Design with forms as well as patterns

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Dedicated to my grandmother CAI Xingshun
献给我的姥姥蔡兴顺

Preface

The motivation for doing this research originated in my own frustrations while learning to become a designer.

Can I learn to be an architect?

"You have to be talented to study Architecture, otherwise you cannot make it to graduation!" We were told over and over again in the first year of our bachelor study. Is that true? Is talent over-rated? What is talent? Is it the capacity to draw nicely? Is it the capacity to present the design well? I asked these questions to myself, especially when the work that seemed unimpressive, but was well-presented, received a high grade.

This was until I met Professor WANG Yuan in the third year of my bachelor architecture education and I became part of the Hankou Impression design studio. Professor WANG claimed *"you have to understand life first to be able to understand architecture, this is the essence of designing good architecture."* It was my first time learning to do research. I went to the site and observed people's everyday life. I talked to the inhabitants who had a very strong local accent which was not easy for me who is from the Northern part of China. I had difficulties understanding them, not only because of their accent but also due to their different life-style. I struggled to understand and incorporate their needs in the design. This studio made me understand that architecture is about life, the life of people and life in general.

Who am I? Transforming experiences into design resources and paying attention to the marginalized urban population

Since then, I have been trying different ways to understand the life of different groups of people. After the completion of my Bachelor of Architecture, I took a year off and participated in the Poverty Alleviation Relay Program of the Central Committee of the Communist Young League. It is a state-led relay program sending masters students to the poorest villages in China to teach for a year. The effort to keep sending well educated young students to the villages will not only contribute to the local education, but will also eventually open up the local teachers and people's minds and keep them updated about the outside world.

It was a year of tough life. I was teaching English and Mathematics in a high school, and at the same time I used any chance to go to the deep mountains to interview the local farmers, most of whom were my students' parents. I visited in total 5 towns and more than 30 villages. I lived in the school teachers' dorm and worked with students 3 times per week from 6:00 in the morning till 10:30 at night. 16 students lived in one dorm without a bathroom. There was no heating in winter, and when it was below zero, two students squeezed into one bed to keep each other warm. My students can only go home once per month, partly because there was hardly any transport and it was difficult for them to travel in the mountains and partly because they did not have much money to do so. The students often have insufficient previous education, mainly because of the inequality of education resources distribution in China. The students who live in villages hardly manage the very competitive national college admission exam. Therefore, these students and their parents already gave up on college education. The only reason why they are still in school is because they are waiting for the moment they become 18 and then it is legal for them to go to big cities to work as cheap labour.

This whole year of experiences touched me deeply. Since then, every time I walk in the city and see the factory workers on the street, I know my students are part of them. How is their life? Where do they live? What do they need? Is the city able to facilitate these yet?

The Chinese central government officer's voice has always been in my mind *"One year is short. Probably you will learn more than you can contribute. Please do remember what is actually happening in China and one day if you are in the position, please, please do something for them."* Since then, I have always been trying to look for ways, professional ways, to let their voice be heard.

The decision to come to the Netherlands to study

I returned to school and did my master research under the supervision of Professor WANG Yuan. I specifically researched into the local inhabitants' life in the former concession areas of Wuhan. Alongside this, I was teaching in the bachelor design studio as an assistant and involved in a local architecture firm working on a series of market driven architecture and urban design projects. Back then, the education program was still very much focused on the aesthetic and technical sides of architecture, not on training systematic design methods and design thinking. Furthermore, the projects I did in the architecture firm mostly prioritized economic profit and were done in a very limited time. We hardly had time to think over and evaluate the existing situation, the historical context and the inhabitants' needs.

For the sake of continuing to explore different life-styles and cultures while looking for professional ways to express the needs of marginalized urban populations, I decided to come to the Netherlands to study. The Netherlands is considered a "design country" and a large part of the Netherlands is a man-made (designed) environment. Beginning from the 9th Century, numerous civil engineering works have been carried out to make the Netherlands habitable (Sijmons, Venema, & Van Dooren, 2002; Van de Ven, 2002). City development and urban design has been concerned with, and integrate, the design and construction of dams, dikes, sluices, polders, etc (Hooimeijer, 2014; 2011). The country is small, yet has extremely influential engineers, architects and urban designers. Rem Koolhaas and a subsequent generation of architects and urban designers strongly influence trends in design, influencing the future direction of world architecture.

Studying and understanding Chinese cities with a Dutch perspective was the initial goal when I applied to the Ph.D position. Wuhan was chosen as a case to apply the Dutch approaches. Next to its geographical location, economical status, political request, etc (see Part 3 Introduction), the most important reason is that Wuhan is the city where I did my bachelor and master education, worked and where my professional network is. This secures data accessibility as well as the necessary professional collaborations. The eight years professional and personal experience in Wuhan gave me an in-depth understanding of the city.

In this research, the emphasis on the Dutch school is almost a prerequisite. Partly because I, being always a curiosity-driven and internationally oriented person with my Chinese and Dutch education background and working experiences, feel the deep desire and almost the responsibility to bridge the two countries professionally. Partly because the Dutch design does have distinctive characteristics which makes it unique and famous in the international context (see Section 2.4, 3.3, 4.3).

Culture shocks every time back home

Being Chinese, having grown up in China yet lived abroad for six years, allows me to look at the city with a fresh eye. A city I used to be familiar with, but not anymore. I have always been nervous when returning to China from Europe every year. Newly released cars drive on newly built ring roads and highways in the city, high speed trains run through China on the progressively well-weaved railway network, brand new shopping malls host prosperous commercial and social activities located on land that used to be filled with old neighborhoods only a year ago, the old city center is under renovation and a few new city centers are emerging. I could not help wondering: is this still the home country/hometown I am from?

Not only have the physical environments changed dramatically, new technology also changed the Chinese life-style. The WeChat pay is the inevitable element in everyday life nowadays. Chinese people use it to communicate, pay almost every bill (food, petrol, internet shopping etc.), order taxis, buy financial products etc. Almost everything in life cannot carry on without WeChat. The most extreme case is that we cannot even pay by cash or bank card anymore at some places, as the commerce only accepts WeChat pay. Self-driving cars, automation, robotic, etc. all the most trendy and new technology have been implemented tremendously fast in people's every-day life in China. Are we really ready for these new technologies? Does technology really make our life easier and more convenient, or it is the other way around? What are the continuous elements in our life-style and culture that demand attention to avoid vanishing?

Originality of its local people and physical setting vs "Wuhan, different everyday!"

The slogan "Wuhan, different everyday" is everywhere in the city, from the speaker in the subway, to the walls by the sidewalks and on the huge advertisement boards everywhere in the city. It has become a promotion and iconic sign of Wuhan. Yangtze River New Town, Yangtze River Axis, East Lake Green Heart etc. and new concepts are spreading everywhere in social media. Wuhan has the ambition to fly forward towards being an international metropolis. New York, Chicago and Tokyo are always used as reference cities. These projects are shown in beautiful renderings and are designed by well-known architecture firms. I could not help wondering: can these future, well-designed places answer the question: what kind of potential is in this place (Wuhan) that we are standing in?

Walking around in the former concession areas and the old traditional Chinese neighborhoods in Wuhan, the buildings, public spaces and the ways in which people use them are somewhat better than anything designed by architects. They are not explained or promoted by the city of Wuhan, nevertheless they do explain what Wuhan is and where it is from. If we do not label these neighborhoods with "chaos", but see them as a physical representation of the complex urban situation in Wuhan, then maybe we can ask ourselves these questions: what is it about Wuhan? How has the city arrived at such a different place than European modernity while being equipped with the same building technology? What is the essence of Wuhan? If we cannot try to turn these authentic buildings and local public life into resources, then there is no reason to promote anything in Wuhan or in China to the world. Surely at least we can start to think about how to take advantages of them, rather than trying to run away (demolish and destroy them).

Activities while studying in the Netherlands

Alongside being a Ph.D researcher, I am also a guest design-studio tutor at the Chair of Urban Design in the Department of Urbanism, Faculty of Architecture and the Built Environment, Delft University of Technology (TU Delft), the Netherlands. I have been teaching in the Research and Design Studio in the master program of the Department of Urbanism, *City Portrait, Analysis and Design of the Urban Form*, and *Designing Sustainable Urban Environments*. In these two studios, the *morphological approach* and the *pattern language approach* are explicitly appointed to be used as the design methods to approach urban design. The Delft interpretation of the two approaches are embodied in other education tracks in the Faculty of Architecture and the Built Environment, starting from bachelor to Ph.D, such as Landscape Architecture, European Master of Urbanism, and some minor programs. This, in time, forms a tradition and a community, in which people share common design language and thinking.

In addition, during the years of doing research and teaching in the Netherlands, I am also the international design-studio coordinator and guest teacher of the School of Architecture and Urban Planning in Huazhong University of Science and Technology (HUST), Wuhan, China. I have organized and taught in three international collaborative urban design workshops together with Professor Henco Bekkering from TU Delft, Professor WANG Yuan from HUST, and Professor Massimo Clemente, the director of National Research Council Italy. In these workshops, I explicitly introduced the *Delft morphological approach* and *the Delft pattern language approach* and guided students to apply the two approaches in urban design. The students' active participation in the studios and workshops, their inspiring application of the two approaches in the design process and representation of the design products enlightened my research.

I was the international collaboration coordinator of two municipal urban-planning and design institutions in China (Wuhan Land Use and Urban Spatial Planning Research Centre and Changchun Institute of Urban Planning and Design) from 2014 to 2016. This allows me to have access to the timely urban design practice in China as well as to participate in in-depth discussions with the local authorities.

Besides the rich professional experiences during these years, I also participated in many seminars and public lectures, in TU Delft and elsewhere in the world, such as in international conferences and in other institutions in the Netherlands.

The above activities together help me to gain insights, broaden the overall view as well as deepen the understanding of the urban design profession.

Acknowledgements

No doubt, my life in the Netherlands has been wonderful! I have experienced a totally different culture and lived a life here for an entire six years. I went to concerts, enjoyed western music, drank coffee, ate bread, tested out different kinds of cheese, learned how to ride a horse, got up at 4:45 am for swimming training, etc. I appreciate it very much. It was definitely a great decision to fly to the other side of the world and explore, instead of living an ordinary life in China after my master graduation. What an adventure!

Dutch architecture and Dutch architects have always been a mystery for me. Their active participation in the modern architecture movement and their creativity and achievement in not only architecture but in almost all design professions made the Netherlands a wonderland for me. I definitely came for curiosity, the curiosity of Dutch design. Yet, in the end, I have harvested a great bunch of friends and teachers in my life. Neither the great life journey nor the professional study is possible without all of your support and help. I would like to sincerely thank all of you who have been with me in this process!

Dearest Henco, meeting you and having you as my promoter is the best that has ever happened to me. I am so thankful for the fact that you saw my potentials when I was a very inexperienced master student in China who had never written any scientific paper in English and who had never ever been living and studying outside of China. That was the end of 2011. That was my portfolio and one skype interview that convinced you to fight for a position for me in Delft. We both know how difficult it was in the year 2012. I still remember, I was being very bold and claiming "if I come to Delft, you have to promise me that you will give me 100% supervision." Then you answered, "of course, I will give you 200% supervision and support." Indeed, you have kept your promise. You are so experienced in supervising Ph.Ds in not only the content, but also in what to say and when. You have got the most out of me. All these years pushing and pulling, have not only resulted in an impressive book, but most importantly, a me, someone who overcomes all the struggles and becomes an independent thinker. Thank you very much for recognizing me and then shaping me!

Dear Machiel, I was very enlightened by the first two talks we had two weeks before my go/no-go evaluation. Since then, I started 'stalking' you by participating in almost every lecture and workshop you gave to students. I was intrigued by your view on the built environment. It was my great honor that you joined my supervision team in the third year of my Ph.D. I admire your structured thinking and sharp input. Thank you for all the constructive comments and inspiring questions, that keep me thinking and moving forward.

I sincerely thank my very qualified international jury, Professor Han Meyer, Professor Frits Palmboom, Professor Tom Avermaete, Professor Momoyo Kaijima, and Professor Joaquín Sabaté Bel. Thank you for the enormous time you have put in reading my work and thinking with me. I am very grateful for your very constructive, insightful, and illuminating comments which I was more than happy to work with. They have deepened my understanding of our profession and have directed my future. In addition, the fact that you agreed to be in my committee and traveled all the way to make the Ph.D defense was already a big acknowledgment and encouragement for me. You are all leading figures in the profession and have been my heroes. Your presence definitely makes the kick off of my professional career shining!

25-Nov-2018

Rotterdam night

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Summary

The research investigates **How can *the morphological approach* in combination with *the pattern language approach* assist urban designers to achieve historical continuity in *urban design*** both on theory and application levels.

This research overviews the developments and applications of the two approaches worldwide with a special emphasis on the Dutch school. The Dutch morphological reduction technique and the Dutch interpretation of a pattern language are used in the case study—Wuhan, a Chinese city—to study the transformation of urban form and life style. The multi-scalar historical morphological analysis results in an atlas that consists of four series of analytical maps on three levels of scale as well as 13 spatial structuring elements of the city; whereas the public life study results in a pattern book consisting of 20 individual patterns and three pattern languages. The practical implications and relevance for -- the design of -- the future of the city are discussed.

The research is set up in a systematic and symmetrical manner for comparison of and reflection on the two approaches. It concludes that:

1   *The morphological approach* can be used to interpret first space (perceived space) and convey its information into second space (conceived space), whereas *the pattern language approach* can be used to interpret third space (lived space) and convey its information into second space (conceived space).

2   *The morphological approach* has a tendency to work from large scale to small scale and *the pattern language approach* tends to be built up from small scale to large scale, whereas *urban design* works with multiple scales at the same time.

3   *The morphological approach* and *the pattern language approach* provide means for urban designers to systematically recognize historical layers so as to distill the meaning in the physical and non-physical contexts respectively. Consirately adding another layer that contains the contemporary meaning (design intervention) to these recognized layers is the way to pass down and simultaneously generate incremental change in the tradition of the context. This results in historical continuity and thus in permanence in urban design.

4   *The morphological approach*, *the pattern language approach*, and *urban design* are processes in themselves and can be combined into one integrated process.

5   *The morphological approach, the pattern language approach* and *urban design* are characterized by reduction, abstraction, interpretation, and communication.

6   Some properties of the two approaches can be seen as counterparts, because the roles these properties play in the design process tend to be similar:

 — Individual homogeneous areas vs Individual patterns;
 — Structural homogeneous areas vs Anchoring points/ Structuring patterns;
 — Secondary connections in homogeneous areas vs Linkages between patterns;
 — ? / Typology of homogeneous areas vs Clusters of patterns.

Samenvatting

In het proefschrift wordt onderzocht **Hoe *de morfologische benadering* in combinatie met *de pattern language benadering* stedenbouwkundig ontwerpers kan ondersteunen om historische continuïteit te bereiken in *het stedenbouwkundig ontwerp*** op theoretisch zowel als praktisch niveau.

Het onderzoek geeft een overzicht van de ontwikkelingen en toepassingen van beide benaderingen wereldwijd, met de nadruk op de Nederlandse school. De Nederlandse techniek van morfologische reductie en de Nederlandse interpretatie van de pattern language worden in deze studie toegepast in de case study—Wuhan, een Chinese stad—om de transformatie te onderzoeken van de stedelijke vorm en stijl van leven. De morfologische analyse resulteert in een atlas met vier kaartenseries op drie schalen en 13 ruimtelijk elementen die de stadsvorm structureren. De studie van het leven in de openbare ruimte bestaat uit 20 patterns en drie pattern languages. De praktische toepassingen en de relevantie voor—het ontwerp van—de toekomst van de stad worden besproken.

Het onderzoek en het proefschrift zijn systematisch en "symmetrisch" van opzet om de vergelijking tussen de twee benaderingen te vergemakkelijken. Er worden zes conclusies getrokken:

1 *De morfologische benadering* kan worden toegepast om de first space (perceived space) te interpreteren en de informatie daarvan over te brengen naar de second space (conceived space), terwijl *de pattern language benadering* kan worden toegepast om de third space (lived space) te interpreteren en de informatie daarvan over te brengen naar de second space (conceived space).

2 De tendens in *de morfologische benadering* is te werken van de grote naar de kleine schaal en de tendens in *de pattern language benadering* van de kleine naar de grote schaal, terwijl *het stedenbouwkundig ontwerpen* werkt met verschillende schalen tegelijkertijd.

3 *De morfologische benadering* en *de pattern language benadering* leveren stedenbouwkundig ontwerpers instrumenten om systematisch historische lagen te herkennen en daarmee de betekenis te achterhalen van respectievelijk de fysieke en niet-fysieke context. Het bewust toevoegen van een nieuwe laag met hedendaagse betekenis is een manier om de traditie van de context zowel voort te zetten als gradueel te veranderen. Dit resulteert in historische continuïteit en daarmee in permanentie van het stedenbouwkundig ontwerp.

4 *De morfologische benadering*, *de pattern language benadering*, en *het stedenbouwkundig ontwerpen* zijn processen die in één geïntegreerd proces gecombineerd kunnen worden.

5 *De morfologische benadering*, *de pattern language benadering* en *het stedenbouwkundig ontwerpen* worden gekarakteriseerd door reductie, abstractie, interpretatie en communicatie.

6 Een aantal eigenschappen van de twee benaderingen kunnen worden gezien als elkaars tegenhangers, omdat deze een vergelijkbare rol spelen in het ontwerpproces:

— Individuele homogene gebieden versus individuele patterns;
— Structurele homogene gebieden versus Ankerpunten/Structurele patterns;
— Secundaire verbindingen in homogene gebieden versus Verbanden tussen patterns;
— ?/ Typologie van homogene gebieden versus Clusters van patterns.

PART 1 Background

Part 1 contains one chapter which provides context and defines the research. It introduces the challenges, scientific gap, research objective, research methodology, research questions, research contributions and the structure of the dissertation.

1 Introduction

§ 1.1 Background

§ 1.1.1 BUILD, BUILD, BUILD! Against the time pressure and move even faster?

The website, *The Tab*, created a list of professions in February 2017 based on surveys of more than 1,500 students from 41 states in the United States. Architecture major was proven to be the most sleep-deprived major in the United States. *"Sleeping just 5.28 hours a night on average, architects are not only the hardest-working, but also the sleepiest."* (KAPLAN, 2017) In addition, a research conducted by Indiana University's National Study of Student Engagement demonstrates that architecture students, on average spend 22.2 hours a week working on projects, the most time outside of their classes studying, beating out the other professions (Ingalls, 2017). This is not only because the architecture education covers broad aspects that include theory, history, mechanics and structure, physics and materials, construction, hand drawing and fine art studio, and design studio, which demand enormous time and practice, but also because of the nature of design education. It is a learning by doing process which demands *" intensive study, a good deal of trail and error, and years of focused deliberate practice to acquire expert level of performance."* (Curry, 2014) Therefore, I asked myself the question how to work more effectively as a novice designer?

Unfortunately, this lack of sleep does not change after a novice designer grows into an expert designer. Once urban designers work, the issues that they need to work overtime for are far more challenging than the technical ones. Meeting clients' needs and communicating with different professions as well as laymen are the predominant tasks designers have to do during the day, while they can only work on the design in the evening or in the night. In 2017, the sudden deaths of several young architects, who were born in the late 80s, occurred due to the long and intensive working hours in China. Therefore, the question remains, how to work and communicate more effectively?

Not only the profession itself, but the constantly changing domestic and international environment also raises challenges for designers; one example is the enormous amount of work under extreme time pressure. Professor Klaus R. Kunzmann (2017) listed *time pressure* as the top of eight challenges faced by Chinese local governments and urban designers in their daily work (Kunzmann, 2017). Chinese cities have been expanding since the early 1980s and have been experiencing unprecedented large-scale and high-speed globalization, modernization and urbanization. China becomes a society that is always on standby and a place where time is never enough. A shared characteristic of urban planning in China is that it prioritizes economic development, which pushes the rapid urbanization as the top political task (Zhang & Zhou, 2014). Market-oriented policies, the development of new technologies, the pursuit of efficiency and competitiveness has accelerated the pace of urban life and work. Therefore, city expansion, infrastructure development and urban renewal projects, have to be completed in a very short period of time. There is no time to learn from successful international projects substantially, reflect on the previous realized projects, conduct research on the undertaken

projects, or systematically build local designers capacity; there is also not much time to invite public participation, including local inhabitant, private sector, commercial entrepreneurs, and new city immigrants, in the design process (Kunzmann, 2017). All the responsibilities and workload fall on the designers' shoulder.

