Changsha in 1984

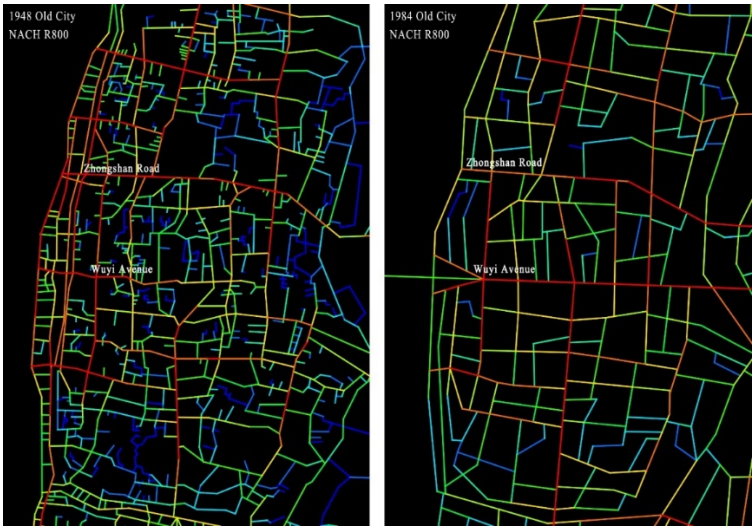


Figure 5.2: NACH R800 analysis of Changsha's Old City Part in 1948 and 1984

This study proposes that the change of Changsha's spatial form could be explained by the transformation of the city's political role from city of consumption to city of production. In the late 20th century of Changsha, economic activities were no longer emphasized or even banned by the government in this special time with a considerable number of industrial work-units built around the old city (Figure 5.4). Because of the economy shortage at that time, Changsha's government had no choice but kept major urban functions inside the old city. In other words, governmental facilities in the old city gave production order to work-units and also provided them with living supplies (Figure 5.3). North-south roads were extended from the old city to link the work-units for the transformation of goods. Because the effect of economy movements was minimised, which used to be led by the port trade, east-west roads connecting the riverside were therefore not important for the social need. Also, to widen and lengthen roads for better transportation efficiency, historical laneways were removed.

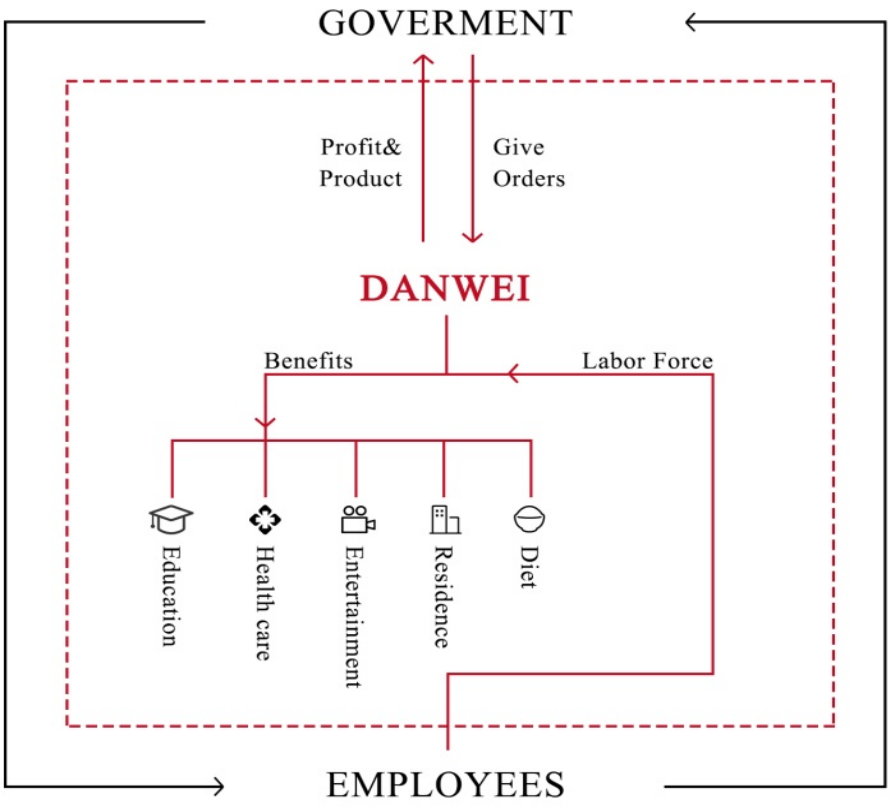


Figure 5.3: Structure of the Chinese Danwei

As mentioned before, the living scope of work-unit employees was limited, for the reason that all of their daily needs could be satisfied within the boundary of the work-unit. As the main social group of this time, the workers of this production city were segregated from the town centre. One interesting finding is that over 85% of the work-units were well connected in the urban network, which obtained or linked to roads with top 20% choice value in radius 800m (Figure 5.4).