Furthermore, the newly published *The State of China's City 2016/2017* indicates the current Chinese urbanization rates exceeds 56% and the Chinese government has no intention to slow down and even makes more ambitious plans to transform the China development model overseas, such as to Southeast Asian countries and the least developed counties (Qizhi, Yisheng, & Nan, 2017). In the two newly released reports by United Nations Conference on Trade and Development—— *the World Investment Report* and *the Least Developed Countries Report* in 2017, the US remained the largest investor worldwide, however, China remains the largest investor in the least developed countries, far ahead of France and US (United Nations Conference on Trade and Development, 2017a; 2017b). The Chinese government states that this outward investment will stay at a high level, because the country pushes forward the *One Belt and One Road Initiative*[1] and international industrial capacity cooperation. The above implies that Chinese urban planners and designers have been and will be facing unprecedented challenges. They not only have to understand the constantly emerging new urban mechanisms and seek balance among stakeholders under the strict rules and regulations of the government or in the international context, but they also constantly need to cope with the changing environment often under extreme time pressure.

If the lack of sleep in the student era can be solved by effective design education "*introducing a specific model, methodology or methodologies to design students at progressive stages, as a teaching strategy*" (Curry, 2014, p. 644) and "making explicit" (van Dooren, Boshuizen, van Merrienboer, Asselbergs, & van Dorst, 2014, p. 53), the time pressure that expert designers are against demands systematic design approaches that assist them to be as objective and precise as possible, to have a relatively precise and fast start and grip on new emerging topics in the constant changing situation nowadays, to be efficient in communication with other professions and laymen.

§ 1.1.2   **Reclaim the losing local identity and the right of margined urban population**

The above-mentioned fast urbanization pace not only leads to extreme pressure on designers, but also results in losing identity in the built environment and loss of the margined group of urban population's rights.

The loss of urban identity based on historical areas and buildings is caused by a few large-scale urban redevelopment policies with different purposes. One of the main causes in China was the Shantytown Redevelopment Project that began in 2008. It is a State-Led Redevelopment of Declining Neighborhoods that aimed to improve the living conditions of low-income residents in the city as well as stimulate the depressed housing market (Li, 2018). The scale and consequence of the project is massive and substantial. Since 2008, in four years, approximately 12.6 million households were affected and the corresponding old inner city neighborhoods, danwei communities, and urban villages

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[1]   The Belt and Road development is also known as the Silk Road Economic Belt and the 21st Century Maritime Silk Road. It is a strategic plan and development proposed by the Chinese government to enhance the connectivity and cooperation between Eurasian countries. It consists of the land-based Silk Road Economic Belt and the ocean-going Maritime Silk Road.

were demolished (He, Wu, Webster, & Liu, 2010; Liu & Wu, 2006; MOHURD, 2013). The inhabitants involved in these projects were mainly forced to move to the relocation neighborhoods built by local governments, sometimes this relocation was onsite, but most of the time it was outside of the city (Li, 2018). In 2013, a second round of large scale Shantytown Projects was initiated by the central government and aimed to displace around 10 million households (Li, Kleinhans, & van Ham, 2017; The State Council of PRC, 2013).

In parallel with the redevelopments aimed at improving the living conditions of low-income urban populations, an enormous amount of projects were elaborated on to achieve economic success and create international branding for cities. Cities in China became increasingly aware of the need to take a position in the globalized economy, and therefore have embarked on prestigious developments in order to achieve these goals; such as new central business districts (CBDs), regenerated inner city historical areas, waterfronts, business hubs for finance, high-tech industrial parks, high market level neighborhoods. However, these projects eventually lead to a generic city and gentrification with little attention for the marginalized urban population. Both redevelopments have not only resulted in tremendous loss of old urban tissue, but consequently also loss of social structures.

The inhabitants involved in these projects are often low-income, aged, less skilled, or have mental or physical problems (Fried, 1963; Gilroy, 2012; Manzo, Kleit, & Couch, 2008; Popkin et al., 2004; Posthumus & Kleinhans, 2013). Often, they have lived in these neighborhoods for generations and have developed strong bonds with the physical and social settings. "*These homeowners cleverly mobilize local resources, such as strong social bonds among homeowners, low living costs, flexibility on space usage and good neighborhood location to cope with their life constraints, which is translated into their strong neighborhood attachment*" (Li, 2018, p. 105). Unfortunately, the demolition and relocation is threatening to this marginalized urban population and leads to tremendous changes in their daily life and living strategies (Manzo et al., 2008; Popkin, 2010; Vale, 1997).

Fortunately, the awareness of the value of a local identity and the value and meaning of continuity is growing. This is based on both physical aspects, urban patterns and historical buildings, and intangible cultural aspects, people's everyday life and their bond with the environment.

Chinese scholars have not only researched the meaning of Chinese traditional space in relation to Chinese philosophy, but have also experimented with the Chinese conception of space in practice. For instance, the following are several notable figures who have participated in this discussion: Professor Heng Chye Kiang, Professor LI Xiaodong, Professor WANG Yuan, Professor LONG Yuan and Professor XU Leiqing[2].

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2   Professor Heng Chye Kiang from the National University of Singapore wrote the book 'Cities of Aristocrats and Bureaucrats' (Heng, 1999), to explain the urban form of old Chinese cities and initiated symposiums to explore Asia-based networks, ideas, and results of research projects that focused on Asian cities (2010). He also chaired international student design competitions working on Asian cities to experiment possible solutions for Asian centric problems. LI Xiaodong is currently a professor at Tsinghua University. He completed his Ph.D in TU Delft with Professor Alexander Tzonis and afterwards worked at the National University of Singapore. His books (1991; 1993; 2002; 2010) and practice, especially Yuhuwanxiao, were written and implemented based on an in-depth study and systematic research in Chinese philosophy and traditional space. Professor WANG Yuan and LONG Yuan and their research group at Huazhong University of Science and Technology have been researching informal public spaces in Wuhan, including traditional Chinese settlements and former western concessions. Since 2010, Professor LONG Yuan became the dean of the Architecture School in Huaqiao University and had established his research team there to study the informal settlements in Quanzhou and Xiamen. Professor XU Leiqing and his Environment Design Research Lab at Tongji University researches about environmental behavior and endorses microscale interventions.

Together, they show an awareness and initiative of taking care of the traditional and existing conditions in the Chinese context. Their work draws significant attention and is used as a reference for emerging researchers and practitioners who would like to work with the local 'context' while taking care of local inhabitants. However, their efforts are (almost completely) invisible in the fast expanding areas of Chinese cities. This is evident even in the transformations or so-called 'restorations' of existing urban areas. Furthermore, most of their work ranges from a purely theoretical level or if used in practice, are at an architectural or district scale. There is still a need to systematically understand cities as a whole; physically and socially. So the questions remain:

How to distill the underlying determined elements in urban form and in people's everyday life? How can these elements be translated into design languages? Is there any design approach that assists urban designers and decision makers in making responsible choices regarding urban transformation considering the physical and non-physical aspects? The above questions are important because successful implementation of these continuous elements in the city are of value to the inhabitants and can be of historical value for, the future of, the city, also in an economic sense through the attractiveness of a recognizable and meaningful local identity.

§ 1.1.3   Necessity of integrated design approaches

Pattern recognition is one of the basic capacities of human mind (Haken & Portugali, 1996). This capacity is one of the advantages humans have to adapt and change our environment. The human brain abstracts causes and effects, and documents recurring solutions obtained in different circumstances in order to understand the structure and underlying principles of the surrounding environment (Salingaros, 2008). In time, people not only learn to counteract the difficulties in life based on existing solutions but also combine different solutions to deal with more complex problems.

Though recent researches claim that designers have their own ways of thinking and communicating, (Cross, 2007; Curry, 2017) in a general sense designers as human beings still share this way of working in the design domain. For example, designers construct their "solution library" based on the experiences gained from previous projects; or the information from trips on which they learn from many successful environments; or books and journals, etc. They search for solutions in their mind to make references for a design commission they are facing. Although these phenomena are known among designers, the knowledge of the essence of a "designerly way of thinking" and how designers approach design is generally rather implicit.

Design studies progressed significantly since the Design Methods Movement in the sixties in the last century. Design theory and methodology in the architecture and industrial design domain has been elaborated on remarkably because of the sophisticated development of design studies. However, little attention was given to the urban design domain (Curry, 2017; Çaliskan, 2012). Çaliskan made a step further in the urbanism domain regarding design thinking. He reviewed the concept of the design process through the lens of cognition and renewed the conventional inductive approach and technical-rationalist-approach model to a self-reflective approach model. Then he tested his model in two urban design projects conducted by one expert designer and a beginning level designer respectively. The design reasoning in action is revealed in the analysis in particular. The method he used to conduct the analysis is based on in-depth interviews with the designers and evaluation of original drawings, which were made during the design process. However, his research focus was not how designers use certain approaches to design. Besides, his analysis is based on the designers' memories (interviews) and their

drawings, a so-called "afterwards analysis" instead of real time observation and self-reflection during the design process.

Standing upon Çaliskan's research, aiming to also contribute to the study of design thinking in the urban design domain, this research seeks to understand how designers can use design methods[3] towards urban design and how design methods influence the design process. Among others, *the morphological approach* and *the pattern language approach* are relatively explicit and well developed in the urban design profession.

§ 1.1.4 Morphological approach, pattern language approach and urban design

The morphological approach encompasses a long tradition of studying urban forms. It originated from Italy in the 1960s and developed further around the world (Moudon, 1997). The International Seminar on Urban Form (ISUF)[4] is an international organization for researchers and practitioners in the field of study of the urban form (see Chapter 3).

Co-evolving with the morphological studies since the 1960s, design and planning professions also paid attention to sociology and environmental psychology. Person-environment relation research, investigating how people use, like, or behave in a given environment, has become a bona fide part of the architecture and urban design domains (Moudon, 2003). The pattern language introduced by Christopher Alexander is an efficient tool to relate the use of space to physical urban forms (see Chapter 4).

The above two both possess a long tradition and were developed around the world into different schools with their own interpretation and characteristics (see Section 3.2.2 and 4.2.2). The two seem to have totally different cores, starting points and mechanisms. *The morphological approach* deals with physical forms and initially gains information from maps and tends to work from large scale to small scale. The other, *the pattern language approach*, deals with how forms are used by people and initially gathers information from direct life experience and tends to work from small scale to large scale. In addition, *the morphological approach* seems more scale dependent and the other, *the pattern language approach,* seems more time dependent.

Are there any similarities between the two approaches? If so, what is the discrete yet related relationship between *the morphological approach*, *the pattern language approach* and urban design? What roles can *the morphological approach* and *the pattern language approach* have in the urban design process?

The two are often used implicitly in the urban design process. No explicit research has proposed to combine the two or discuss the possibilities of this combination. Though the two approaches were introduced to China in the last decades, the reflection on the design approach and design

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[3] "*Design methodology is understood as the overall process leading to a design solution, whereas design methods are specific strategies used during the various stages of the design process.* " (Curry, 2014, p. 632)

[4] ISUF is based in Great Brittan. It was inaugurated in 1994, bringing together urban morphologists worldwide. It seeks to advance research and practice in fields concerned with the built environment. Members are drawn from several disciplines, including architecture, geography, history, sociology and town planning. http://www.urbanform.org/

thinking level are hardly addressed in Chinese urban design academia and practice. For the sake of curiosity and the desire to explore an integrated design method to relate urban form and public life to achieve historical continuity in urban design, the author and Professor Henco Bekkering together with Professor WANG Yuan in Huazhong University of Science and Technology in China conducted a collaborative urban design workshop in 2014 as a first attempt.

§ 1.1.5 A first attempt in an eight-days collaborative urban design workshop

In order to investigate the role of *the morphological approach* and *the pattern language approach* in a collaborative design[5] process and the relation between the two different approaches towards urban design, an eight day urban design workshop[6] with sixteen students was setup. Students were asked to elaborate an urban design to improve the current built environment of the former British Concession in Wuhan, P.R. China. The background of the participating students was architecture, urban planning and landscape architecture. The students with different backgrounds were divided evenly in four groups. Two groups were appointed to use *the morphological approach* in the design process, while the other two groups were appointed to use *the pattern language approach*. One student in each group was nominated as a research observer to record the whole design process. The analysis of the role of *the morphological approach* and *the pattern language approach* was conducted based on real time observation of the design process, on the designers' survey and semi-open interviews at the end of the workshop as well as a comparison of the design processes and the achievement of design outcome between different design groups.

The research outcome reveals both methods' advantages and disadvantages. For instance, the "vagueness" property of *the pattern language approach* (ambiguity) leaves room for designers to negotiate. In addition, the fact that each pattern has a "name" makes it easier for designers to grasp, manipulate and communicate with co-designers. Because names imply meaning and the underlying line of reasoning a rationale can be shared or debated. Thus, the openness and the underlying logic in names help designers to communicate more efficiently and makes it easier to reach certain decisions regarding the framing of the design problem or to elaborate design strategies (in the beginning phase when flexibility is needed). However, *the pattern language approach* might be too abstract to ground the design in a concrete manner, which results in difficulties in the design phase. Whereas, *the morphological approach* tends to lead to a better spatial hierarchy in the design outcome, which can be explained by its difference of working through scales.

Though the workshop did bring some interesting and meaningful insights, there were obvious limitations. First, due to limited samples, the students' individual design capacity could be a main factor to influence the research outcome, despite the actual properties of *the morphological approach* and *the pattern language approach*. Second, the average age of the participating students was 24 and most of them only had internship experience in practice. Further discussion with expert designers

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[5]   The basic understanding of design differs. The conventional opinion to see design as problem solving has been challenged by emerging debates. Salustri and colleagues (2009) propose that designing can be considered as an act of balancing a situation. To avoid a complex debate about the underlying nature of design, and to avoid misunderstanding and misleading the students in the first place, this research takes the general and common opinion to see design as a way to solve concrete problems in the environment.

[6]   The result of the workshop is published and presented in the 3rd Future of Places conference in Sweden. Please see the paper Thinking in forms as well as patterns at (CAI, 2015).

could help establish emerging results more strongly. Third, the duration of the workshop was rather short. Students did not have time to play with the elements of the urban fabric, to compose, to experiment, to get a feel for using the methods before undertaking the formal design. Forth, the students' understanding of two approaches is rather limited, therefore a systematic set up to compare the two approaches through sophisticated scientific researches is needed.

§ 1.1.6   Designerly way of thinking and reasoning

The discussion about design and design research deserving a place in academia has been going on for some time under deliberation for a long period of time. Since the 1960s, Herbert Simon, a psychology professor at Carnegie-Mellon University in Pittsburgh and Nobel Prize winner for economy in 1978, claimed in The Science of the Artificial (1969), as referred to by Johnson (2015):

[-] few scientists today know anything about design as a process for understanding, creating and managing complex systems; but by the end of this century [-] design will be required study for complex systems science, alongside mathematics, statistics, computation?and other core topics. Many of the systems that we find hard to understand are socio-technical - systems of systems - with tightly coupled physical and social subsystems. Most of these systems are artificial, meaning that they are in part or whole man-made – they are designed.

(Johnson, 2015, p. 193)

Presently, universities have realized that in order to connect to society and have a real impact, in addition to the technical complexity that hard-core science and engineering are dealing with, design has the capacity to create bridges between the powers of technique and society. However, design has been criticized as being ambiguous in the realm of academia and design practices are also not well integrated (Dorst, 2013). Though Professor Kees Dorst from the University of Technology Sydney is working in the field of industrial design, it is most obvious in the domain of architecture and urban design, where design practice and research seem to ask for different skills and work towards different kinds of outcomes than academia usually expects. Even within the profession—and the education—of urbanism,

there exists rather a tension regarding the requirements for research between on the one side the designerly approach and on the other the planning approach. The last tends to hold onto the classical criteria for scientific research, combining the approaches in the natural sciences with empiricism, and is focused on finding and constructing proof of the answer to a research question. This is different from what I and most of my design-oriented colleagues call the designerly way of thinking

(Bekkering, 2014, p.17)

What is the essential difference between design research and research in general? Dorst (2013) clearly explains the difference between design research and scientific research by clarifying the underlying reasoning patterns of: deduction, induction, normal abduction and design abduction (Figure 1.1). The model consists of simple equations that compare different settings of knowns and unknowns. The 'what' refers to the elements in a problem situation, the 'how' refers to the 'pattern of relationships' or the laws, methods and principles, and the outcome refers to the result of the particular reasoning process (Dorst, 2013)
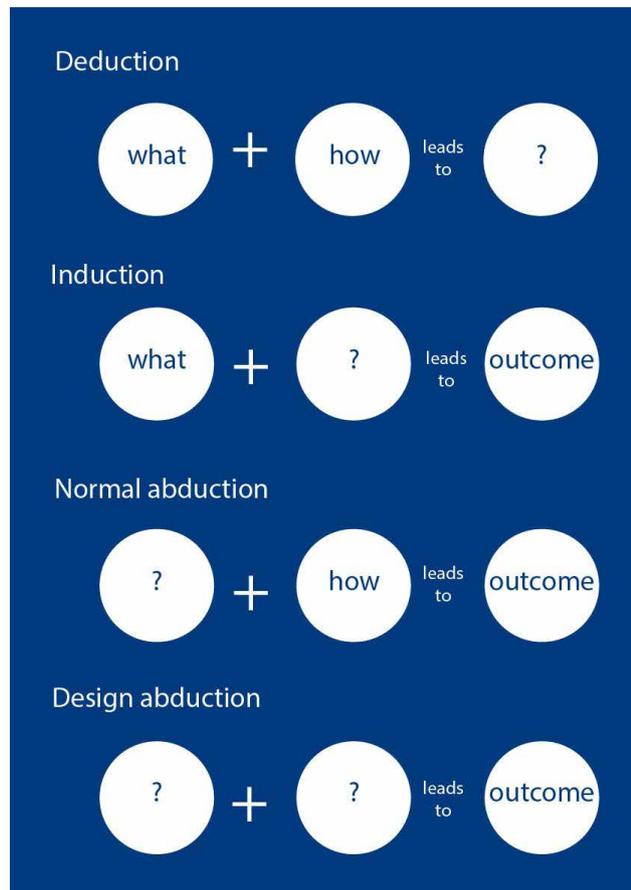
FIGURE 1.1 Four basic types of problem solving challenges that lead to different patterns of reasoning: deduction, induction, normal abduction and design abduction (Dorst, 2013)

The difference between abduction and the two types of reasoning, deduction and induction, is that science usually applies the unknown 'what'. Abduction requires the creation of new elements together with the 'how', the mechanism in the system, to lead to a desired outcome. Yet, there is also a difference between normal abduction (mainly the reasoning in engineering) and design abduction (in the design profession). In design abduction, the "how" is also unknown. We only know a somewhat vague desired value (outcome) that we would like to achieve, but we do not know what to create and we do not know how to create it. Therefore, in design, we need to think backwards.

The central challenge of design, which is design abduction: how to think from consequences (e.g., a need to be addressed, or a value to be attained) back to causes (the designed objects, systems, services) and working principles (the way things work, as well as the way they need to be used/enacted to achieve functionality).

(Dorst, 2015a, p. 24; quoted also by Houkes, Vermaas, Dorst, & De Vries, 2002; Roozenburg & Eekels, 1995).

In addition, the complexity of reasoning increases when there is a growth in the number of unknown factors. In design abduction, the 'what' and 'how' both are unknown and they become dependent on each other. When figuring out 'what' to create to solve the problem, there is no certainty of 'how' we can accomplish the desired value (outcome). Even if we have figured out one combination of 'what'

and 'how', we will start to doubt if there is another more effective combination of 'what' and 'how'. Then another round of reasoning and testing starts (Dorst 2011; Dorst 2015b).

Dorst (2015a) calls this constant doubting and experimentation, the act of "*constantly proposing a hypothetical way of looking at the problem*", "*framing*". Dorst considers this 'framing' as the key element of design abduction. Thinking backwards, from the only vaguely 'known', the desired value (outcome), to a constant adapting and optimizing combination of 'what' and 'how' that is effective towards solving the problem (Dorst 2011; Schon & Wiggins, 1992).

Learning to design requires learning by doing. Overtime, designers will slowly develop an 'intuition' based on previous experiences and through the exploration of different and possible combinations in the problem field. Intuition will help designers to make decisions in the relatively early phase of the design process before they dive more in detail (Dorst & Cross, 2001; Curry, 2017).

Designerly way of thinking and reasoning in this research

This research applies the designerly way of thinking and reasoning. The desired value (outcome) is to achieve historical continuity in urban design. The 'what' we are working with and 'how' we can do it is unknown. From previous research and professional experiences (the developed 'intuition'), the 'what' can be urban form and the corresponding 'how' can be the historical morphological approach; whereas the 'what' can also be public life and social structure and the corresponding 'how' can be the pattern language approach. Both the techniques and the subjects of the two types of analysis are interrelated. The research thinks backwards, from the desired value (historical continuity in urban design), back to the causes (urban form and public life) and the working principles (the morphological approach and the pattern language approach). Then, on a more abstract level, it discusses the values and effectiveness of these two combinations of 'what' and 'how' and explores how these two combinations complement each other and how they can be combined. This research makes explicit the designers' constant doubting and questioning: the design thinking.

Therefore, the 'doing' is the most important. The actual doubting, testing out, experimenting and reflecting can only be done while actually applying and doing it. Therefore, by the nature of design thinking and reasoning, Part 3 of this dissertation is the main part of the research. Part 2 Theories and practices, Chapters 2, 3, 4 and 5, provides an overview of the three fields: urban design, morphological approach and the pattern language approach. Part 2 is also intended as the background for the case studies in understanding historical continuity mentioned in Part 3.

Indeed, back to Professor Henco Bekkering:

[--- the] designerly way of thinking, that in addition applies creative, inductive and abductive thinking and the associative and interpretative combining of ideas in new ways, and in which the steps of the argument can rely on probability without delivering proof beyond all doubt. It works from images, real or in the mind; it is literally 'imagined'. The intention, and the value, lie in the furthering of the argument, and may even partly be based on intuition.

(Bekkering, 2014, p. 17).

Research design, research questions and corresponding methods

This dissertation intends to investigate the essence and the application of *the morphological approach* and *the pattern language approach* in urban design, thereby assisting urban designers to work more efficiently to achieve historical continuity in the urban design process.

The main research question is:

How can *the morphological approach* in combination with *the pattern language approach* assist urban designers to achieve historical continuity in urban design?

In order to answer this question, some underlying understanding of the profession is needed. Therefore,

Sub research question 1:

Why is it necessary to preserve historical continuity in urban design and how can it be achieved? (Chapter 2)

Some background questions are formed that are elaborated on in the corresponding sections in Chapter 2.

1   What is *urban design*? (Section 2.2)
2   What is historical continuity in urban design? What are the inevitable components of historical continuity? (Section 2.3)
3   What are the characteristics of Dutch urban design? (Section 2.4)

Methods: Review of literatures and urban design practice are used to answer the above background questions in Chapter 2 in order to set up the theoretical basis and provide a professional conviction for this book.

Then the research goes to the two approaches respectively. In order to compare the two, *the morphological approach* and *the pattern language approach*, the research is set in a symmetrical manner at both the methodological level and application level. The sub research questions, background questions and therefore the corresponding sections in each chapter are set symmetrically to facilitate comparison and reflection.

Sub research question 2:

How is *the morphological approach* used in the urban design process? (Chapter 3)

Some background questions are formed that are elaborated on in the corresponding sections in Chapter 3.

1   What is *the morphological approach*? What are the developments and application of it in different contexts? (Section 3.2)
2   What are the characteristics of the Delft morphological approach? (Section 3.3)

Sub research question 3:

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How is *the pattern language approach* used in the urban design process? (Chapter 4)

Some background questions are formed that are elaborated on in the corresponding sections in Chapter 4.

1   What is *the pattern language approach*? What are the developments and application of it in different contexts? (Section 4.2)
2   What are the characteristics of the Delft pattern language approach? (Section 4.3)

Method: Review of literatures and urban design practice regarding the two approaches all over the world, participation in seminars and public lectures, critical reflections on author's previous teaching, and design practice experiences are used to reflect on the two approaches and investigate the characteristics of the two approaches.

Insights gained from above three chapters are summerized in Chapter 5 and applied further in the case study: the application of the two approaches in two researches: *Mapping urban form transformation in Wuhan* and *A pattern language of everyday life style transformation in Wuhan*.

Chapter 6 gives a general introduction of Wuhan.

Method: literature review.

Sub research question 4:

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How can *the morphological approach* assist urban designers in the urban design processes to achieve historical continuity? (Chapter 7)

Some background questions are formed that are elaborated on in the corresponding sections in Chapter 7.

1   How to use *the morphological approach* to analyze the physical urban form in Wuhan? (Section 7.2)
2   What are the urban form transformations of Wuhan on different scales (Metropolitan area scale, Inner city scale, Hankou riverside scale)? (Section 7.3)
3   What are the spatial structural elements of Wuhan on these three scales? What are the practical implications of the spatial structural elements? What are the spatial characteristics of Wuhan? (Section 7.4)

The methods of the mapping research consisted of review on literature and maps[7], the actual mapping itself[8], in-depth field trips[9] to observe the city, workshops[10] and seminars[11] with local and external authorities, collaborative workshops with local universities[12], and a public lecture and afterwards discussions[13] with the general public of the city. The intensive discussions with experts from various fields and the students and professors from local universities have further deepened the understanding of the city, which has been integrated in the research.

Sub research question 5:
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How can *the pattern language approach* assist urban designers in the urban design processes to achieve historical continuity? (Chapter 8)

Some background questions are formed that are elaborated on in the corresponding sections in Chapter 8.

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[7] Next to the general literatures about Wuhan history and culture, the main body of data in this research is different kinds of maps. Please see Section 7.2.3-1

[8] *Mapping* is used as a tool to analyze the spatial characteristics, present the physical forms and their transformations and distill the spatial structural elements. For more in-depth description of the mapping method please see Section 7.2.

[9] Of course, not everything can be read clearly from maps, such as infrastructure boundaries, wetland buffer zone and urban villages both in the inner city as well as in the metropolitan area, etc. Together with the WLSP team, four two-day excursions by car was done at different phases of the project. This was intended to gain more direct experience with the city, and understand the invisible and unclear elements in the maps.

[10] Working sessions, in person as well as online video communication, with the project team of Wuhan Land Use and Urban Spatial Planning Research Centre were organized. The content was mainly discussions on data availability, research framework as well as preliminary research. The WLSP team also provided many insights of local planning policies and social economical transformations.

[11] Three seminars with diverse expert teams were organized to discuss and reflect on the preliminary research of the Mapping Wuhan project. The expert team consisted of the Vice director of Wuhan Planning Bureau LIU Qizhi, Vice director of Wuhan Land Use and Urban Spatial Planning Research Centre HUANG Huhuan, Associate professor of Chinese University of Hongkong Dr. Hendrik TIEBEN, Professors of Huazhong University of Science and Technology Dr. WANG Yuan and Dr. WAN Yanhua, Professor of Wuhan University WANG Guo'en, Urban designer and partner of well-known Chinese practice Urbanus LIU Xiaodu, and the director of international collaboration department of WLSP CAO Dawei.

[12] Besides the workshop mentioned in Section 1.1.5, another two workshops were organized. One was an eight-day international collaborative workshop between TU Delft and HUST, October, 2015: *Mapping Hankou Riverside—Analysis and Design of the Urban Form.* 21 Master students with architecture, urban planning and landscape architecture background from the School of Architecture and Urban Planning of HUST were supervised by Professor Henco Bekkering, CAI Jiaxiu and Joran Kuijper of TU Delft and Professor WANG Yuan, LI Shasha and CHEN Lijing of HUST. The students with different backgrounds were divided evenly in four groups to work around four themes: *open city, city as landscape, typo-morphology* and *city as a complex system* on Hankou riverside (the third level of scale area in the Mapping Wuhan project). As a result of the insights and in-depth understanding gained during the exploration with students, the workshop directly contributed the draft of the categorization of different types of homogeneous areas in Hankou riverside. (see Section 7.4.3) Urban Knowledge Network Asia (UKNA) funded another workshop and the author was appointed by UKNA to conduct research and teach in the School of Architecture at Tianjin University from October 2015 to March 2016. Together with Professor XU Zhen, the vice dean of the school, the author conducted a workshop with 16 third year architecture bachelor students on applying morphological approach in a national design competition. Applying the approach in another Chinese city, Tianjin, broadens the Chinese context where the method is applied in.

[13] On March 16th, 2016, Professor Henco Bekkering and the author presented the final results of Mapping Wuhan to more than 300 local urban planners and architects and the general public of the city. The interaction with the citizens and the input about their personal experiences in the city added another layer to our understanding of the city.

1   How to use *the pattern language approach* to represent the everyday life style in the Hanzheng street area in Wuhan? (Section 8.2)
2   What are the representative individual patterns regarding the everyday life transformation? (Section 8.3)
3   What are the pattern languages of everyday life in the Hanzheng street area? What are the practical implications of the languages' properties? What are the everyday life characteristics of the Hanzheng street area? (Section 8.4)

The methods of the pattern language research consisted of literature review[14], collaborative workshop[15]s and education[16] with the local university, public lectures[17] and discussion afterwards with students and local planners, and in-depth onsite investigation of local life consisting observations[18]

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[14]   Next to the general literatures about Wuhan and Chinese history and culture, the main body of literature in this research is the group of published master theses from the Urban Environment Research Centre led by Professor WANG Yuan and Professor LONG Yuan, in the School of Architecture and Urban Planning of Huazhong University of Science and Technology/HUST in Wuhan. They are shown in the pattern book (see Section 8.3).

[15]   The workshop mentioned in Section 1.1.5 was not only set to explore the role of *the morphological approach* and *the pattern language approach* in the urban design process, but also to look for design strategies to boost the former British Concession in Wuhan, where the old traditional form and traditional life style has not disappeared yet. In the workshop, a special focus was set to explore the ways to apply the pattern language approach and the representation of individual patterns and pattern language. Correspondingly, the local people's everyday life was explicitly required to be discussed and explored.

[16]   The serials of collaborative international workshops mentioned above are a mandatory part of the master program in the School of Architecture and Urban Planning in HUST. By participating these workshops, students gain credits to complete their master education. These workshops were designed, organized and taught by author, together with Professor Henco Bekkering and Professor WANG Yuan, intentionally applying the Dutch approach in the Chinese context. In addition, the author also assisted Professor WANG Yuan to supervise master thesis in HUST. One of them is *Research on Micro Vertical Urban Space, take the Jinchang Building in Hanzheng Street as an example*. The research extensively studies the inhabitants' use of space in the Jinchang building complex to explore design strategies for big building transformation in the area. Incorporating these education activities in this Ph.D research not only assisted the author to gather research data and gain insights, but also working closely with students allowed the author to test and reflect on the performance of the two design approaches in the design process.

[17]   Together with Professor Henco Bekkering, the following public lectures were given in HUST towards a general audience from the city, including students and local planners and designers: *Radical Conceptualism, Morphological Analysis and Urban Design, A Pattern Language and Urban Design, the Sources of the Imagery of the Guanggu Shopping Mall in Wuhan*. Next to introducing the knowledge of Dutch design approaches, some of the lectures were also followed by hands-on workshops that instructed the participants to actually apply these approaches in some small exercises. These together have directly contributed to the reflection and understanding of these two approaches in this research.

[18]   The observation of the local life in Hanzheng street area and in Wuhan is a continuous activity dating back to 2005 when the author was a third year architecture bachelor student in HUST. Till the end of her bachelor study in 2008 (the accredited architecture bachelor education in China is five years), every year there was a design studio that focused on the Hanzheng street area or the concession area in Hankou. The author went to the site, took pictures, talked to the inhabitants, and tried to understand their basic needs in life so as to provide design strategies for the design studio. Back then the observation was somewhat intuitive and prerequisite. In fact, before going to the site, the author already had a design concept based on which the observation was made. In other words, the author was looking for inspirations and aspects that she was hoping to use in design. It was a design goal oriented observation. Then the author had the privilege to start her Master of Science in Architecture Theory and Design under the supervision of professor WANG Yuan, who had had conducted research on the Hanzheng Street area with his research team for 4 years, in 2009. In the three years master program, all the exercises done in the studio as well as the research raised up to a more methodological level consisting of more systematic structured observation. For instance, the author structured the observation considering the differences regarding weekdays/weekend, the weather (sunny, rainy, etc.), seasons (spring to winter), days/nights, and groups of people (men/women/kids/elderly people). The results of these researches were partly exhibited in the 12th Venice Architecture Biennale, and partly published in her maser thesis in Chinese language as well as in English in a conferencing proceeding (CAI & LI, 2012). Since 2012 September, the author started her Ph.D in the Netherlands. Next to working in the mentioned workshops with the students on the site, the author also went to Wuhan every year on her own to observe, talk to the inhabitants, and to record any changes. The goal is to check what has changed and what has remained in people's everyday life; then talk to the inhabitants and try to understand why. As such, the observation in this research regarding people's everyday life has been continuous and going on for 13 years. This continuous observation made it possible to show the life style transformation in individual patterns. (see Section 8.3)

and open interviews[19]. The combination of collaborative exploration with the local university on site as well as the author's own personal and professional experience in Wuhan has directly contributed the basic data and input, based on which individual patterns are developed.[20]

Then, the insights gained from the above research synthesize the two approaches and answer the main research question in the end of the dissertation.

Writing was considered as an additional method in this comparative research. By setting up the whole dissertation in a symmetrical way, every section in one chapter has a counterpart in the other chapter that addresses the other approach. In addition, thinking and writing in the same style helps the author to reflect and compare the two approaches along the writing process. Writing has developed gradually during the whole Ph.D process, in working sessions and discussions with the promotor, co-promotor, and colleagues. The research also considers visual representations (maps, diagrams and sketches) to have the same importance as written texts in presenting the findings of the research and indicating possible solutions in design practice.

§ 1.3 Outline of the dissertation

This dissertation is organized into four main parts: (1) background, (2) theories and practices, (3) case studies, (4) synthesis and outlook (Figure 1.2).
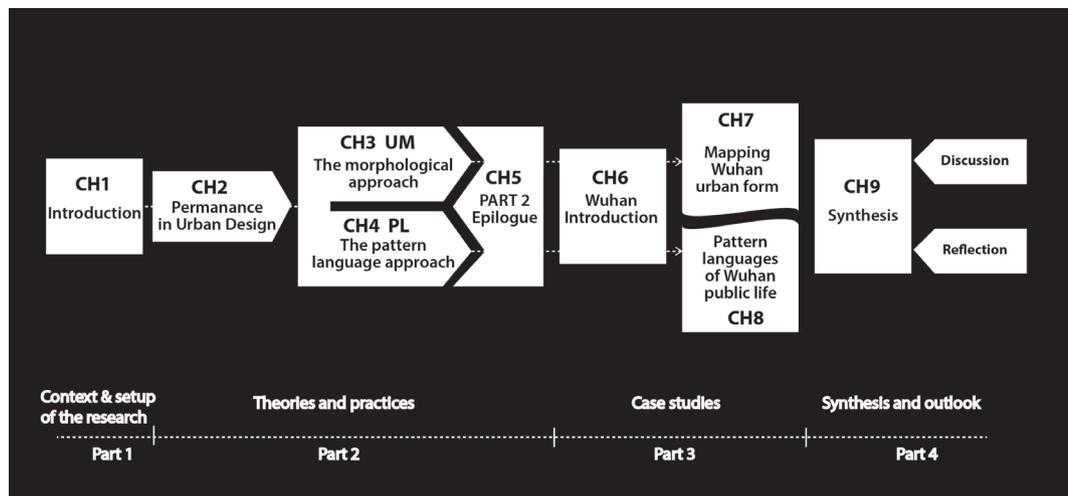
FIGURE 1.2 The structure of the dissertation

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[19]   "*Interviews are useful for investigating complex behaviors, opinions and emotions and for investigating a diversity of experiences*". (Longhurst 2010, p. 113). Especially in this research, it is an effective way to gain insights of inhabitants' everyday life regarding occupation, daily routine, habitats, and changes in life, which are rather informal and scarcely documented in any official documents. The author tried to be involved in the local communal activities and chat with them. This is to avoid inaccurate information. After all, the current exclusive urbanization model made most of the inhabitants alert and cautious about what to say to a stranger.

[20]   *A Pattern language* is used to organize information and present the everyday life transformation and its structure. For more in-depth description of the pattern language approach please see Section 8.2.

The first part sets the scene:

Chapter 1 is an introduction. It presents the background of the research, the research design, the research questions and corresponding methods, and the outline of the research.

The second part sets up the context, give an overview of the state of art in the three fields the dissertation pulls together: *urban design*, *the morphological approach* and *the pattern language approach*. Part 2 is intended as the background for Part 3 Case studies: understanding historical continuity.

Chapter 2 provides a professional conviction as a background for this research. It defines and understands urban design by discussing its differences from urban planning and architecture. It further introduces historical continuity and explores its inevitable components in urban design. In the end, a stand on the Dutch approach is specified.

Chapter 3 reviews the development and application of *the morphological approach* in different contexts. It starts with the three traditional schools: Italian, French and British. Then the Delft reduction drawing and layer approach is introduced. American interpretation and application is explained after that. This systematic way to study urban forms has been introduced to China in the last decades. The comparison between different schools is summarized. Then the characteristics and examples of the Delft approach to design and analysis are elaborated. The meaning of morphological approach to architectural and urban discourses is demonstrated. At the end, the relevance of the Delft approach to China is specifically explained to set up the basis for the case study in Chapter 7.

Chapter 4 reviews the development of *the pattern language approach* and different interpretations of it in academia, practice and education in United States, England, Japan, the Netherlands, and France. The comparison between different schools is summarized. Then the characteristics and examples of the Delft approach to design and research are elaborated. The meaning of *the pattern language approach* to architectural and urban discourses is demonstrated. At the end, the relevance of the Delft approach to China is specifically explained to set up the basis for the case study in Chapter 8.

Chapter 5, an epilogue reflecting on the previous chapters ends Part 2. It also applies Henri Lefebvre's seminal trialectical thinking on space to link the designers' dialectical framework. *The morphological approach* is a means to conceive the perceived space, whereas *the pattern language approach* is a means to conceive the lived space. The theoretical frameworks structure the following case study in Part 3.

The third part applies the Delft morphological approach and the Dutch pattern language approach in a Chinese city, Wuhan, to further explore how the two approaches can assist urban designers to achieve historical continuity.

Chapter 6 gives a general introduction of Wuhan.

Chapter 7 applies *the Delft morphological approach*, reduction drawings in particular to analyze Wuhan. It presents series of four analytical maps that reveal Wuhan urban transformation on three scales and spatial structure transformation over 8 time intervals. It concludes 13 spatial structural elements and further explains their practical implication in practice. The chapter ends with a reflection on working processes and recommendations for city expansion and regeneration.

Chapter 8 applies *the Delft pattern language approach,* using individual patterns as vehicles to bridge research and design and build up a language to reveal the hierarchies and relevance of individual patterns in order to analyze the public life in the Hanzheng street area. It presents a pattern book consisting of 20 individual patterns. Three pattern languages resulting from a workshop are shown and discussed to further explore the meaning and practical implications of pattern clusters, linkages, and anchoring points. The chapter ends with a reflection on working processes and recommendation for the future of the city.

The forth part deepens the discussion of *the morphological approach***,** *the pattern language approach* **and** *urban design* **in relation to each other and synthesizes the findings from the theoretical investigation and application in the case study.**

Chapter 9 synthesizes the insights gained from previous findings and concludes the dissertation with four illustrations. It discusses the discrete yet related relations between t*he morphological approach*, *the pattern language* a*pproach* and *urban design*. The chapter ends with recommendations and puts forward the potential areas of future researches.

PART 2 Theories and practices

In Part 1 Background, the problem, research questions and corresponding methods, and research structure are introduced. Part 2 deals with theories and practices. It intends to provide a context and gives an overview of the state of art in the three fields the dissertation pulls together: *urban design, the morphological approach* and *the pattern language approach*. Furthermore, it gives insights that will be applied in Part 3 and will be reflected and discussed in Part 4.

Part 2 consists of the Chapters 2, 3, 4 and 5.

Chapter 2 Permanence in urban design provides the background for this research, and a professional conviction.