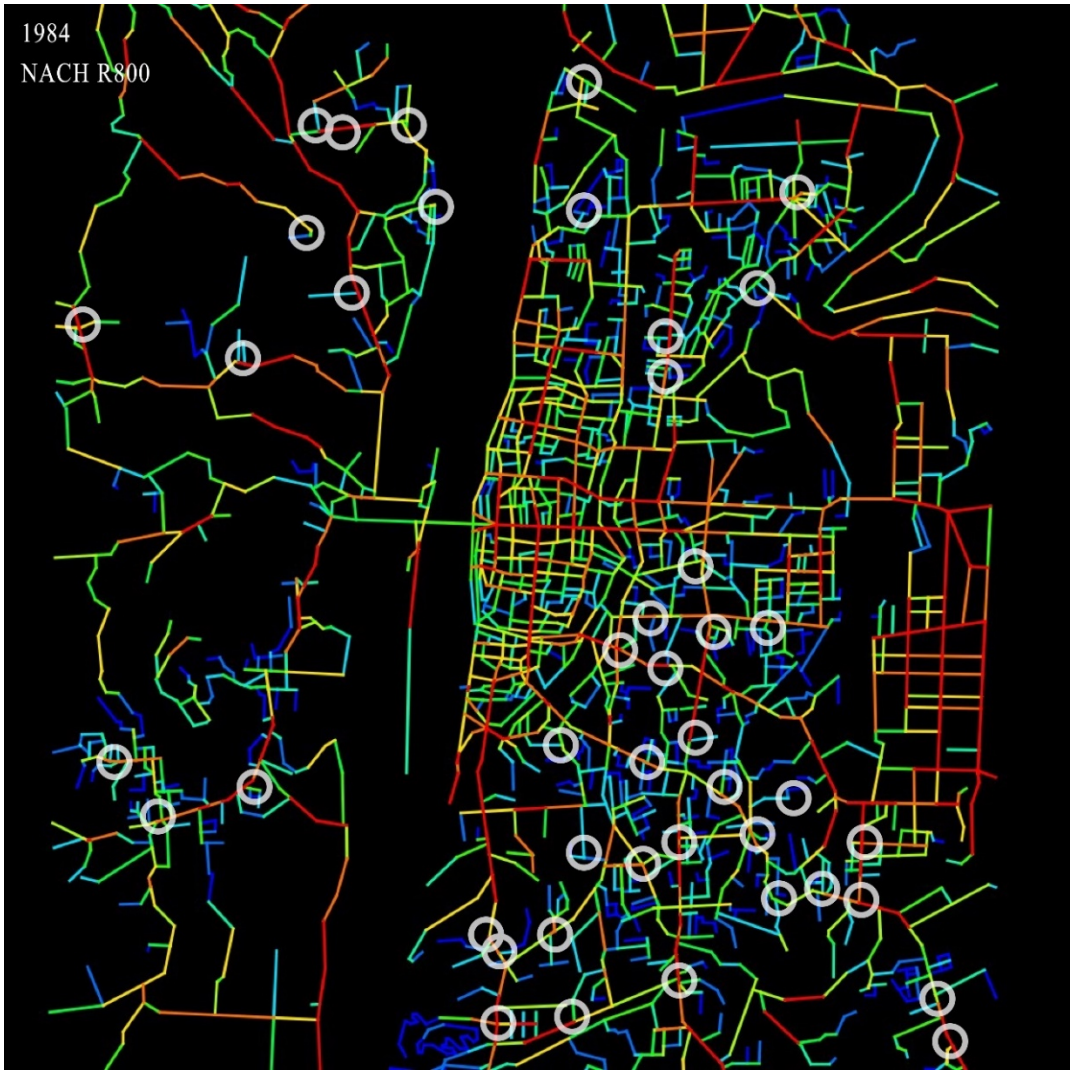


Figure 5.4: NACH R800 analysis of Changsha in 1984, with while circles pointing out the work-units

4.3 Changsha's Urban Development During the Second Expansion

As presented in Figure 6, the spatial configuration accurately reflects Changsha's top-down expansion plan. The designed major roads with high choice value make up the foreground network of current Changsha. A geometric grid has replaced the historical patterns of integration core within the ring road. From the historical area to the periphery of the city, the urban grid gradually changes from dense to sparse, and from organic to order.