Chapter 3 Morphological approach and *Chapter 4 Pattern language approach* review the approaches worldwide with a specific emphasis on the Dutch approach.

Chapter 5 Part 2 Epilogue summarizes the gained insights and bridges Part 3.

2 Permanence in urban design

§ 2.1 Introduction

Chapter 2 intends to answer the sub research question 1:

Why is it necessary to preserve historical continuity in urban design and how can it be achieved?

In order to answer the sub research question, some background questions are formed that are elaborated on in the corresponding sections.

1 What is *urban design*? (Section 2.2)
2 What is historical continuity in urban design? What are the inevitable components of historical continuity? (Section 2.3)
3 What are the characteristics of Dutch urban design? (Section 2.4)

Chapter 2 provides a professional conviction as a background for this research. Section 2.2 defines and understands urban design by discussing how it differs from urban planning and architecture. Section 2.3 discusses permanence in urban design. Section 2.4 introduces the characteristics of Dutch urban design.

§ 2.2 Urban Design

The definition and the role of urban design as a profession and how it differs from architecture and urban planning has always been investigated and discussed. Rittel argues that there is no distinction between designing and planning and the two are synonymous (Protzen & Harris, 2010). Gunder, in contrast, claims that urban design is "… a *subfield of urban planning particularly concerned with urban form, livability and aesthetics*" (Gunder, 2011, p. 184) Whereas Buchanan writes "*Urban design lies between the broad-brush abstraction of planning and concrete specificities of architecture.*" (Buchanan, 1997; cited in Cowan, 1997, p. 20)

The conventional perception of urban design is that it categorically belongs to a certain scale and one of the differences between planning and design is that they revolve around different scales (Banham, 1976; Erickson & Lloyd-Jones, 2013; Lang, 1985). The author argues this is not necessarily true. For instance the *Nieuw Nederland (New Netherlands)*, the project conducted by Nederland Nu Also Ontwerp Foundation (The Netherlands Now As Design Foundation) in the eighties, invited four groups of urban designers and experts from various field to elaborate urban design on national scale based on four scenarios. The result was large-scale form and structure rearrangements, which were big, but they were still design (Figure 2.1).
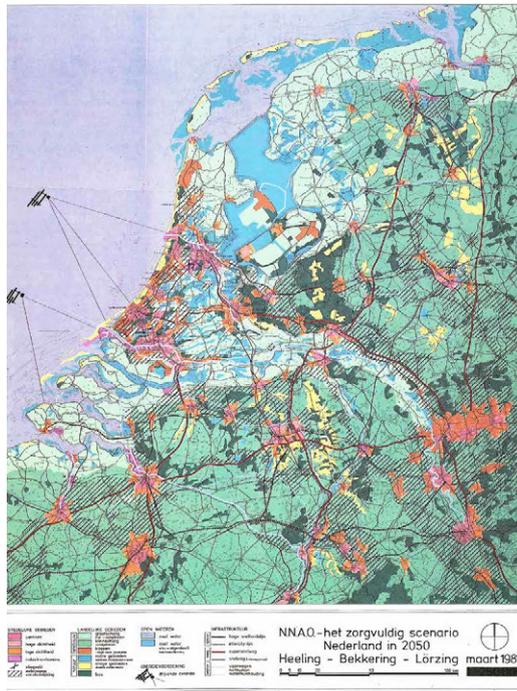
1 Zorgvuldig [Careful]
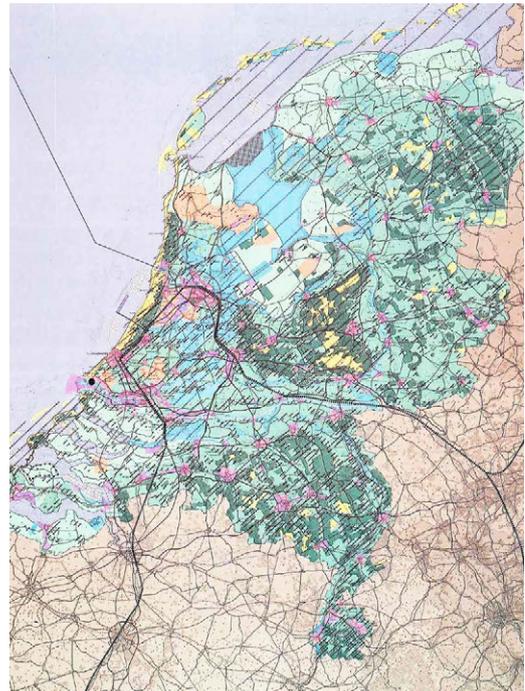
2 Dynamisch [Dynamic]
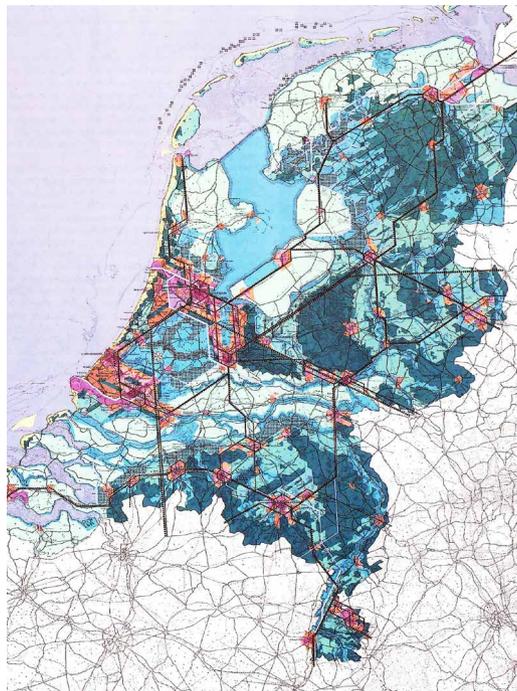
3 Kritisch [Critical]
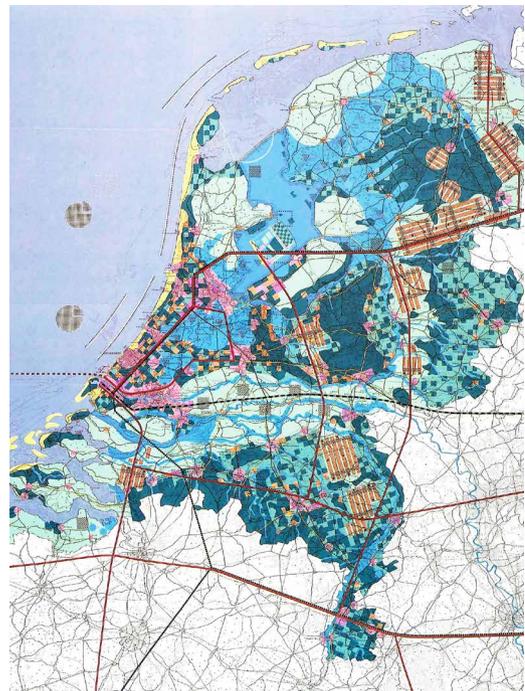
4 Ontspannen [Relaxed]

FIGURE 2.1 Designing the Netherlands: 1. Zorgvuldig [Careful], Jan Heeling, Henco Bekkering, Han Lörzing; 2. Dynamisch [Dynamic], Hubert de Boer, Teun Koolhaas; 3. Kritisch [Critical], H.E. Bakker, W. Hartman, m.a.v. P. van Beek, G. Nassuth; 4. Ontspannen [Relaxed], Henk de Boer, Alle Hosper, (H. Van Der Cammen, 1987).

Therefore, what makes urban design different from urban planning is not scale, but its direct relation with morphology (Çalişkan, 2013) and its different ways of thinking. Urban planning is about how to mediate different interests from different stakeholders and how to effectively redistribute the public resources,

whereas urban design is how to spatialize these. Therefore, it is about form and it is spatial. The main difference with architecture is not scale but its different focuses. In architecture the focus is on the use of an individual or group, while urban design is focussed on the public realm (Bekkering, 2006).

As such, urban design deals with all scales and it is a process that consists of analysis and synthesis (Lawson, 2006) as well as a well presented end product that shapes the form of city and the public realm (Buchanan, 1988; Childs, 2010; Leupen, Grafe, Körnig, Lampe, & De Zeeuw, 1997; Wall & Waterman, 2010).

§ 2.3   Permanence in urban design

1. Urban design and context

Any urban design is part of a context, a larger whole… this is simply a question of scale: there are always higher levels of scale that remain unchanged and thus are dominant, as seen from the perspective of the assignment.

(Bekkering, 2008, p. 58)

For instance, the Sino-French Wuhan Ecological Demonstration City, with its planning area of 35,8 km^2, is proposed to accommodate 200,000 inhabitants. This massive scale asks for an urban design for an entire city with consideration for industry, infrastructure, housing, etc. (Figure 2.2). However, the urban design is still elaborated in and as part of a larger context. Looking at it from a larger scale, this area is only a section of the metropolitan area of the city of Wuhan. The consideration of the urban design with regard to the population, industry, ecology, transportation, economy, politics etc. is placed in the overall planning status of Wuhan and even the entire country of China (Figure 2.3).

FIGURE 2.2 Sino-French Wuhan Ecological Demonstration City perspective, Wuhan Land Use and Urban Spatial Planning Research Center, Arte Charpentier Architectes, Safege (Suez Consulting). Source: Wuhan Land Use and Urban Spatial Planning Research Center.
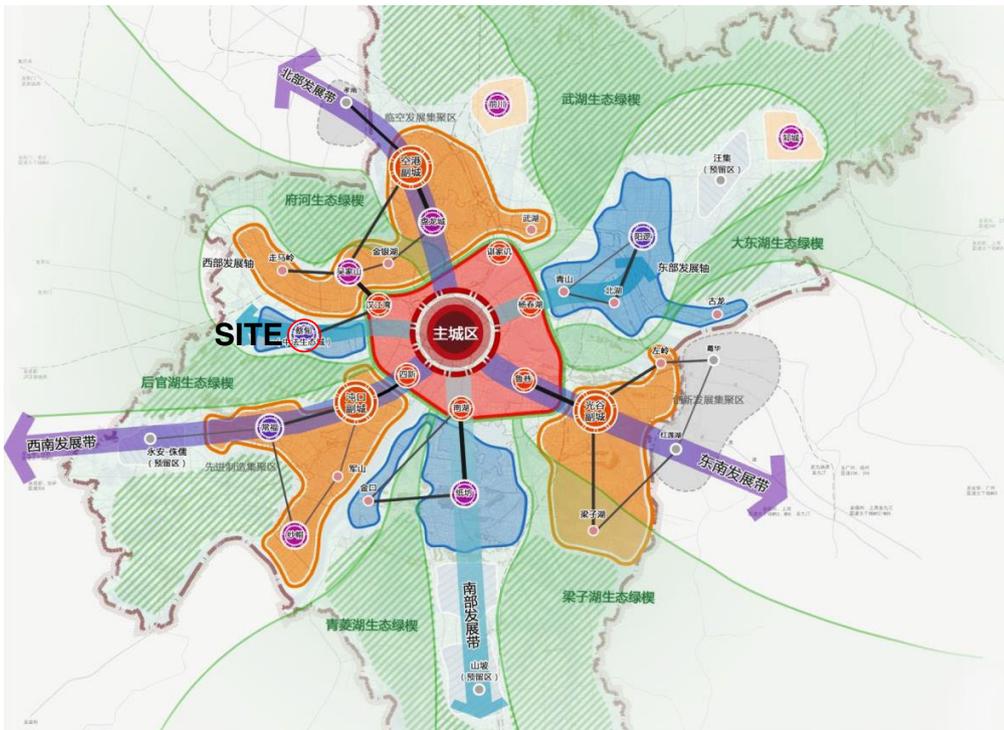
FIGURE 2.3 Sino-French Wuhan Ecological Demonstration City in relation with the Wuhan metropolitan area, spatial structure, Wuhan Land Use and Urban Spatial Planning Research Center, Arte Charpentier Architectes, Safege (Suez Consulting). Source: Wuhan Land Use and Urban Spatial Planning Research Center.

Another example is the statement building for China Central Television (CCTV) by world famous Dutch architect Rem Koolhaas and his office OMA, Office for Metropolitan Architecture. Its contorted form upset an enormous amount of local Chinese scholars and architects censured its disturbance of the local identity and its high expenses in construction (ZHANG, 2009). Despite of the fact that when zooming out the CCTV building becomes part of the city scape, as a collage, what this building offers most is meeting the political and social requirements at that particular period of time; China's ambitious race to the future as well as establishing the reputation of Beijing as a future city right before the 2008 Olympic Games (Ouroussoff, 2011). Besides, the unconventional high rise building typology in combination of its function— China's predominant public media— indeed glorifies the propaganda organ of the Chinese central government. In this way, this design is context based physically, socially, politically and culturally (Figure 2.4)

1 Source: rino.xu, 2015

2 Source: MA Jianqiang, ZUIBEIJING

3 Source: OMA/Jim Gourley, 2015

4 Source: MA Jianqiang, ZUIBEIJING

FIGURE 2.4 CCTV and its context

To sum up, every urban design is a part of context, the physical context and its extended context (Bekkering, 2001) (Figure 2.5). Every site where an urban design takes place is a series of information of layers: history, culture, economy, geology, etc. The awareness of these aspects and responses to them through physical forms in the actual design are the essential elements of urban design as a profession, whereas *tradition* provides a basis for it.

FIGURE 2.5 Context

2. Context and tradition (Figure 2.6)

Tradition could be defined as anything ranging from objects to symbolic beliefs and behavior that is transferred to the next generation. This results in a presence of the past in the present (Green, 1997; Shils, 1983). " *Traditions are constantly reinvented and renewed in form and content*" (Ibelings, 2009, p. 237) It is a common understanding among communities. It is dynamic as it passes down over generations and each generation adds meaning to tradition from their interpretation at the time. It is recognizable, even though changes have been incorporated overtime. *"Traditions are contemporary interpretations of what existed in the past, not the automatic continuations of it. They evolve because new forms arise with each generation"* (Ibelings, 2009, p. 237). Thus, it is originally from the past, has a capacity to change in a given context and further adapt to the future context while still be recognizable as continuity. Professor Henco Bekkering stresses that it is a social and cultural mechanism (Bekkering, 2013). The mechanism of tradition can inspire urban design as a profession in how to distill meaning from the context and pass it on in a legible way.
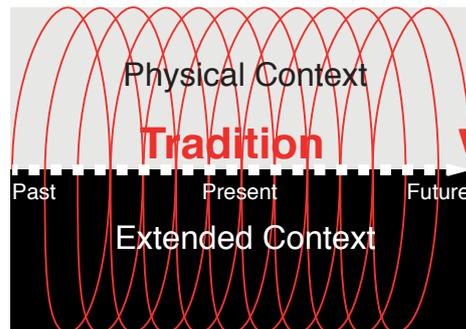
FIGURE 2.6 Context and tradition

3. Tradition, meaning and historical layers (Figure 2.7)

Tradition passes down the 'symbolic meaning' over generations (Green, 1997; Shils, 1983). A City's "... physical structure contains meaning." (Bekkering, 2008, p. 58)

Meanings of places are formed through time and highly subjective, embedded in people's narratives and experiences and interpreted by cultural and social context… the challenge for urban design is then to understand how socio-spatial attributes assign meaning to places, to be perceived and collectively experienced.

(Karimnia, 2018, p. 32).

Physical forms are accumulated and materialized entities of people's interpretation of the 'symbolic meaning' that change over time. Thus, meaning is manifested in historical layers in the built environment. To be able to distill meaning, historical layers need to be interpreted by the urban designers.
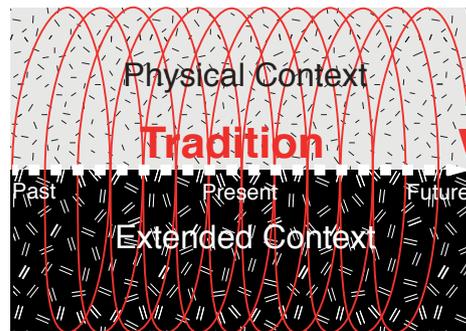
FIGURE 2.7 Meaning

4. Historical layers, historical continuity and urban design (Figure 2.8)

Reading, identifying and understanding historical layers in the physical and extended context are the tangible steps for urban designers to distill meaning from it. The legibility of the historical layers is a prerequisite for historical continuity in the built environment (Bekkering, 2013). Therefore, to understand and respect the meaning embedded in the historical layers, to carefully add another layer that contains contemporary meaning, and make these layers visible in the built environment makes it possible to pass down tradition and results in historical continuity and permanence in urban design.
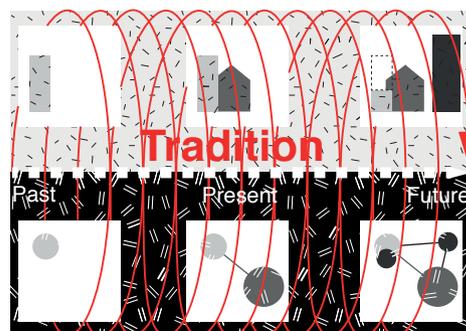
FIGURE 2.8 Historical layers

§ 2.4 Dutch approach

Dutch design is characterized by and famous for its inventiveness, the creative ways of using materials, and the dynamic, challenging and experimental design process (CHU, 2012; Lootsma, 2000). Also, the high integration of planning and design and the strong relation between research and design are among the characteristics that have made Dutch design world famous.

§ 2.4.1 Integration of planning and design

The high integration of Dutch planning and design manifests in three ways (based on (De Jong & van der Voordt, 2002)):

1   the integration of different domains in architecture
2   the influence of design and research on one another across multiple scales
3   the comprehensive role of designers in practice.

First, the term bouwkunde in Dutch language, and in the Dutch name of the Faculty, covers everything from architecture to the built environment in its entirety. The literal translation to English is the science of building. In the Faculty of Architecture and the Built Environment of the Delft University of Technology, it covers everything from small-scale furniture design and interior design to urban design and large-scale regional design; from architectural technology and material science to structural and civil engineering; from actual design studies to real estate management and planning that relate to economics, etc. This high level of integration of related disciplines in architecture and architectural education creates designers who understand the complex built environment. Second, the term stedebouw, as in the Dutch name of the Department of Urbanism, translated into English literally means the building of places for humans to live. In the Dutch context, it refers to urbanism, urban design, planning, and also includes aspects of landscape architecture. In the Netherlands, dealing with nature has always been a necessity in striving for safety and through the centuries has changed from "fighting against nature", notably water in its rivers and the sea, to "building with nature". The constant threat of floods made water management and flood control a main concern in the Netherlands, which necessitated planning and civil cooperation early on. This demands designers to comprehensively and systematically think of and deal with complex projects across scales. This demanding concern with nature also explains why the characteristics of Dutch architecture, urban design, and the research methods of the layer approach and reduction drawing, have originated from landscape design. Last but not least, the work range of stedebouw contains the balanced communication and negotiation among users, municipalities, communities and as many stakeholders that can be involved. This highly comprehensive role of designers represents the Dutch integrated planning and design system. It explains how in the Netherlands planning and design is a holistic process without a strong separation between different phases and roles. All of this is incorporated in legislation.

Integration of research and design

The strong relationship between research and design forms the basis for experimentation and creativity in practice. At the same time, it results in practice and design oriented aspects in science and academia. Research and design, and their relation, are the main focus in design education and this is reflected in practice as well. 'Research-based design' is one of the main characteristics of the famous contemporary Dutch design companies, such as OMA and MVRDV. Also, 'research by design' is common practice in Dutch research institutes in the design domain. This is design-oriented research with a high degree of design involvement in the research process inspired by designerly ways of thinking. Finally, the discussion of 'research through design' has been put on the agenda recently. The Netherlands Organization for Scientific Research NWO has set up a specific funding program for the design domain and invites research proposals on design related topics.

§ 2.5   **Conclusion**

This chapter with its 3 sections has answered the sub research question 1 and its background questions.

Sub research question 1:

Why is it necessary to preserve historical continuity in urban design and how can it be achieved?

Background questions:

1   What is *urban design*? (Section 2.2)
2   What is historical continuity in urban design? What are the inevitable components of historical continuity? (Section 2.3)
3   What are the characteristics of Dutch urban design? (Section 2.4)

Chapter 2 sets up the professional conviction and theoretical base for this dissertation. It distinguishes urban design from planning with its direct relation to morphology and different ways of thinking. It defines that urban design deals with all scales and it is a process that consists of analysis and synthesis (Lawson, 2006) as well as a well-presented end product that shapes the form of the city and the public realm. It concludes that in order to understand and respect the meaning contained in historical layers and carefully add another layer that contains contemporary meaning is the way to pass down and at the same time incrementally change tradition, resulting in historical continuity and thus in permanence in urban design. The chapter ends by pointing out the distinctive characteristics of Dutch urban design in the world, the integration of planning and design, and the integration of research and design. These characteristics provide the fundamental reason why the Dutch approach is emphasized and applied in this research.

3 Morphological approach

§ 3.1 Introduction

Chapter 3 intends to answer the sub research question 2:

How is *the morphological approach* used in the urban design process?

In order to answer the sub research question, some background questions are formed that are elaborated on in the corresponding sections.

1   What is *the morphological approach*? What are the developments and application of it in different contexts? (Section 3.2)
2   What are the characteristics of the Delft morphological approach? (Section 3.3)

The purpose of this chapter is to provide an overview of the application of *the morphological approach* worldwide with an emphasis on the Dutch approach, which serves as the main reference and methodology in the case study in Chapter 7 and the basis for the further discussion in Chapter 9.

Section 3.2 defines morphology and urban morphology, and provides an overview of the different schools of *the morphological approaches* worldwide. Section 3.3 characterizes the Delft School of morphological analysis and shows examples. Section 3.4 demonstrates how the Dutch approach is relevant and applicable to the Chinese context.

§ 3.2 Different schools of urban morphology study

§ 3.2.1 Morphology and urban morphology

The term 'morphology' was originally introduced by the German writer and polymath Johann Wolfgang von Goethe, 1749–1832. (Marshall & Çalişkan, 2011) Goethe pointed out that 'morphology' is *"a science dealing with the very essences of forms"* (Bullock & Stallybrass, 1988). The research objects are actual physical form and its structure (Duan, 2008). Firstly applied in biology, morphology later developed in different domains. For instance in geography morphology refers to the form of a landscape and its transformation. In linguistics morphology refers to the elements and structure of language. The use of morphology in the context of the built environment began in the early 19th century (Duan, 2008). This is called 'urban morphology', and can be considered as the science of urban form and structure.

The main schools of urban morphology and their characteristics

American researcher Anne Vernez Moudon (Moudon, 1994; 1997) and her Dutch colleague Elwin Koster (2001) refer to three traditional schools in the study of urban morphology: Italian, French and British. The approach of the British School gained international attention because of the use of the English language over the world. Once this approach became known, urban morphology was adopted by the International Seminar on Urban Form (ISUF), as an international organization of researchers and practitioners in the field of the study of urban form. ISUF has expanded to many 'schools' since. The Dutch and American Schools also developed their own interpretations and approaches to urban morphology.

Some Chinese overseas scholars introduced the basic concept and knowledge of 'urban morphology' to China in the late 80s and early 90s of the 20th century by (Chen, 2018). Table A3.1 presents and characterizes the Italian, French, British, Dutch, American and Chinese schools of urban morphology as for the aspects of research objects, research aims, research characteristics, main researchers and disciplines, and the time dimension. It offers an overview of existing applications of the morphological approach. The goal of this table is to provide a context for the discussion and emphasis on the Delft approach in Section 3.3, which serves as the main reference and methodology in the case study in Chapter 7 and the basis for the further discussion in Chapter 9.

	Research objects	Research aims	Research characteristics	Main researchers and disciplines	Time
ITALY	– Architectural forms/lay-outs, and their types and transformations	– Provide context and references for the renovation of historical buildings and small-scale urban regeneration projects	– Origin and development the typological study of architecture – Understanding the urban tissue and the city as architecture and a composition of different architectural types – Architectural type and typology as architectural design tool	– Saverio Muratori (1960) – Aldo Rossi (1980), etc. – Mainly architects	– Main focus on the past, i.e. before modern architecture, that is seen as a major transition
FRANCE	– Public infrastructure, street networks, land divisions, buildings – Urban transformation in relation to economic and social aspects	– Understand the mechanism of urban transformation – Develop theories and methods to analyze cities	– Focus on the actual urban form and its formation – Study of urban spatial patterns in relation to originally proposed ideas and theories of urban design	– Henri Lefebvre (1970) – David Harvey (2006) – Philippe Panerai and Jean Castex (1980; 1982; 1997; 1999; 2001; 2004; 2008) – Bruno Fortier (1989), etc. – Geographers – Socialists – Economists – Philosophers – Architects – Urban studies	– Focus on history and present
ENGLAND	– Land use, town planning – Decision making in the planning process	– Understand why and how a city is built – Examine the influence of decision-making in the planning process – Setup town planning theory – Study of the human scale and walking experience in cities	– Focus on land use, town planning and architectural forms – Examine the influence of decision-making in the planning process – More descriptive and less explorative and analytical – Serial sketches as representation of the human experience of the city (the "picturesque")	– M.R.G. Conzen (1958; 1960) – J.W.R. Whitehand (1987; 1990; 2001) – Gordon Cullen (1961), etc. – Geographers – Urban planners	– Focus on history
THE NETHERLANDS	– Design and practice oriented study – Relation between nature and city – Urban forms, urban spatial structures, urban transformation – Design	– Strongly design oriented – Developing design proposals through morphological analysis of the context – Analyze and understand the underlying logic of the design	– Reduction drawings and layer approach – Design oriented urban morphology studies – Focus on relation between water and the city – Invention of cartoon-like drawing – Integration of research and design	– Rein Geurtsen (1981; 1988; 1990; 2009) – Frits Palmboom (1987; 2010; 2014; 2018) – Maurits de Hoog (2005) – Han Meyer (1999; 2002) etc. – Urban designers – Architects – Educators	– Future oriented through understanding history
USA	– Suburbs and urban periphery – Post industrial urban morphology – People's perception of the city	– Understand the problems in and of cities	– Focus on commerce and consumerism – Environmental psychology	– Kevin Lynch (1960) – Venturi (1966), Scott Brown (1977), – Anne Moudon (1989) etc. – Urban designers – Architects	– Present
CHINA	– Architecture, architectural layouts and types – Streets and street networks – Public space	– Understand the original architectural forms and their transformations – Understand urban transforma-tions on different scales – Provide references for urban design and urban regeneration	– Focus mostly on the forms themselves, lack of attention for the transformation of types – Mostly descriptive research, not analytical – Well-developed and widely accepted method of analyzing urban form in China does not exist yet	– DUAN Jin – GU Kai – CHEN Fei – WU Liangyong, etc. – Architects – Urban designers – Urban planners – Geograph-ers	– Focus on past, present and future – Look-ing for references for the future in study-ing the past

TABLE 3.1 Urban morphology and different schools (based on Pinzon Cortes, 2009; CHEN & Thwaites, 2018)

Tradition and history in the built environment have been discussed in the Netherlands for a long time and this can be seen in: design practice, government policy and academia (Meyer & Van den Burg, 2006). The notion of tradition and the attitude towards it falls back to the1920s and has developed over the decades. Therefore, the effort to constantly deal with history and heritage has become a tradition in itself. The following paragraphs introduce three successive stadia of what is called the 'Delft School' and its continuity in a chronological order. In addition, each section offers an explanation of the perspective of the tradition, relationships within the tradition, and the interrelations between them.

1   The first 'Delftse School'

The Dutch name 'Delftse School' is translated to 'Delft's School' in English. The school refers to a group of professors and architects during the 1920s to 1950s in the Department of Architecture of the Technical College of Delft in the Netherlands. They advocated traditional architecture, conventional urban forms, with a predilection for refined craftsmanship, and were opposed to the rising power of modernism in architecture and urbanism (Kuiper, 1991; Steenhuis, 2007). Professor M.J. Granpré Molière (with his practice partner P. Verhagen) was the most representative figure in this branch. Over time, the group of people became widely acknowledged as the 'Delftse School'.

2   The second 'Delftse School'

In the 1960s, a group of young students in the Architecture Faculty of TU Delft edited and published a magazine for which they (re)used the name 'Delftse School'. The content of the magazine was closely related to a series of lectures given by Prof. J.H. van den Broek. The magazine proclaimed position against the traditionalism and the specific architectural style and ways of working that were advocated by the first 'Delftse School'. The intention was to show that 'Delft' was doing much more than just paying attention to traditional form and was actually 'modern'. Thus, the name 'Delftse School' was rather ironic.

3   The Delft approach to morphological analysis, or the third 'Delftse School'

In the 1970s, the educational system and professional agencies in the Netherlands were critical of the status quo in architecture and urbanism, reflecting on the Rotterdam and Amsterdam urban renewal (Bijhouwer, 2008). *"Notions such as design analysis and morphological analysis have taken their place in design education and research"* (Leupen et al., 1997, p. 8). This attention to historic-

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21   This section was written with the help of Professor Henco Bekkering, Professor Han Meyer, Professor Frits Palmboom and ir. Emiel Karthaus.

morphological analysis and to 'Plan-analyse'[22] was deeply rooted in Delft (Karthaus, 2008), and also in the present education system. It was initiated by a group of critical students and staff at TU Delft in the Architecture Faculty. They were attempting to develop alternative design strategies for urban renewal and to explore possible housing typologies. Many design studios and researches were undertaken in the faculty. For instance, Max Risselada worked closely with students on plan analysis in design studios and developed it also on the theoretical and methodological level. Studios exploring and distilling the morphological structure of the urban fabric were among those (Bijhouwer, 2008).

Discussions and explorations were not only limited to the studios. The students and staff members also reached out and interacted with the world by initiating a platform — the magazine *O*.

'O', as OASE was first called, referring to Ontwerp, Onderzoek, Onderwijs (Design, Research, Education), was born in an atmosphere of discontent, imbedded in the educational context of the Faculty of Architecture of Delft University of Technology (then Afdeling Bouwkunde of the Technische Hogeschool Delft)[…] It aspires to continue the engagement of the student movement that started in 1966, and to offer a platform with the ability to react to current subjects.

(Schoonderbeek, Geerts, Patteeuw, & Declerck, 2008, p. 8).

The very first issue of the magazine *O* was titled *Plan Analysis and Typology* and was published in the spring of 1981. It was prompted by the discussions and preliminary explorations of plan analysis, morphological and typological research and design in education and urban renewal at that time (Bijhouwer, 2008). To date, OASE has published 100 issues and *"it has changed from a student magazine to now a peer-reviewed publication for architectural design and reflections"* (Schoonderbeek et al., 2008, p. 3). Yet, its origin began in Delft and *"the editorial board found themselves by default, given the dominant position of Delft among the Dutch schools of architecture at the time"* (ibid, p 3). This effort to develop historical morphological analysis and plan-analysis is indicated as the 'Delft approach'.

Since the 1980s, this approach became predominant in the educational program at the Faculty of Architecture of TU Delft. Several books were developed based on the daily teaching in design studios. Two representative publications were based on the lectures-series of Rein Geurtsen, *'De Stad als object van bewerking' [The City - Object of Adaptation]* (Geurtsen, 1981), and the *'LAS boek' (LAS = Landschap, Architectuur, Stedebouw: Landscape, Architecture, Urbanism)* (Geurtsen et al., 1990). These became the central study-guides in design studios. Later, the LAS boek was elaborated into the book *'Ontwerp & Analyse' [Design & Analysis]* edited by Leupen et al. (1997). *"It introduces the analytical drawings as a way to obtain insight into the process of designing"* (Leupen et al., 1997, p. 8).

The above three chronological 'Delft Schools' have different original goals, were developed in and addressed different contexts, and stood for different contents. However, they do have something in common and that was the critical attitude towards the existing and dominating practices that are characterized too much by economics, technocracy and bureaucracy. The first 'Delftse School' was also referred to as traditionalism. The second 'Delftse School' opposed tradition, and in doing so they were actually studying tradition and establishing a relation to tradition. The third 'Delft School', which is the most commonly referred to nowadays (and in this dissertation), tries to develop systematic methods and techniques to understand history and tradition in order to build a history-based future.

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22   In English: plan-analysis. *"It does not automatically produce a design, but can only serve as a tool for the architect-designer"* (Bijhouwer, 2008, p. 18). In short it is a method to systematically disassemble and analyze (prototypical) designs.

4 Continuity of the 'Delft approach' – *Dutch Urbanism Today*

The approach introduced and developed in Delft in the 70s (the 3rd 'Delft School'), *"was brought to the practice of urban renewal by the graduates who took up posts as designers at the urban development departments in Rotterdam and the Hague"* (Bijhouwer, 2008, p. 18). and some private urban design practices.

After three decades of practice in the field, the Chair of Urban Composition-Theory and Methods led by Professor Han Meyer in the Department of Urbanism at the Faculty of Architecture and the Built Environment of TU Delft organized a series of books and expositions on *'Dutch Urbanism Today'* between 2003 and 2008.

The most important goal of this series is to provide a systematic insight into the debate on the various assumptions, methods and concepts of designers. In doing so, insight can be gained into the characteristics and perspectives of current urban development practices in the Netherlands or rather, Dutch Urbanism Today.

(Meyer & Van den Burg, 2006, p. 7).

The first of the series was on the work of Professor Frits Palmboom and his practice partner Jaap van den Bout (Meyer, 2003). As a student of Max Risselada, influenced by his teachers Michiel Polak and Pjotr Gonggrijp among others, Palmboom's work is closely associated with the *Delft School* and he has gradually developped his own stand at the school. *"A characteristic feature of the firm's approach is its persistent pursuit and investigation of new relationships between urban design, architecture and landscape design"* (Meyer, 2003, p. 2). Frits Palmboom not only integrates the layer approach[23] with a form-oriented morphological analysis, but he also elaborates on the way to understand the different form-layers as process-related 'systems' (delta-dynamics, occupation-process, traffic machine) over the course of time.

The second of the series was 'In Dienst van de Stad (Working for the City)'. It examined and reflected on the urban developments since the 1980s which was led by the municipal urban design departments in Amsterdam, Rotterdam and The Hague. As explained above in the 3rd Delft School, that in the 1980s, the Dutch practice was rethinking the role of urbanism and questioning the results of modern city planning. These urban departments put forward and addressed the following issues that urbanism should create *"conditions for urbanity: places for diversity, changeability, attractive*

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23   The 'Layer approach' is imported from the USA (McHarg, 1969) in the 1970s. It is further developed by Wageningen University and Research (WUR) Landscape Architecture Group and blown over to Delft in the 1980s/1990s. The fundamental principle of the layer approach and its great contribution is that it introduces a systematic method to approach the complex built environment by distinguishing different layers and exploring the interrelation between them. It discovers that the underlying natural landscape, the man-made infrastructure networks and the urban built up areas all have their own development pattern, speed and time-frame. For instance, the layer of the underlying natural landscape changes the slowest but it determines the changes in the other layers. The layer of the man-made infrastructure networks changes faster than the natural landscape but slower than the urban built up areas. This is mainly because of big economic transformations and political decisions involved. While the layer of the urban built up areas tends to change relatively faster because of the demographic growth, social needs and economic developments, etc. The awareness of the differences and interrelation between these layers plays a significant role in the Dutch urban design. Next to Frits Palmboom's office, it is also well utilized in the book '4 x Amsterdam' by Maurits de Hoog (2005) and in the 'Room for the Rivers' program.

public spaces" as well as should pay *"special attention to elements of the 'Longue duree'[24]"* which were missed back then in the urban design practice (Meyer, 2016). They worked around three principles in urban development: "a) designing integrated structure plans for the city as a whole; b) designing integrated plans for public space, and c) designing urban projects" (Meyer & Van der Burg, 2005, p. 7). Amsterdam, Rotterdam, and The Hague all addressed these three principles, and at the same time each of these cities has its own specialization: Amsterdam (a), The Hague (b), and Rotterdam (c). By assessing and reflecting on the Dutch urban design practice since the 1980s through the lens of these three principles and asking "to what extent can they be considered valuable contributions to the development of a city and what is the perspective for the future?" (Meyer & Van der Burg, 2005, p. 7) creates bridges between the past and the present and explores the possibilities for the future.

The reflections and discussions in the second exhibition and symposiums are naturally brought up the third of the sries, 'The Memory of the City' (2006). This deals with the interpretation and utilization of 'tradition' in the contemporary Dutch urban design practice. It shows eight different approaches regarding 'tradition and history' from eight different urban design offices. These offices acknowledge the significance of 'tradition and history'. They consider studying and understanding the historical, physical and social context is the essential working method to find design solutions (Meyer & Van der Burg, 2005). Reviewing and discussing these approaches and projects not only gives an overview of contemporary Dutch urban design, but it also is a way to implicitly question the validity of the 'traditional' Delft approach still present today. What is the attitude nowadays? Have we changed? Do we have an alternative approach towards the constantly changing urban dynamics?

The above mentioned series of exhibitions and symposiums explicitly show the continuity and persistence in the exploration of Dutch urban design approach. Together can be seen as a continuation of the Delft School.

Apart from reflecting on the Dutch practice and researching the fundamental innovation of urbanism on a methodological level, the Urban Design section also tries to explore the applicability of the Dutch approach overseas. A few Ph.D researches were developed in these respects, such as Pinzón Cortes (2009), Zhou (2012) and XIONG (2019).

This Ph.D also falls into this collective effort. It reflects and studies Chinese cities with a Dutch perspective. It introduces two urban design approaches, the Delft interpretation of the morphological approach and the pattern language approach. The thesis intends to explore and discuss if a combination of the above mentioned approaches might work as an applicable alternative in urban design in general, and specifically for Chinese cities.

Dutch architects have been very active and influential internationally since the modern architecture movement. There are many different branches and explorations that emerged from the Delft School: the richness of the methods and the Dutch design culture. When zooming out and discussing the Dutch in an international context, there are a few predominant characteristics of Dutch architecture. This will be highlighted in the following sections.

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24   In English 'long term'. It is an expression in French that refers to the approach in history, first mentioned in 1949 by Fernand Braudel in 'La Méditerranée et le monde méditerranéen à l'époque de Philippe II (The Mediterranean and the Mediterranean World in the Age of Philip II)'. He based his work on that of the Annales-school of Lucien Febvre en Marc Bloch. The approach priorities the long-term, permanent and slowly evolving historical structures over the short-term ones.

The Delft School of morphological analysis

The two most representative characteristics mentioned in Section 2.4 (integration of planning and design as well as integration of research and design) not only lead to the unique position of Dutch Design in the world, but also result in the unique characteristics of the Delft School of morphological analysis (De Jong & van der Voordt, 2002; Leupen et al., 1997). Some key characteristics are:

1   It is strongly design oriented.
2   It was developed both in actual design projects and in education.
3   Though it started as a historical research on urban transformation that was intended to understand urban form through its historical development, it has a strong analytical character. It looks both backward and forward at the same time, studying the past to understand the present with a strong perspective on the future.
4   The concerns[25] of landscape architecture led to design and analysis across scales and to the layer approach. The relation is explored between large scale (infra-)structures and urban fabrics, with the design of infrastructures as an important (and for a long time neglected) part of the urban design scope.
5   Reduction drawings recognize and define homogeneous areas and omit detailed information in order to better understand the hierarchy in urban structures.

In the method of the Delft School the following techniques of reduction, addition, and *démontage* are applied, either separately or in combination in order *"to extract from the plans of projects and urban areas the essential aspects which depend on the analyzed theme in order to reveal a certain logic and structure through the drawing process."* (Leupen et al., 1997, p. 207) For the purpose of the analysis of the urban form, the reduction technique is the most relevant. Reduction is considered to be

the most elementary way of processing a map or a drawing. Its purpose is to visualize the structure of a design. A commonly used technique in design analysis, reduction consists essentially of omitting all irrelevant data from a design drawing so that only information essential to the study remains.

(Leupen et al., 1997, p. 207)

There are two fundamentally different modes of reduction: morphological reduction and typological reduction.