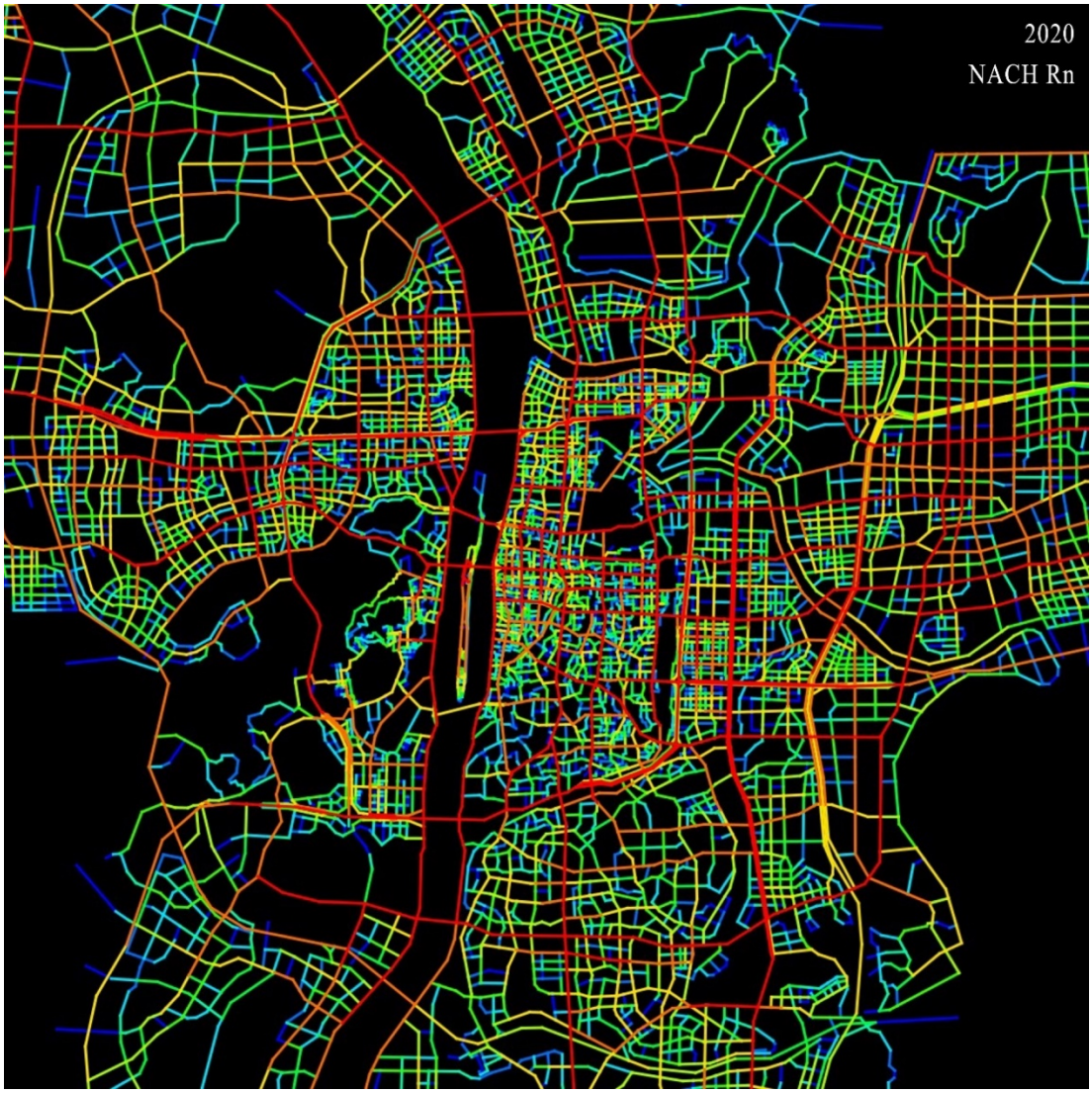
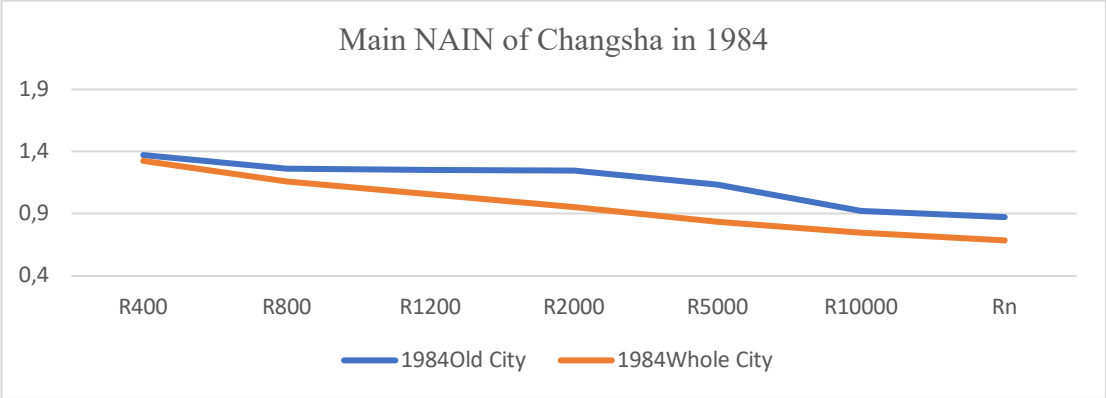


Figure 6: NACH Rn analysis of Changsha in 2020

Table 1 shows the comparison of the main values of NAIN analysis between 1984 and 2020. In 1984, the overall difference of main NAIN value between the old city and the whole city was much larger than the figure for 2020. This paper suggests that it is because the first expansion of Changsha heavily relied on the old city. Although the work-units around the old city could satisfy the needs of life, they were unlikely to independently operate without connections with the old city. On the other side, the comparison between 1984 and 2020 reflects the successful separation of central functions from the old city to subcentres in the second expansion. The comparison of main NACH value also illustrates this separation. From local to global, the old city in 1984 had high NACH value than the rest of the city, while the difference in 2020 gets smaller with the increase of radius distance. The reason for the vast difference of R400m in 2020 is suggested to be the high grid density of the old city.