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25   This together with the play-analysis are 'typical Dutch' (Engel, 1978; Meyer & Van den Burg, 2006), which has a Delft origin and a Wageningen origin. The attention on infrastructure is also influenced by American morphological school. Kevin Lynch (1960) and Robert Venturi & Denise Scott Brown (1977) addressed the role of new features in the form of the city, such as the highway and the modern hotels and casinos. On one hand, they highlighted the disastrous effects of these modernities on urban form and urban life, and on the other hand they also questioned the architects and urban designers who only endorse the traditional urban fabrics and refuse to work with these newly emerging features. Lynch and Venturi explored ways to combine modern infrastructure and urban form by 'urbanizing the infrastructure', as it is called in Barcelona, where several successful projects were realized in this respect (Meyer, 1999). A representative text in the Dutch context is the essay of Rein Geurtsen and Maurits de Hoog 'Stad in Stolling' (City in fixation), in the book 'Stedebouw in Rotterdam' (1981). They explain how changes in the main structure (and in the systems of infrastructures in the city) result in changing urban fabrics, illustrated with a monography on 'Het Oude Noorden' (city district 'the Old North') in Rotterdam. These are important aspects of the city. Yet the natural landscape, the urbanized landscape, and the big infrastructures are not further explored in Chapter 7 Mapping Wuhan project. This is because of the limited availability of data. The data on infrastructure is mostly considered confidential in China and cannot be shared with foreign institutions. We were not given access to the landscape data and the data on nature and the environment either.

Morphological reduction is a means of uncovering and explaining the spatial structure of an object. The purpose of the analytical drawings is to visualize the spatial characteristics of a building, an area or a city. To do so, they make a distinction between built (i.e. mass) and unbuilt (space or void). Typological reduction can serve two distinct ends: 1. stripping a design to its essentials leaves a diagram of the underlying structure; 2. by comparing the diagram of a design obtained by reduction with the typological diagram of a type from which that design probably derives, we can get an idea of the changes the design has undergone with respect to the original type.

(Leupen et al., 1997, p. 207)

With its clear design orientation, the Delft School of morphological analysis has two main directions: to analyze a specific area, working towards a design or vision for that area; and to analyze a design to understand its original source.

Reduction drawing techniques are deeply rooted in the education of the Faculty of Architecture and the Built Environment in Delft. These techniques are also widely used in Dutch practice in offices like the OMA, MVRDV, Neutelings Riedijk Architects/NRA, Palmbout Urban Landscapes, HKB Urbanists, etc. For examples see 3.3.3.

Reduction drawings can resemble the so-called figure-ground drawings (Figure 3.1) that were developed by Colin Rowe and Fred Koetter with their students at MIT in the USA and derived from the 17th century Nolli Map of Rome (Figure 3.2). This topic appears in Chapter 7.

1   Figure-ground drawing of the center of Parma, Italy
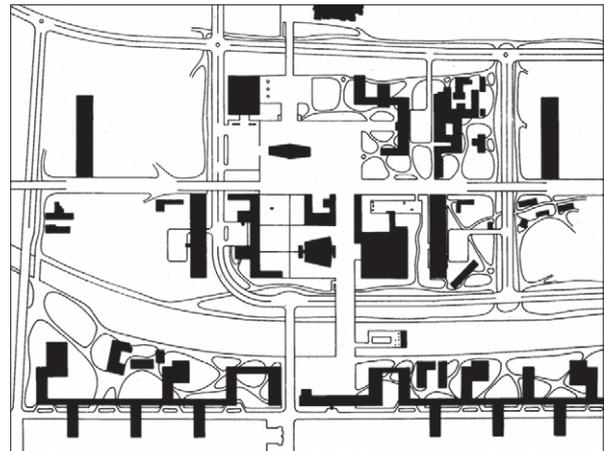
2   Figure-ground drawing of the Project for Saint-Dié, France by Le Corbusier

FIGURE 3.1 Figure ground maps from (Rowe and Koetter, 1978, pp 62–63)
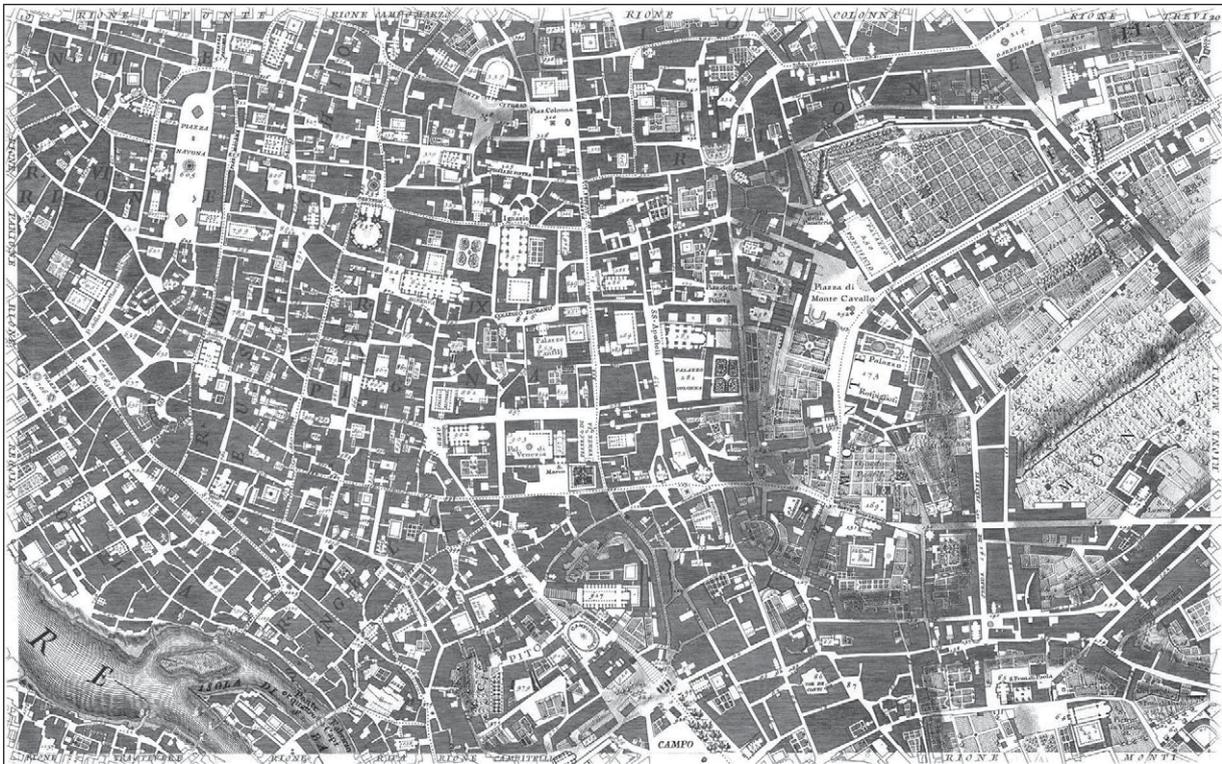
FIGURE 3.2 Map of Rome by Giambattista Nolli, 1748. The map shows public space and building mass, with the public space including interior public spaces in churches and other public buildings..

§ 3.3.3 Examples of the Delft School of morphological analysis

This paragraph presents a series of representative examples of the results of the Dutch method of morphological analysis on the urban scale. These give an overview of the method, but not all aspects presented were applied in the research of the urban form of Wuhan. However, it is relevant because it shows its origin and the context for which the research completed in Chapter 7 stands.

1. Delft, the Netherlands: Rein Geurtsen

The work of Rein Geurtsen, at the time Associate Professor of Urban Design in Delft, was fundamental in developing the Delft method. The example provided is part of the analysis of (the southern part of) the town center of Delft. The reduction drawing (Figure 3.3-2) more clearly shows the formal structure of the city, when compared to the aerial photograph that is much harder to 'read' in (Figure 3.3-1). This research covers a series of important historical development phases of the city, together explaining its present state (Geurtsen, 1988).

1-Aerial photograph of the town center of Delft, the Netherlands in 1988, (Geurtsen, 1988, p 0)
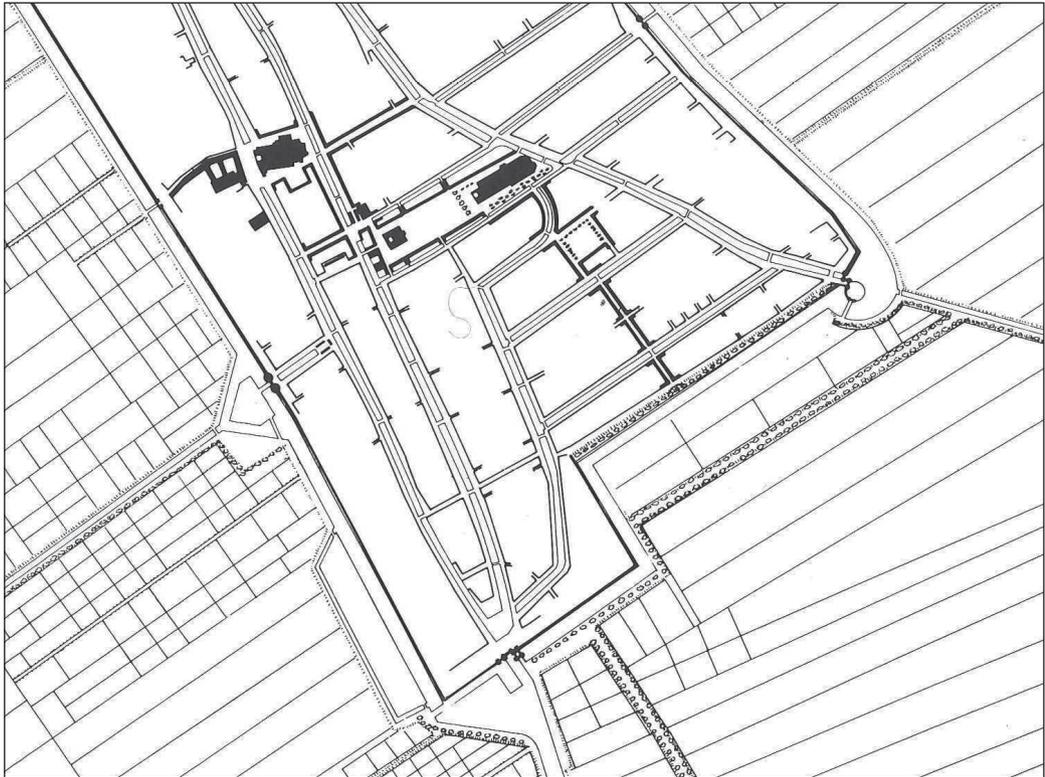
2-Reduction drawing of the same area in the 17th century by Rein Geurtsen. (Geurtsen, 1988, p. 15)

FIGURE 3.3 Rein Geurtsen's morphological research of Delft

2. Alphen aan den Rijn, the Netherlands: Heeling Krop Bekkering, Stedebouwkundigen/Urbanists (Nicola Körnig)

For this example, a series of sketches reconstructed the history of the river town, from Roman times to the present. These sketches supported the urban design extension of the center of the small town Alphen aan den Rijn in the Netherlands (Figure 3.4) (Meyer and van den Burg, 2006).

a   *b*

c   *d*

e   *f*

g   *h*
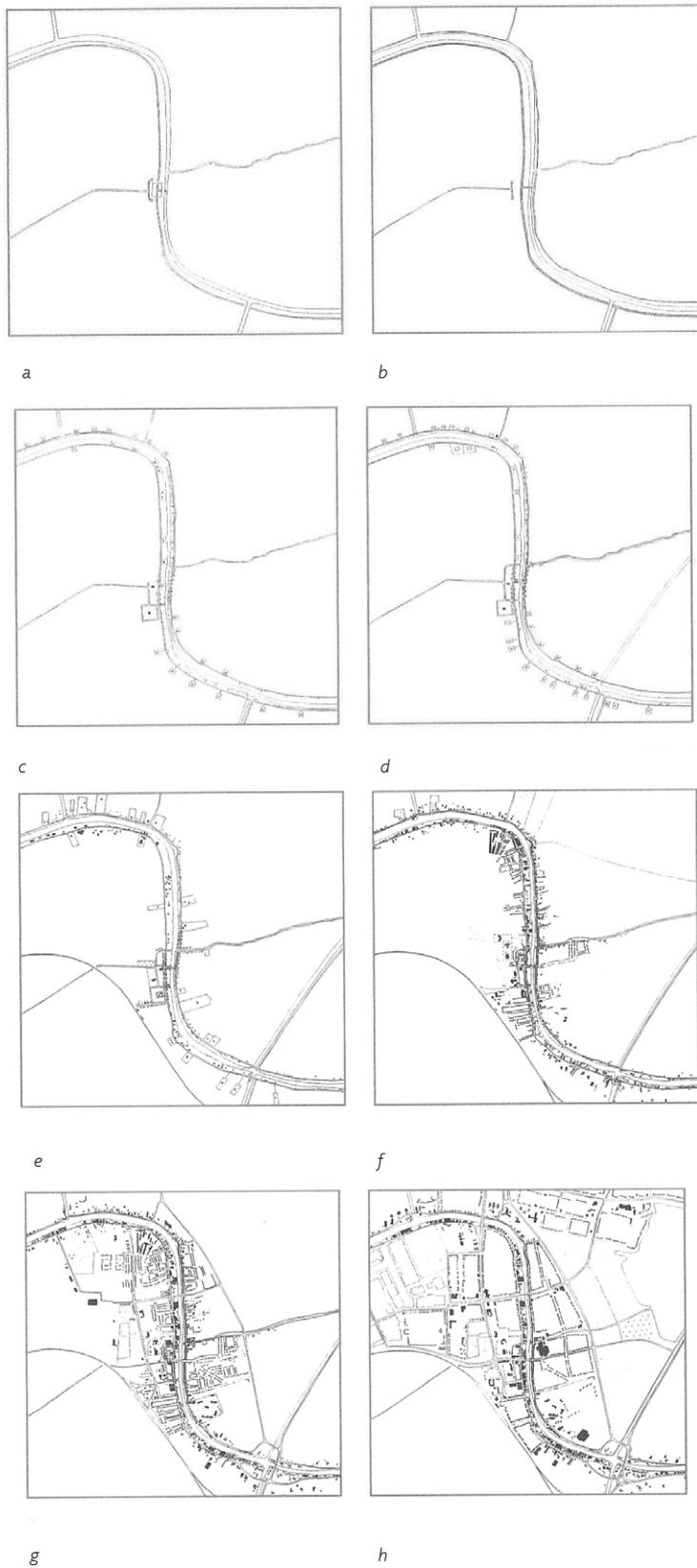
FIGURE 3.4 Historical morphological development of Alphen aan den Rijn, the Netherlands, 1995, by Heeling Krop Bekkering Stedenbouwkundigen/ Urbanists (Nicola Körnig) (Meyer and Burg, 2006, p. 32)

3. Amsterdam, the Netherlands: Casper van der Hoeven and Jos Louwe

The technique of the reduction drawings was developed in Delft into a method by young researchers like Casper van der Hoeven and Jos Louwe, students of Rein Geurtsen. Figure 3.5 shows the morphological analysis one step further by straightening out Amsterdam's Canal Zone, that is in reality curved, disclosing the regularities and irregularities in its formal structure (van der Hoeven & Louwe, 1985).
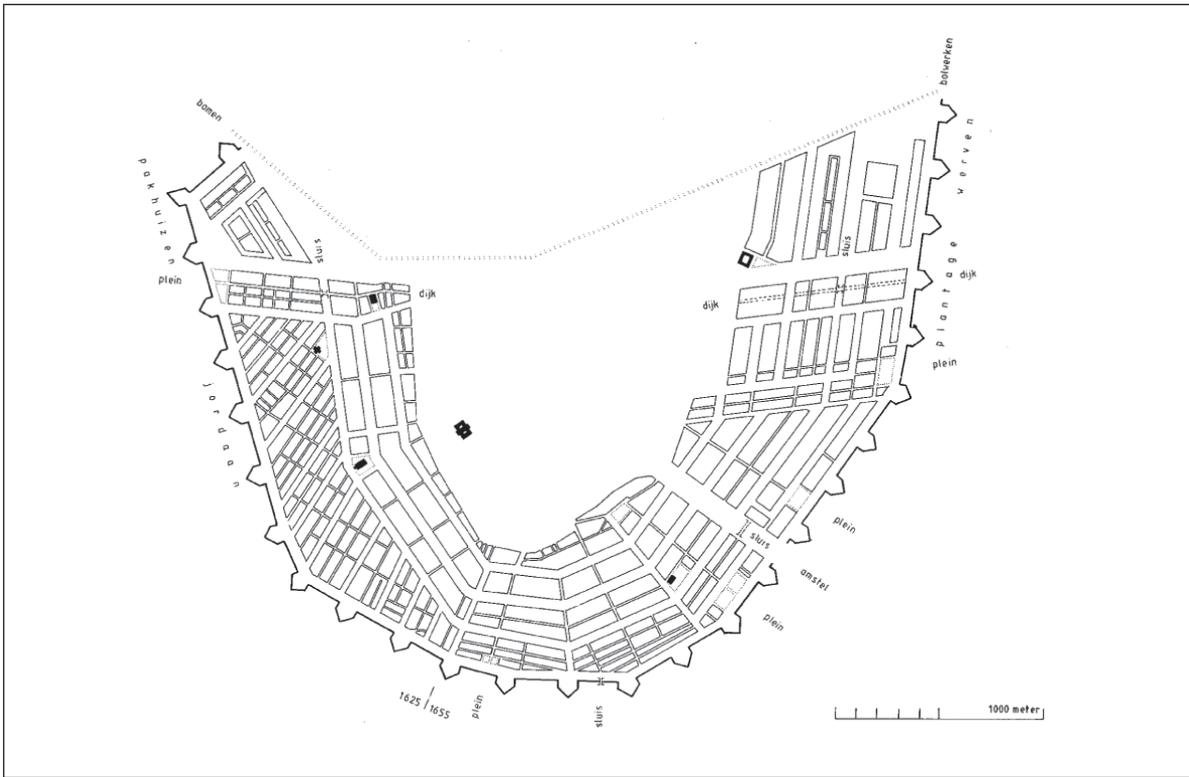
1-Reduction drawing of the canal zone in Amsterdam, the Netherlands
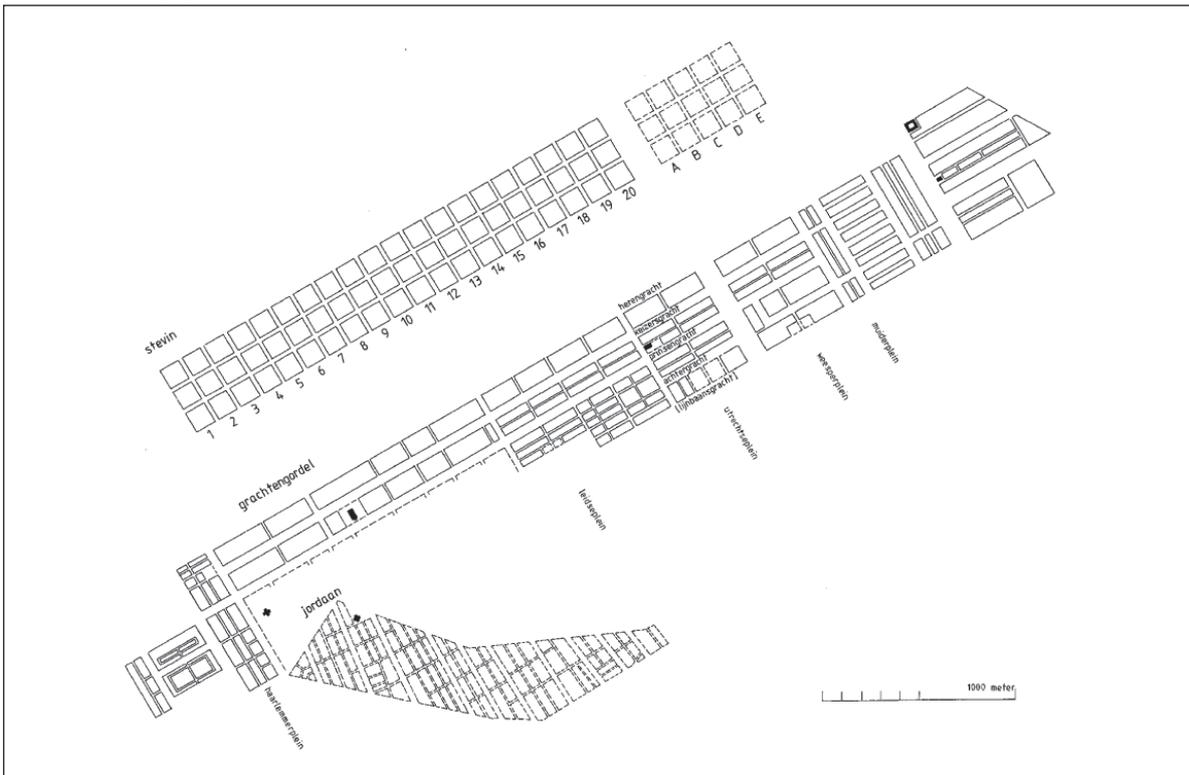
2-The canal zone "straightened"

FIGURE 3.5 The morphological analysis of the canal zone in Amsterdam. (Van der Hoeven and Louwe, 1985, pp. 62–63)

4. Rotterdam, the Netherlands: Frits Palmboom

Professor in the Van Eesteren chair in Delft, Frits Palmboom's contribution (Section 3.2.1- 4) is best illustrated by his earlier analysis of Rotterdam. The city is taken apart in three layers: the underlying landscape, the traffic infrastructure for cars and trains, and the built-up areas ('islands') in between these two. Superimposed, these drawings clarify why the urban form of Rotterdam is what it is (Figure 3.6) (Palmboom, 1987).
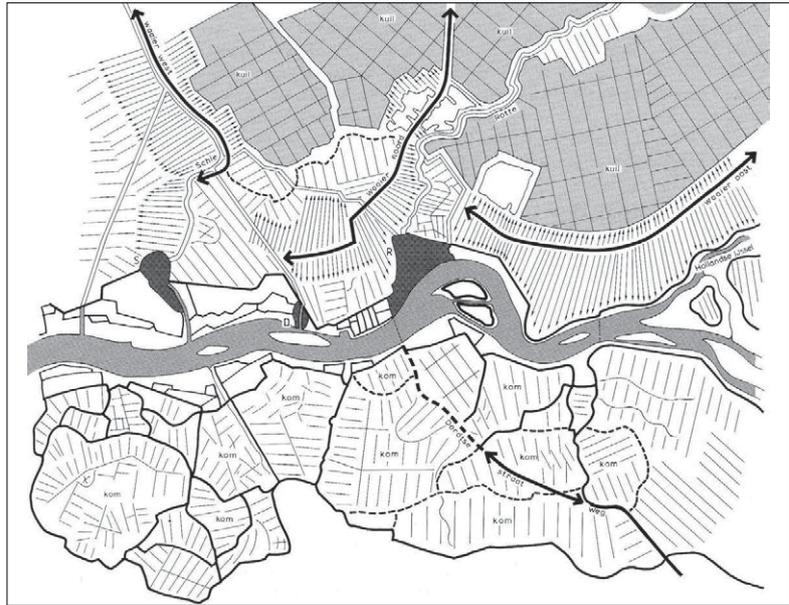
1-Landscape and parcels, (Palmboom, 1987, p. 22).

2-Traffic machine, (Palmboom, 1987, p. 34).

FIGURE 3.6 Morphological layer analysis of Rotterdam, the Netherlands

3-Islands of built-up areas, (Palmboom, 1987, p. 40).

4-The 3 layers combined, (Palmboom, 1987, p. 64).

5. Detroit, MI, United States of America: Henco Bekkering, LIU Yanjia

The morphological analysis of Detroit discovers the structuring systems of the urban form, like in the examples above explaining why and how it has become what it is. It is a strong example of the mechanism of cities to keep their basic form through long series of urban transformations. (Figure 3.7 and 3.8) Another outcome of the research is the visualization of the growth of the city proper and of the metropolitan area surrounding it (Bekkering & LIU, 2015).
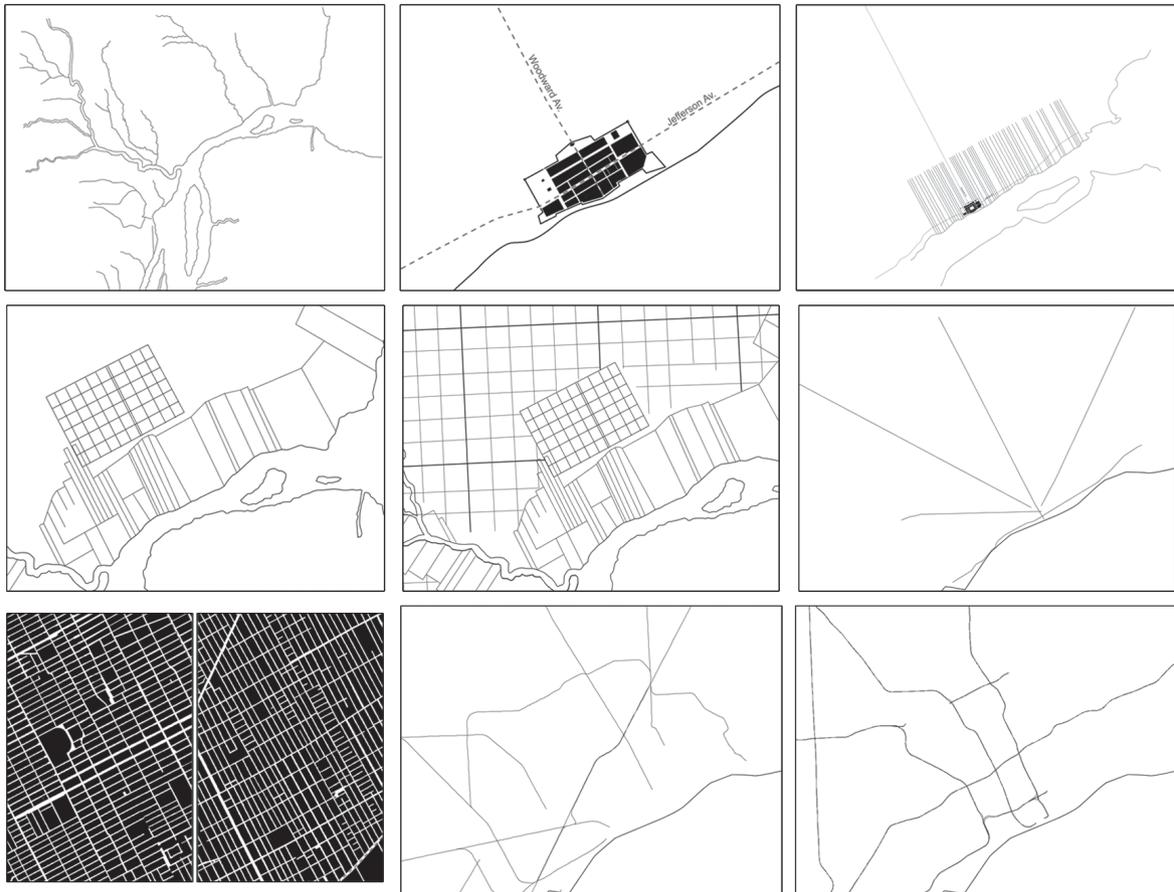
FIGURE 3.7 The nine structuring systems of the Detroit morphology: rivers; early fort; Ribbon Farms; Ten Thousand Acres Grid; Jefferson Grid; radial avenues; street grids; railroads; highways. Henco Bekkering and LIU Yanjia, Mapping Detroit: The City of Holes (Thomas and Bekkering, 2015, p. 40)
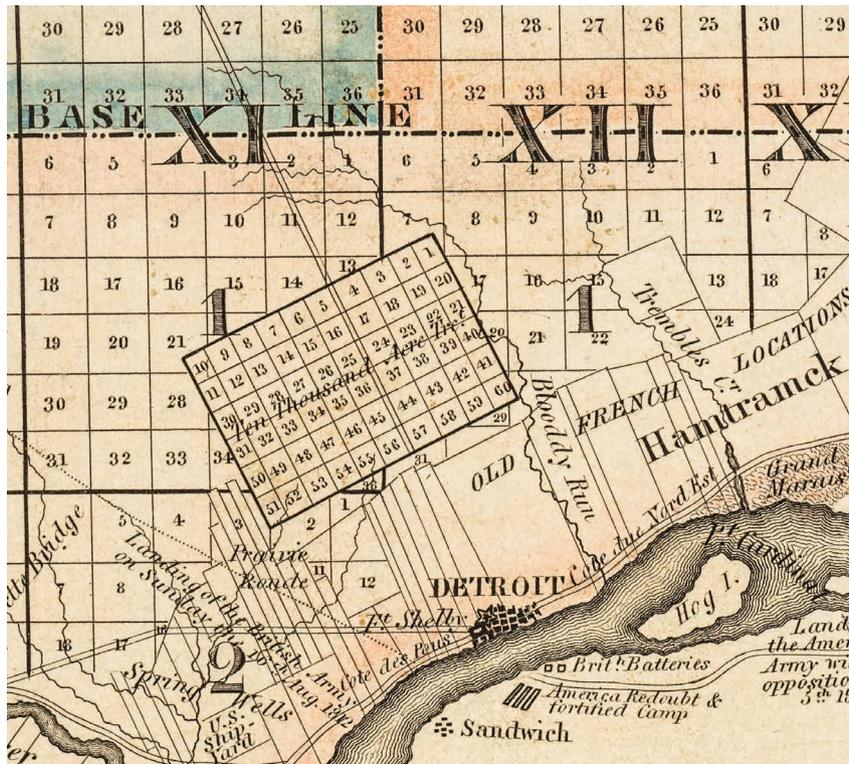
1-Detail of the Map of the Surveyed Part of the Territory of Michigan by Risdon (Dunnigan, 2001), showing the so-called Ten Thousand Acre Grid surrounded by the larger and differently oriented Jefferson Grid, and with original Indian trails indicated by double lines

2-The analytical map of the present city with superimposed in red the Ten Thousand Acres Grid area and the Indian trails, now avenues

FIGURE 3.8 Henco Bekkering and LIU Yanjia, Mapping Detroit: The City of Holes (Thomas and Bekkering, 2015, pp. 33–34)

63   Morphological approach

Mapping in Architectural and urban discourses

In architectural discourse, mapping is used to visualize the complexity of the built environment down to the smallest detail and is intended to generate better-informed designs. Marc Schoonderbeek, who obtained his doctorate in the Department of Architecture of the Faculty of Architecture and the Built Environment in Delft, argues that mapping should be seen as a standard design tool for architects. In his dissertation *Place-Time Discontinuities: Mapping in Architectural Discourse* Schoonderbeek demonstrates that mapping as a design tool can be manifested in three modalities: instrumental, operational and conceptual. First, mapping can be used as an instrument; by using a specific notation technique, architectural forms can be generated. Bernard Tschumi's *Manhattan Transcripts* are a classic example in which a series of scenario mappings were developed as an architectural language. Second, mapping can be used as an operation; in which ideas can be explored in an architectural design process. Daniel Libeskind's approach in the Jewish Museum Extension in Berlin is a clear example. Sketch lines through the urban tissue of Berlin connect historic locations where Jewish and German culture are related, and this forms the basis for the architectural design. Third, mapping can be used as a concept; by formulating a theoretical position in architecture by recognizing, discussing, and defining spatial structuring systems. Aldo Rossi's 'analogue city' (Rossi, 1982) is one example in which he used 'urban artifacts' to map urban patterns and historical lines (Schoonderbeek, 2015).

In the urban design discourse, mapping is considered to be a means to comprehensively understand, efficiently present, and reasonably design the complex built environment on different scales. The role of mapping can be expanded as:

1   A tool for handling spatial data: different types of data from various domains can be analyzed, integrated, and incorporated in the same platform allowing for interaction and supporting multi-disciplinary research.
2   A tool for presentation and communication: mapping visualizes factual information and research outcomes enabling communication among design partners and with clients.
3   A design tool: similar to architecture, mapping as a design tool in urban design also has three modalities: instrument, operation and concept. As an instrument, mapping is used to detect the logic and the physical characteristics in the complex built environment across scales. Mapping as an operation implies the explorative experimentation process, creating, developing, and testing to generate plans and designs. Mapping as a concept contributes to urban design theory and broadens its scope and effectiveness.

§   3.4   The relevance of the Delft morphological approach in China

The study of the existing urban form and its structure, or urban morphology, is an important part of urban studies. Urban morphology has correlations with urban expansion, city development, functional zoning, public transportation, and public space. A well-developed and widely accepted method of analyzing urban form, at present, does not exist in China. The application of urban morphological research in China is very limited. Most studies focus on the forms themselves, without attention to their transformation. In addition, the majority of research since the 1990s is mainly descriptive, not analytical. Though some architects exert themselves to incorporate a morphological approach in their design method, due to the usual abundance of constraints, such as financial and political situations, complex procedures of dealing with different stakeholders, the thus developed designs often fails in

the end. Moreover, of the limited amount of urban morphology studies in China, most focus on Beijing and the mega-cities in the coastal area. The studies on cities in the interior parts of China are far more limited or absent.

Furthermore, Chinese cities usually possess an enormous scale, urban population and ample data. This implies an unprecedented complexity for designers to understand and comprehend. Therefore, the methodology of simplification might be the necessary and basic attitude for designers. This demands a well-developed reduction method, which the Dutch is famous for.

In addition, the Chinese cities exert themselves with the unprecedented urbanization rate. Therefore, the Dutch characteristic of thinking towards a future (design-oriented) while looking backwards (systematic analysis), can meet the local government's ambition to transform the city or part of the city into an internationally known and economically successful hub in addition to maintaining its local identity.

§ 3.5 Conclusion

This chapter with its 3 sections has answered the sub research question 2 and its background questions.

Sub research question 2:

How is *the morphological approach* used in the urban design process?

Background questions:

1 What is *the morphological approach*? What are the developments and application of it in different contexts? (Section 3.2)
2 What are the characteristics of the Delft morphological approach? (Section 3.3)

The investigation in Chapter 3 has established the theoretical foundation and understanding of *the morphological approach*. The overview on the three traditional morphological schools, Italian, French and British, and further developments in the Netherlands, the United States and China, together show that *the morphological approach* usually possesses a birds-eye view and focuses on urban form, its structure, and transformation. The Delft morphological approach's most representative characteristics— (a) reduction and (b) design and future oriented analysis— have been discussed as effective means to meet Chinese cities' current challenges— (a) the complexity of enormous scale and overwhelming size of the data, as well as (b) the ambition to develop forward with an unprecedented speed while keeping city's identity. The Delft approach will be further explained in Chapter 7 and applied in Wuhan. Mapping will be used as a means for morphological analysis and is at the same time the representation of the outcome of the historical morphological research. (see Chapter 7)

The overview and reflection on *the morphological approach* in Chapter 3 points out that next to the form itself, there are many other aspects of a city that need to be incorporated in the designer's conceptual domain, such as how people experience the city, how the inhabitants define their territory, and how the city can be understood from the eye level perspective. This gradually introduces Chapter 4 which introduces *the pattern language approach*.

4 Pattern language approach

Chapter 4 intends to answer the sub research question 3:

How is *the pattern language approach* used in the urban design process?

In order to answer the sub research question, some background questions are formed that are elaborated on in the corresponding sections.

1. What is *the pattern language approach*? What are the developments and application of it in different contexts? (Section 4.2)
2. What are the characteristics of the Delft pattern language approach? (Section 4.3)

The purpose of this chapter is to provide an overview of the application of *the pattern language approach* worldwide with an emphasis on the Dutch approach, which serves as the main reference and methodology in the case study in Chapter 8 and the basis for the further discussion in Chapter 9.

Section 4.2 critically introduces individual patterns and *the pattern language approach* and overviews the different schools of *the pattern language approaches* worldwide. Section 4.3 characterizes the Dutch or Delft School of the pattern language approach application and shows examples. Section 4.4 demonstrates how the Delft approach is relevant and applicable to the Chinese context.

§ 4.2 Different aspects of pattern language application and a critical reflection

§ 4.2.1 Individual patterns and a pattern language

A Pattern Language: Towns, Buildings, Construction (Alexander et al., 1977) and *The Timeless Way of Building* (Alexander, 1979) introduced by Christopher Alexander and his colleagues are two halves of a single work (Bhatt, 2010). The former provides design patterns and introduces how these patterns can be formed as languages for urban planning and design; the latter provides theory and instruction for the use of the language. Together the two not only present diagrammatic patterns but also provide a far-reaching philosophical understanding and critique of the alienated modern condition. Modernism is characterized by far distances between humans and nature, rigid divisions between work and home, and separation of elite architectural domain from everyday users (Bhatt, 2010). In contrast *A Pattern Language* tries to discuss how to transform a specific space from being functional to being

socially interactive. The written patterns often challenge the conventional ways of understanding and interpreting the built environment (Bhatt, 2010). Christopher Alexander, a mathematician, architect and theoretician, was always searching for *"the relation of parts to wholes [...] and useful new design tools for their genesis and transformation"* (Mehaffy, 2007, p. 41). The pattern language, introduced by him, is an efficient tool that relates the use of space to physical urban forms. It is also an effective approach for designers to communicate with each other and invite laymen to participate in the design process (Bhatt, 2010; CAI, 2015; Dovey, 1990).

Similar to actual languages, which are composed of words, phrases, sentences, paragraphs, and are organized according to certain common rules, i.e. Grammar, a pattern language's components can find its own counterparts in these languages. (See table 4.1) Next to the possibility to be able to find counterparts, another similarity between the two is that they are both individually dependent; in other words they are subjective to a certain extent. With the same words, or individual patterns, different people may tend to express results differently (different writing or oral expression as well as different pattern languages). Though the results may be different, these will not be completely different, because in the profession there is a degree of both a shared understanding of the built environment and a shared language. In addition, the major difference between the two is that the end result of a linguistic language is linear, while a pattern language has overlapping hierarchy (More discussions please see Section 8.4).

COMPOSITION OF LINGUISTIC LANGUAGES	COMPOSITION OF PATTERN LANGUAGES
Words	Individual patterns
Phrases	Clusters of individual patterns
Sentences	Clusters + linkages
Paragraphs	Pattern fields
Grammar	Shared understanding of the built environment*
Dictionary	A pattern book

TABLE 4.1 Analogy of linguistic languages and pattern languages

*   Shared understanding of the built environment could mean commonly trained professional skills and laymen sharing understanding from their neighbors.

The initial 253 individual patterns in *A Pattern Language* are developed and compiled in seamless descending scales—from regions to construction details. The actual patterns and method approaching the built environment introduced in the book have been a major influence on architecturally related professions all over the world (Saunders, 2002) (see Section 4.1.2). Not only have the scholars from academia developed further theory, but also practitioners tried to implement it in contemporary architectural and urban design practice. More intriguingly, this empirical based methodology gained great success in computing. (Bhatt, 2010; Mehaffy, 2007; Salingaros, 2008)

Along the implementation world wide, no doubt, there have been critics too.

The critiques of pattern language have been varied and have pointed to its essentialism, its reduction of the design process into a diagrammatic language and its emphasis on comfort, ease, and pleasure, which many critics see as bourgeois and encouraging of complacency (Bhatt, 2010).

J.P. Protzen is one of the representative criticizers who examine *the pattern language* through the lens of an empiricist. He considers *the pattern language* as 'consensus theory of truth' which can be seen as common sense. He claims that it should be refuted as a whole as it *"enforces an unenlightened*

conformism" and *"leads to deterioration of intellectual capacities and of the power of imagination"* (Protzen, 1978). He also views the patterns developed in Alexander's book to have low empirical content in the scientific sense and are hardly falsifiable (Dovey, 1990). He fails to understand the key issues that *the pattern language approach* addresses and he overlooks the limitations of empirical approaches when understanding the 'soft science'. As Dovey argued that patterns are distilled from the real world and based on real life experiences they gain their power and have been accepted by the collective *"not by being proven empirically correct, but by showing us a direct connection between the pattern and our experiences of the built environment"* (Dovey, 1990, p. 4). The word 'empirical' in Alexander's work means *"based on practical experience without reference to scientific principles"* instead of *"based solely on experiment and observation"* (Dovey, 1990, p. 4). Therefore, the patterns are like 'scientific hypothesis'. They are resonated with the users on a personal and intuitive level subconsciously. The better performed ones, in other words are the ones that were shared collectively and further seen as a source of knowledge, that are not easily or necessarily empirically verifiable (Bhatt, 2010).

Peter Eisenman, as a representative of structuralist and post structuralist, once questioned Christopher Alexander in a seminar at Harvard School of Design that the value which a pattern language endorsed can easily be seen as bourgeois and encouraging of complacency, passivity and parochialism (Discord over Harmony in Architecture, a script of the conversation between PE and CA). In contrast, Alexander exerts himself and his work to distance from theories of postmodernism and post structuralism. Alexander explains that his original intention of developing a *pattern language* was to explore an alternative concept of knowledge in architecture using a different cosmology. (Bhatt, 2010) Eisenman fails to see Alexander's effort of a shift in knowledge.