Table 1: Main values of NAIN analysis of Changsha in 1984 and 2020



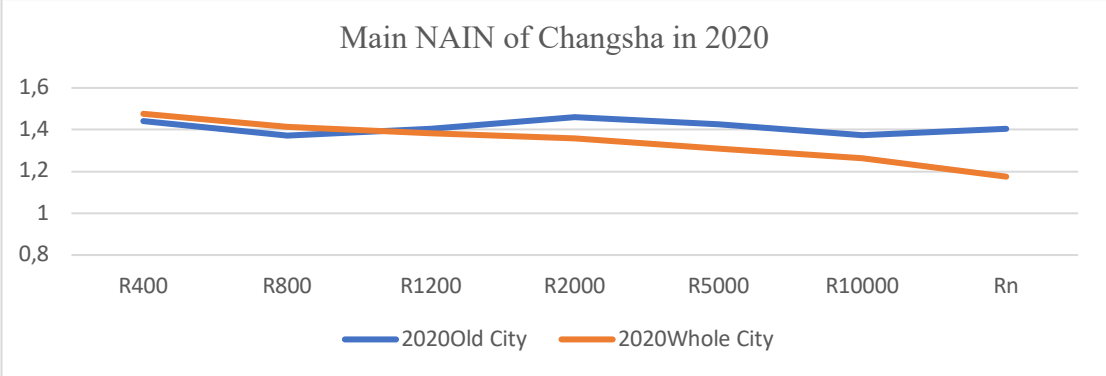
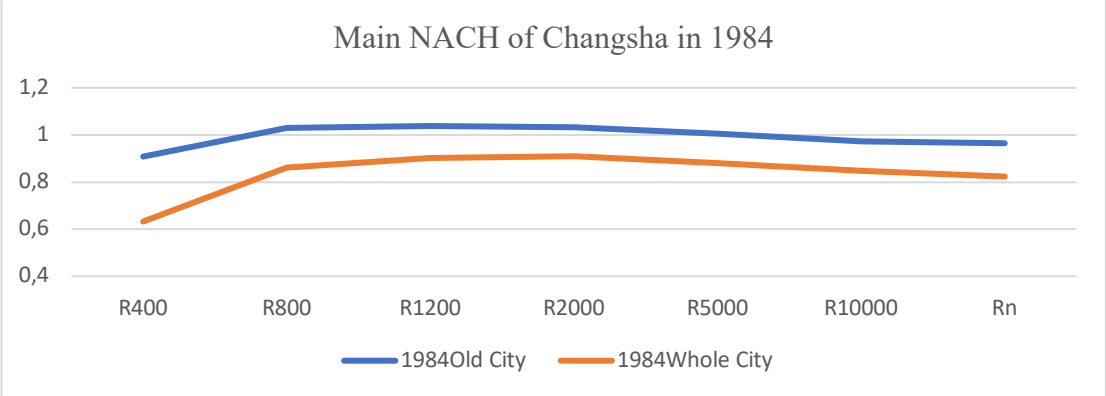
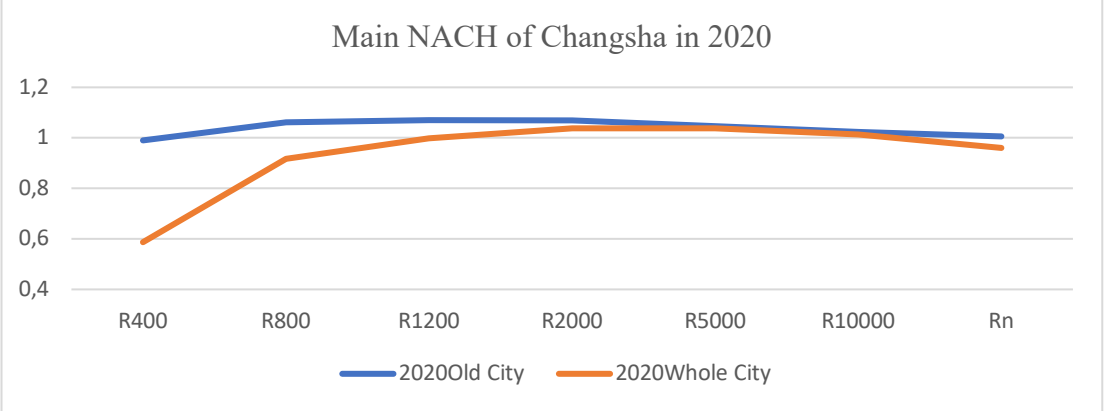


Table 2: Main values of NACH analysis of Changsha in 1984 and 2020

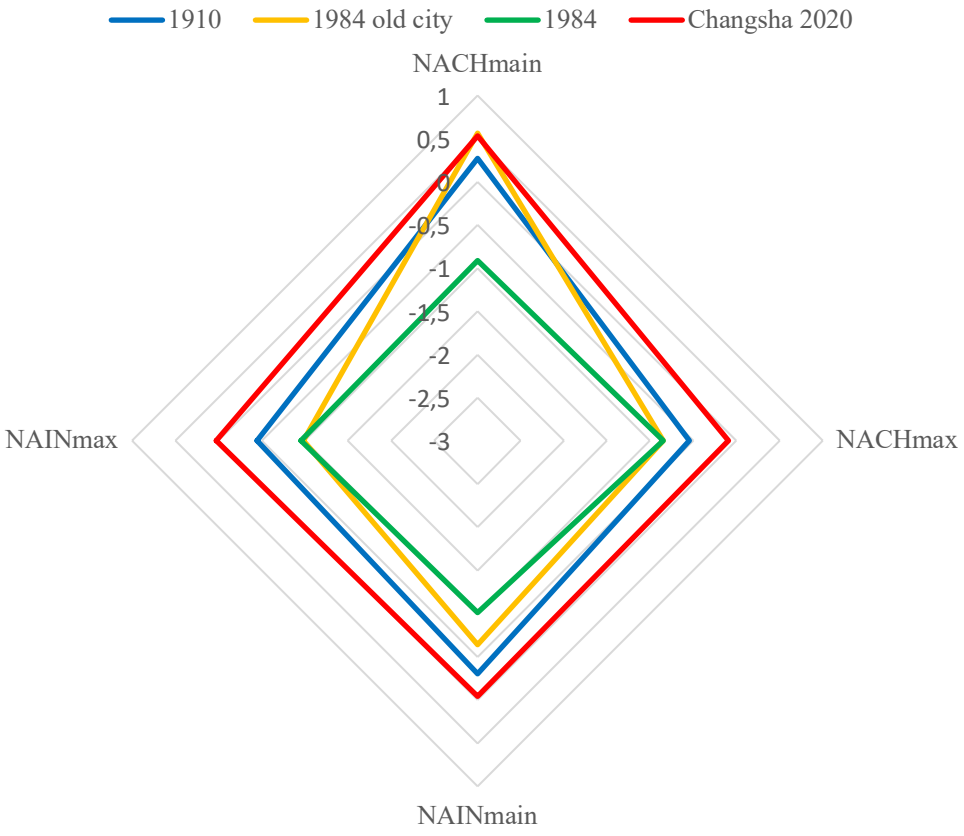




4.4 The Spatial Transformation Over 100 Years

The star model presents z-scores (standard scores) of the NAIN and NACH of Changsha's spatial configuration in 1910, 1984 and 2020, using figures from Hillier's study of 50 cities as the database (Table 3). The city in 1984 was surprisingly weak on NAIN, although its urban area is much larger than 1910 after the first expansion. As Hillier suggests that the mean and max NAIN illustrates the ease of accessibility, there seems to be a relationship between the political limitation of movement with spatial performance. In other words, the low accessibility in 1984 reflects the Chinese mechanic solidarity, which isolated the work-units from the urban system in order to obtain more efficient productivity. The much stronger main NACH of the old city in 1984 that the whole urban area also illustrates the discontinued background network in areas outside the old city, where work-units located.

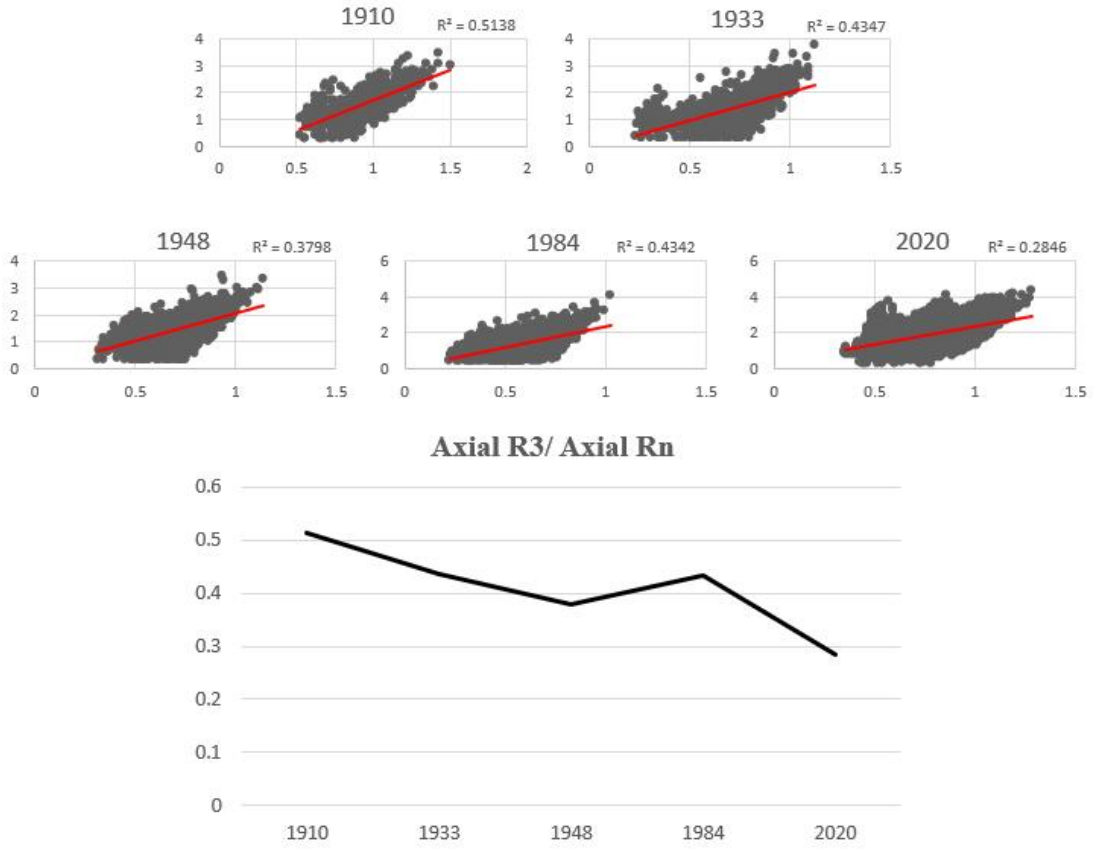
Table 3: Star Model of Changsha in 1910, 1984 and 2020



The comparison of axial synergy (R3/Rn) in different periods provides another perspective for the understanding of Changsha's spatial characteristic in 1984 (Table 4). With urban growth, it is natural to see the decline of axial synergy because of the appearance of a more complex dual-network. However, the increase of the figure from 0.38 in 1948 to 0.43 in 1984 shows that the ten-fold urban expansion in turn slightly improved the synergy between local and global integration, after which the figure sharply dropped to 0.28 in 2020. One possible explanation is that the newly-built areas in 1984, which was mainly consisted by work-units as micro-societies

which contains simplified social structure, follow the similar spatial hierarchy from an integrated foreground road to the residential areas.

Table 4: Changes of axial synergy throughout the periods

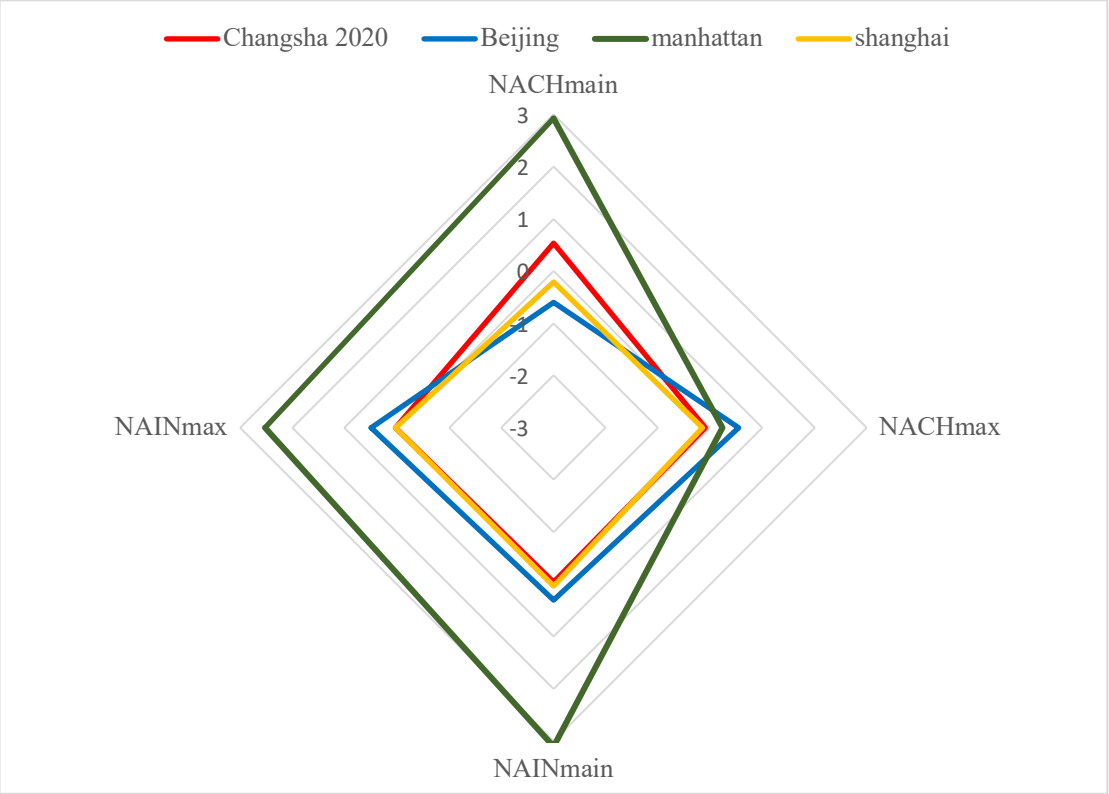


The transformation of leading policy from planned economy to market economy made the developmental goal of Changsha back to city of consumption in the second expansion. Roads which used to link the old city with work-units now form the dense foreground network of the old city for economic activities. Compared with another top-down Chinese city, Beijing, which is the political capital of China, Changsha in 2020 has higher main NACH but lower max NACH. The relationship between Changsha's main and max NACH value is more similar to Manhattan, which in Hillier, Yang and Turner's definition, applies a top-down spatial strategy dominated by the economy (Hillier, Yang and Turner, 2012). Therefore, as Beijing's development mostly follows the social order with ceremonial needs, Changsha's second expansion seems to be economy-driven. As presented in the table, Shanghai, as the economic capital of China, also sees a similar relationship between the background and foreground as Changsha and Manhattan (Table 5).

Building on Hillier's proposition that distinctive spatial cultures differentiate the way society interacts with space in the process of urban evolution (Hillier, 1989), this paper suggests that the spatial configuration in the three stages of Changsha's evolution express changes of the city's spatial culture, from economic in the early 20th century, to industrial in the late 20th century, and

economic again in the current time. This transformation also illustrates the transition of Chinese social solidarity.

Table 5: Star Model of Changsha in 2020, Beijing, Shanghai and Manhattan.

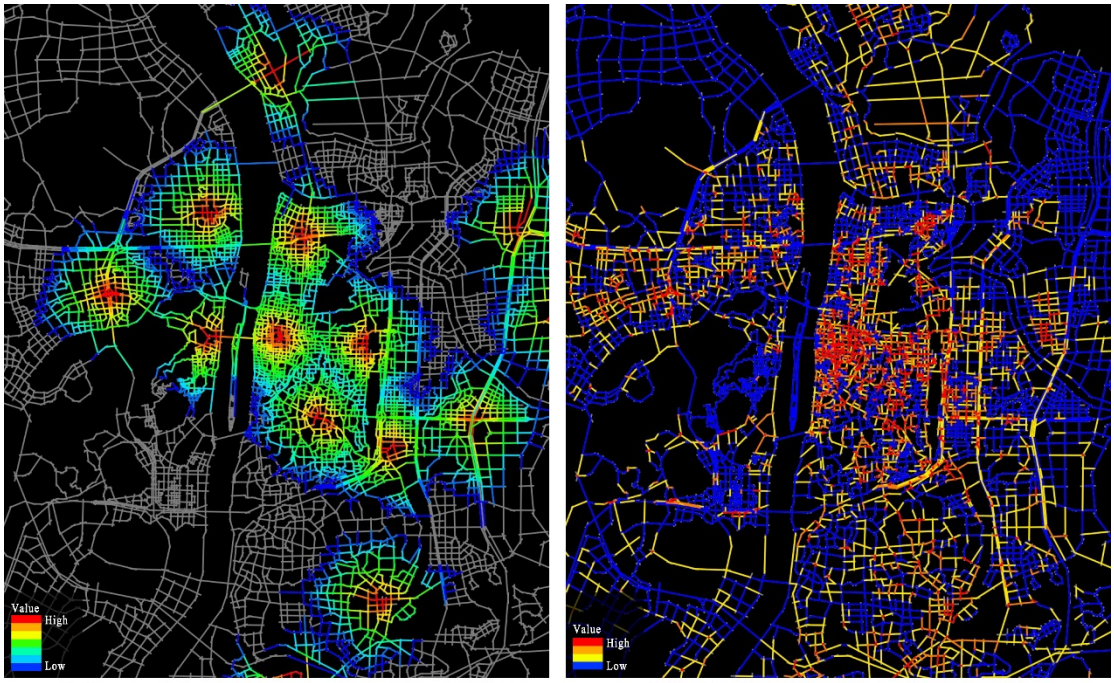


4.5 The 2020 Changsha: Still a Single Centred City

While the previous statistical analysis suggests that Changsha has successfully set up its sub-centres which have less dependency on the old city than 1984, this study chooses retail and public transport as representative variables for the investigation of the actual usage of the city.
The core position of the old city as a commercial centre has not been weakened by the new sub-centres in the east and west side of it (Figure 7). Most of the newly built business centres are located around the original one, while the historical area has the highest density of retail shops.

In the second urban expansion, the relocation of provincial government, scientific research and other urban functions from the old city did not ease its development pressure but instead left it with more space which was eventually developed as new commercial areas. This paper suggests that the failure of the government's attempt to weaken the commercial concentration of the old city illustrates the objective law of economy movements. Compared with newly developed areas, the denser foreground grid of the old city strengthens the attraction inequalities through denser movements influenced by the spatial configuration, thereby increasing its commercial value (Figure 9).

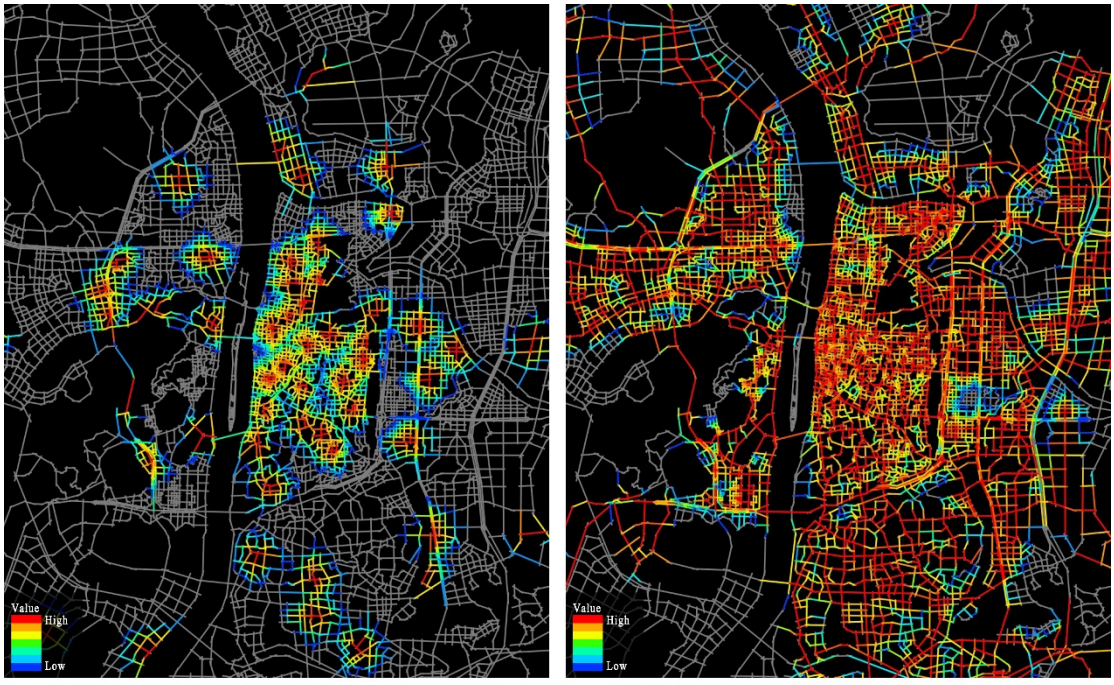
The unequal distribution of public transportation resources further promotes this phenomenon. While the catchment area of bus stations roughly covers the main urban space, tube stations are still concentrated in the old city part (Figure 8). According to Law, Chiaradia and Schwander's study on the bi-network model which combines London's street and underground network (Law, Chiaradia and Schwander, 2012), the integrated tube stations in the old city contribute to optimising the spatial advantage of this area.



a: Catchment analysis of business centres (max catchment: 2000m)

b: Density of Retail Shops (Number/ Segmet Length)

Figure 7: The distribution of retail in 2020



a: Catchment analysis of tube stations (max catchment: 1600m)

b: Catchment analysis of bus stations (max catchment: 800m)

Figure 8: The distribution of public transport in 2020

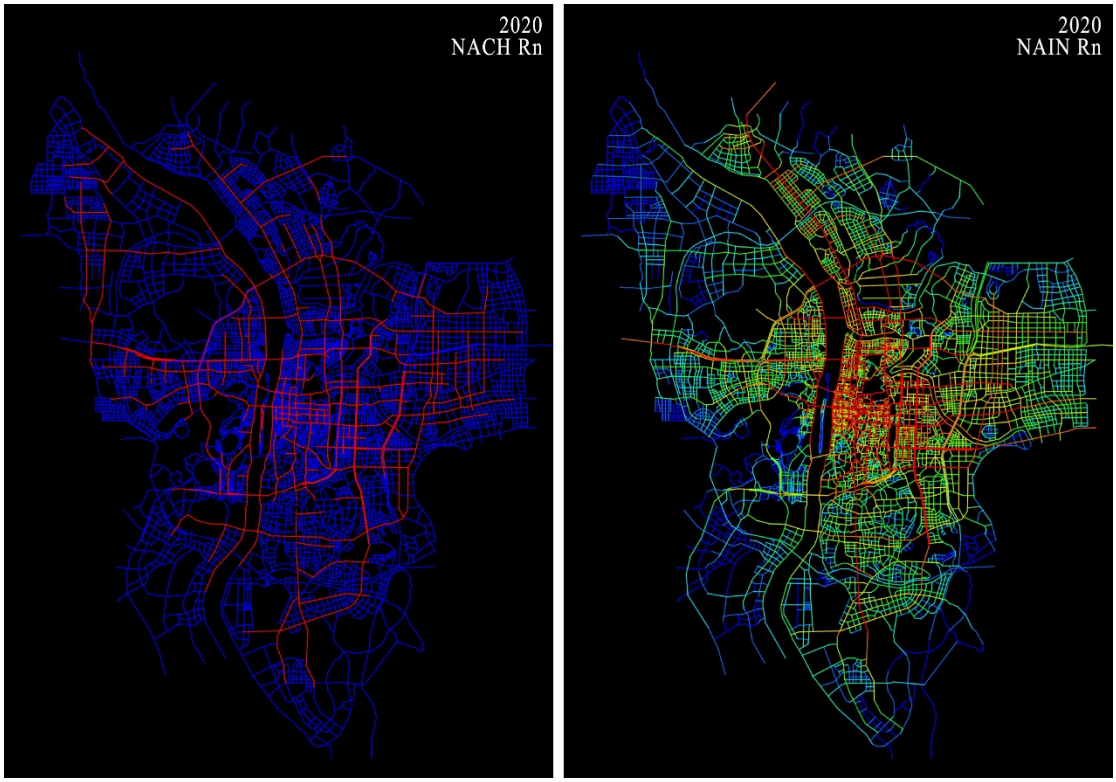


Figure 9_Left: NACH Rn analysis of Changsha in 2020, red lines are roads with top 10% value
Figure 9_Right: NAIN Rn analysis of Changsha in 2020

As the city's growth is approaching saturation, inventory planning will become the focus of Changsha's future development. The overly concentrated business and tourism industries place a heavy burden on this historical area, which would further damage Changsha's historical urban form. This study argues that the future development of subcentres will even increase the commercial pressure of the old city. Due to the dominant role of the old city in the spatial configuration of Changsha, as well as its convenience of public transportation, this study argues that the city will remain as single-centred if no feasible approaches are applied.

5 CONCLUSIONS

This study has investigated the historical evolution of Changsha and its spatial transformation while regarding social solidarity as an intervening variable. In the process of Changsha's urban development over 100 years, different patterns of causal relationships between space and society are differentiated by the changing dominant political ideology. Despite the disordered pre-PRC stage, the change of China's leading policy from planned economy to market economy in the late 20th century has led to the economic recovery and rapid development with an organic transition of social solidarity but also increased the influence of the economy movements.

While suggesting the top-down social order's limitation in current society, the study looks at the protection of the old city in the future. The author argues that because of the old city's dense and

continuous street network with high spatial integration, the most effective way to relieve its spatial pressure is to reduce the centrality of this area. Rather than applying political restrictions from the master plan, it would be more reasonable to build a multi-centred system in which the new centres have larger spatial attraction than the historical one. One possible method to release the old city's pressure is to turn part of the main roads through the old city into pedestrians or restrict traffic, thereby reducing the spatial attraction. Another way is to develop a more comprehensive subway network in subcentres. Therefore, by modifying the city's street network as well as the public transportation network, both reducing the old city's foreground grid density and intensifying current subcentres' spatial form could contribute to the historical protection.

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