On the application level, criticisms are mainly about Alexander's individual patterns' content. For instance, practitioners tend to think design cannot be generalized and design process cannot be reduced to only implementing a few diagrammatic languages. In addition they claim the patterns Alexander provided might not be applicable anywhere in the world and design should be context based. The author argues that the above complaints actually reveal a pattern language's quality. Because it assures users a flexible, open-ended language that allows different groups to actively be engaged in the design process. The developed patterns provide a basis for laymen or designers to have a starting point, from where they can develop their own context based patterns. The author thinks what Alexander's a pattern language approach contributes to the profession is more the approach itself; how it can be used to bridge research and design and to bridge professionals and laymen.

Another mistake practitioners tend to make is that they use patterns individually or use them as a list in the design process, but do not pay attention to how the chosen patterns are linked to each other (Salingaros, 2000). One of the consequences is that the resulting design might lack large-scale coherence, structure and hierarchy (CAI, 2015).

A pattern language is more than just a patterns catalogue. Individual patterns are easier to describe than their language, yet a catalogue is only a dictionary. It does not give a script; it has no rules for flow, internal connections, or ordered substructures. A patterns catalogue lacks the essential validation that comes from recognizing the combinatorial properties in the language (Salingaros, 2000).

Therefore, the pattern language's combinatorial properties (clusters) and corresponding relating patterns cannot be of ignorance. (see Section 4.3.2 and 8.4.2) They together make the pattern language approach more suitable for application in design-process. Sets of connected patterns provide insights in the method itself and at the same time are open to add or replace individual patterns (CAI, 2015).

The main schools of a pattern language approach and their characteristics

Table 4.2 presents and characterizes the implementation of a pattern language approach in the USA, England, Japan, the Netherlands, France, from the aspects of research objects, research aims, research characteristics, main researchers and disciplines.

	Research Objects	Research Aims	Research Characteristics	Main Researchers and Disciplines
USA	– Vernacular architecture – All objects in the built environment – Coding in computer science – Public participation in urban design	-Establish "*a new theory of urban design which attempts to recapture the process by which cities develop organically*" (Alexander et al. 1997, p. 2) – Provide a dictionary and envision a resource that "*any ordinary person could use to produce reasonably good vernacular buildings, in place of the unsatisfying standardized buildings that comprised the vast majority of the built environment.* " (Mehaffy, 2007, p. 44)	-The origin of PL – Systematic both on theory and implementation – Covers all the scales – Emphasis the important of overlapping, interlocking, clusters and hierarchy	Christopher Alexander and his followers; Nikos A. Salingaros; Clare Cooper Marcus and Wendy Sarkissian; Ritu Bhatt; Anne Mikoleit and Moritz Pürckhauer, etc; Mathematics, architecture, urban studies, sociology, computation, etc
ENGLAND	-Students/designers' thinking processes – Implementation of PL in design process	– Use PL "*as a core device for understanding urban form components and relationships.* " (UCL, n.d.) in education – Challenge PL as a generator of urban form to overcome designers' cognitive constrains	-To test PL's interlocking and overlapping in design process -Emergence of individual patterns over time in existing built environment -To reflect on the application of a pattern language in design thinking	Stephen Marshall; Education
JAPAN	-Contemporary architecture – Urban regeneration projects of damaged villages in 2011 Tōhoku earthquake and tsunami	– Create a local inhabitants daily log for understanding the design context -Research and generate a design language for evidence based design solution – Create a design code to be used as general design guidelines – To invite users participation	– Research initiates from human body scale further implemented in the housing design practice – Patterns written from everyday life, based on observation and interviews – defines using PL to design include three phases: programming+creating the pattern language+ investigation	Atelier Bow-Wow; Kazuhiro Kojima（小嶋一浩）; Hiroshi Nakamura（中村拓志）; Ingrid F. King; architecture, urban design, building technology
THE NETHERLANDS	– Human behavior – Urban design process – Design thinking – Knowledge in different professions and translate the information into design languages to be used in urban design	– Research and generate a design language for evidence based design solution -To make explicit design problems and intentions – To invite public participation	-Use individual patterns as entities to bridge research and design; -Think in different layers and scales; – Build a collective pattern field – Implement clusters of individual patterns in design process – Further test on how existing patterns generate new patterns and how new patterns evolve	Machiel van Dorst; Egbert Stolk; Gert Urhahn and Miloš Bobić; Sara van Duijn; Stefan van Bellen; Joost van Andel; Urbanism; Education
FRANCE	– Public space and public life in Paris – Human behavior	– Create a Parisian public life log for understanding Paris public spaces and its transformation -Research and generate a design language for evidence based design solution	– Distill meaning from the built environment – Associate with a specific place and time – Based on observation and give further interpretation – Individual pattern is traced and highlighted from actual urban scenes	Atelier Parisien D'urbanisme;

TABLE 4.2 A pattern language application in different contexts

The Delft approach to bridge research and design as well as to bridge professionals and laymen

The Delft school of a pattern language approach

The two most representative characteristics mentioned in Section 2.4 (the integration of planning and design as well as integration of research and design) not only leads to the unique position of Dutch Design in the world, but also results in the unique characteristics of the Delft School of a pattern language approach:

1   It is originated from Christopher Alexander's pattern language, but expanded the individual pattern's role as a solution in the built environment for data organization, presentation, communication, and as a design tool (see Section 4.3.2 and 4.3.3).
2   Individual patterns are seen as entities to bridge research and design.

The Delft method of the pattern language application admits patterns are multifaceted. Each individual pattern is presented conceptually, theoretically, visually and practically. The title of the pattern is concise and the images next to it give a strong impression in order to easily be remembered by the participants who work with them. The statement is the actual pattern in a compact manner. The theoretical backup gives the credibility, which comes from the experience of daily life, scientific research, etc. The practical implications prescribe the practical consequences of designing with such pattern. In the end, the possible linkage with other patterns is suggested (see Section 4.3.2). Each pattern is set in a compact manner and kept simple. Designers can start writing them in an A4 paper (Appendix 1).

3   Responds to Nikos A. Salingaros's criticisms on the misapplication of PL in contemporary practice by discussing the missing step between making individual patterns and building a pattern language through the clustering of patterns (Salingaros, 2008). It groups individual patterns in different themes/subjects and illustrates clusters as possible design solutions (See Section 4.3.2-1 and 2).
4   It is applied in research, practice and education.
5   It consolidates the running texts in the pattern language that discuss the links and scales of patterns by introducing a pattern field as a tool to structure patterns according to scales and abstraction and look for hierarchy.

The pattern field is a range defined by X-axis from concrete to abstract, and Y-axis from 1:1 scale to 1:10.000 scale (Figure 4.1). The individual patterns are organized in relation with each other. While working together with a group of colleagues to put the individual patterns in the pattern field, there is constant discussion about if a certain pattern is relatively more abstract or concrete in relation to the positioned patterns or if one is larger or smaller in scale in relation to the existing ones. Then, links are made between individual patterns. The pattern field is an overview of the collection of individual patterns. It can be seen as a designer's toolkit generated incrementally. During the process of interrelating individual patterns in the field, some patterns might need to be rewritten, new patterns might emerge, or other patterns might merge or be split. Therefore, working on the pattern field should not be the last phase when all patterns are written perfectly, but during the process. It can help to formulate more precise patterns. As such, the pattern field is dynamic and it is a part of recursive process in the design process.
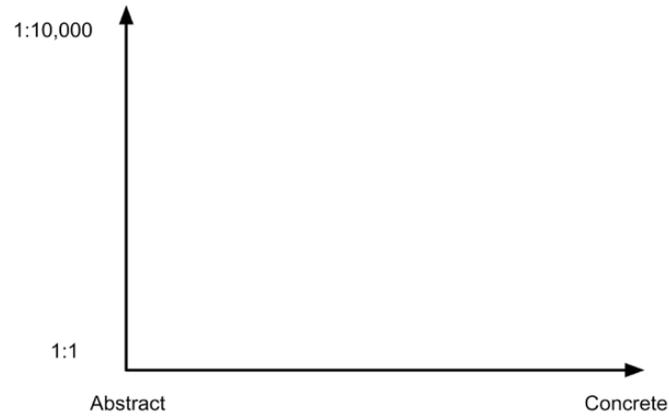
FIGURE 4.1 A pattern field

6 Working collaboratively to build up a pattern language together or building up pattern languages by using the same individual patterns is a process to communicate among professionals as well as with laymen (see Section 8.4 and 9.1.5-4). It creates a system of knowledge that will help to blur the rigid subdivision between professional designers and everyday users (Bhatt, 2010).

7 Individual patterns developed in the Dutch school are normative and have an optimistic layer. They usually show what might work and explore the possibilities instead of showing what does not work.

Examples of the Delft School of a pattern language

This paragraph presents a series of representative examples of the pattern language application in the Netherlands. These give an overview of the method, but that does not mean that all aspects presented have been applied in the research of the public life of Wuhan. (For further explanation see Section 8.2)

1   **Late post-war neighborhoods, the Netherlands: Anne Veerle Bruin (individual pattern composition, cluster of patterns, interlocking)**

The master graduation project from Anne Veerle Bruin, supervised by Dr. Van Dorst, is a good example that shows how an individual pattern is composed (Figure 4.2), how patterns are grouped according to different themes (Figure 4.3-1) and how a possible pattern language is built up (Figure 4.3-2). The fact that one individual pattern belongs to different groups demonstrates the pattern language's interlocking and overlapping properties (Bruin, 2010).

1 A picture depicting the particular problem or missing element in Zevenkamp or a specific quality that needs to be reinforced.

40. Clear green

Statement: Ownership and function of green areas need to be clear to ensure proper use

Clarification: Late post-war neighbourhoods in general have large amounts of public greens, but often with limited maintenance budget and limit programming. As far as Zevenkamp is concerned, patches of green without clear ownership and/or function can be found scattered across the neighbourhood and building blocks. These patches are cluttered and litter tends to accumulate there. Some appear to function as the neighbourhood's public dog toilets. Their ownership and function are not legible from their layout. Such green does not enhance the quality of the public space, but does very much the opposite.

Solution: Transform underutilised green patches into built-up areas

......or privatise green patches to adjoining garden or housing owners....

.........or design for them to have a public meeting function
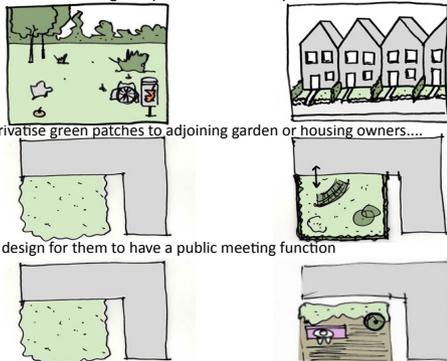
Sources: Luten 2008, Bruin, 2010

Group:

Relation: legible public space, lively park, water structure, eatable green, natural green, local square, dog space

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2 The actual pattern to solve the problem.

FIGURE 4.2 An individual pattern example--clear green (Bruin, 2010)

Something which, considering the aspects of social interaction and social safety, is a **particular quality** of the neighbourhood but which needs to be reinforced, consistently applied or applied in more parts of the neighbourhood.

Something which, considering the aspects of social interaction and social safety, is **noticeably missing** and needs to be introduced.

Something which, considering the aspects of social interaction and social safety, is a **particular problem** of the neighbourhood and which needs to be solved.

Intervention aimed at improving **visibility** of the environment

Intervention aimed at improving uniformity or **legibility** of the environment

Intervention aimed at improving ór decreasing **accessbility** of the environment

Intervention aimed at improving **attractivity** of the environment

Intervention aimed at **assembling people** and events in time and space

Intervention aimed at **integration of functions**

Intervention aimed at **inviting people** to come use and stay in public space

Pattern predominantly concerns the **neighbourhood within its context** of the city or surrounding landscape

Pattern predominantly concerns the **neighbourhood by itself**

Pattern predominantly concerns a **part of the neighbourhood**

Pattern predominantly concerns a building **block or street**

Pattern predominantly deals with the **built-up area** of the neighbourhood

Pattern predominantly deals with the **public space** of the neighbourhood

Pattern predominantly deals with the **program** of the neighbourhood

Illustration 5.1: Labeling system for patterns

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1   Labelling system for patterns-- individual patterns groupping

2   Overview graph of the patterns with a web of possible relations

FIGURE 4.3 A possible pattern language (Bruin, 2010)

TOC

The resil(i)once patterns developed in the master graduation project by Martijn Lugten was incorporated into the European Interdisciplinary Project 'Better Airport Regions'. It is a great example showing how individual patterns can be used as a vehicle to translate and convey information, and how knowledge from other disciplines can be incorporated into design languages and be used in design processes. (In this case, it is about noise attenuating measures that is too technical for designers.) Another inspiration from this project is it illustrates its patterns as pattern clusters as suggested by Salingaros (2000) (See Figure 4.4). The integration of individual patterns as a cluster suggests possible design solutions that further show its effects in figure 4.5. Last but not the least, a further validation on individual pattern proposals is completed by stakeholders at the municipality of the Haarlemmermeer (Lugten, 2014).
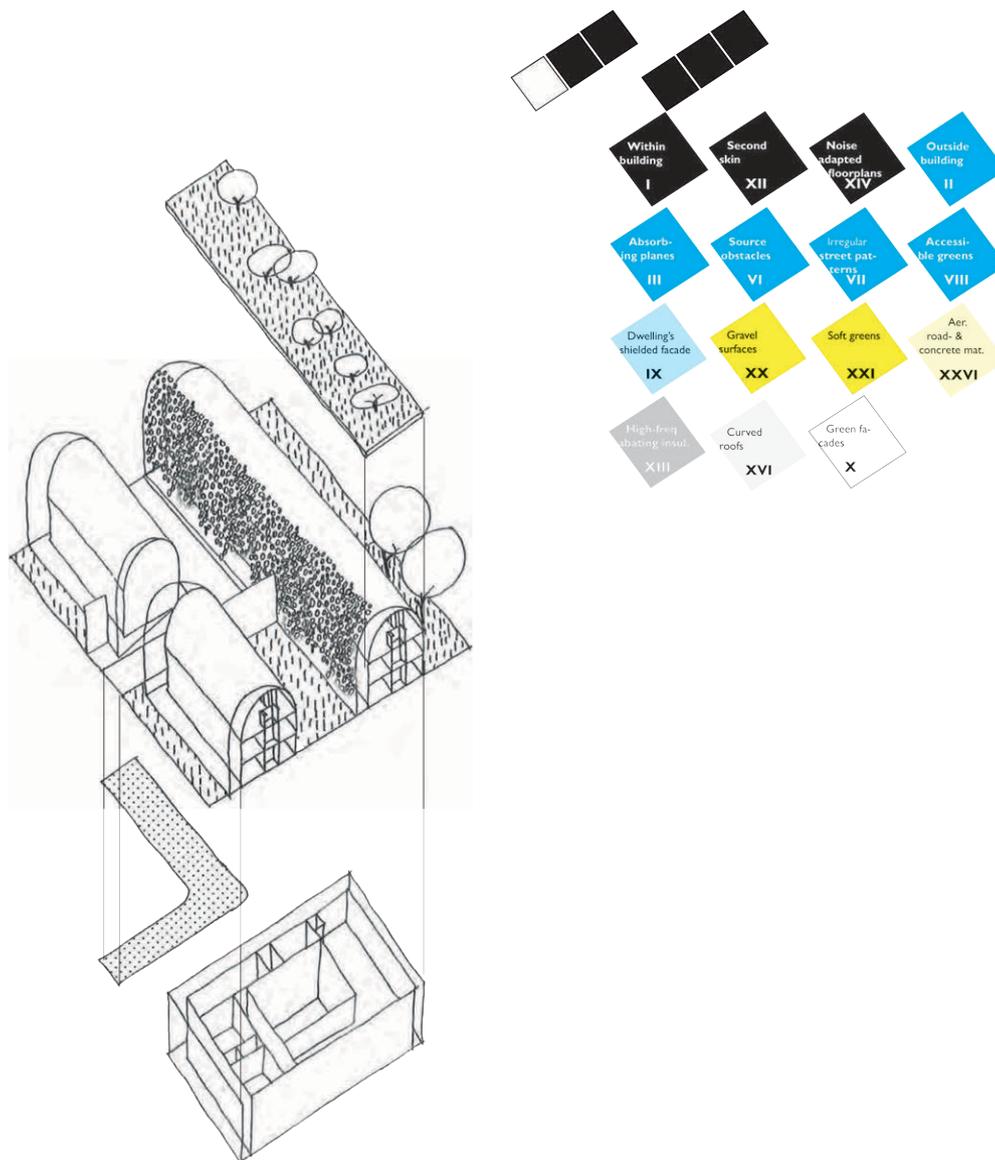
FIGURE 4.4 An example of a cluster of individual patterns within an integrated design solution.(Lugten, 2014)

Direct sound waves
Indirect sound waves
Sound absorption

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FIGURE 4.5 The effects of the typology on Stationary Starting, Taxiing and Crossing Airplanes noise, (Lugten, 2014).

77   Pattern language approach

Direct sound waves
Indirect sound waves
Sound absorption

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FIGURE 4.5 The effects of the typology on Stationary Starting, Taxiing and Crossing Airplanes noise, (Lugten, 2014).

77   Pattern language approach

EMU *"is an advanced master degree that engages with the complexities of the design and planning of cities and landscapes, in a jointly run program by TU Delft, KU Leuven, UPC Barcelona and Università IUAV di Venezia. "* (TU Delft, n.d.) The pattern book serials are the products from its theory course—Sustainable City instructed by Dr. Van Dorst (Figure 4.6). The students, with different majors and country origins, tend to develop different patterns with specific focuses coming from their own professional, academic, and personal life experiences (Figure 4.7). Though the individual patterns are loaded with personal styles, the discussions and the processes to build up collective pattern languages in the course are very accessible and easy to comprehend. The course itself is a proof that a pattern language approach is quite international, without context limitations as well it is a communication tool that works as a platform for people from different background to cooperate (Van Dorst, 2012; 2013)

1 The pattern book 2012   2 The pattern book 2013

FIGURE 4.6 Pattern book serials developed by the students from European Post-master in Urbanism in 2012 and 2013, (van Dorst, 2012 & 2013)

.

026
Multiple self-organized clan

Hypothesis

"Associational forms of civic life should be nurtured not regarded as a potential threat, particularly at the local level."

----John Friedmann

Theoretical backup

The importance of clan and family is perhaps one of the most important features of Chinese culture. However, in China's industrialization process, conducted in early 1950s land reform movement, clan system suffered a huge blow. In that particular historical period, clan was treated as the opposite of industrial civilization; it conducted a cultural offensive to the shrine, genealogy, etc. Clan organization was replaced by new communist party organization; the shrine was transformed into school or City Hall. But because of blood and geopolitical, since the 1980s, as the core of spontaneous clan, continuation of genealogy and other activities such as the gradual recovery still play an important role in the local society.

In addition, since the impact of Christianity, Chinese society begins to rethink the importance of the clan. Clans should not be considered obstacles of social rules, but self-organized link which maintain social and cultural traditions.

Practical implications

Thus, far from encouraging the dreaded chaos, organized civil society should be seen as a source of civic strength, an asset worthy of public support. Its existence acknowledges the full diversity of the city while promoting local citizenship.

In rural China, clans charge with maintaining regulation of rural societies, villagers' basic behavior and ethics of responsibility through institution of local rules and genealogical research. The constraint of clans is also manifested in ruling of the villagers' behavior. Clan teenagers may be contaminated on the prevention of social vices. Genealogy has strict bans on prostitution, gambling, alcohol, fighting and other evils.

SX

See also

Wikipedia: China's clan

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Image source:
Pan Jialai, Yu Ruofei, Chinese heritage

References

Pan Jialai, Yu Ruofei, Ties of blood and the clan governance in Nanxi River basin, Originally published in 8th <Chinese Heritage> 2007 on page 64-73, Copyright (c) 2007 by Chinese Heritage

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07
Port heritage

... city areas with flourishing diversity sprout strange and unpredictable uses and peculiar scenes. But this is not a drawback of diversity. This is the point ... of it. (Jacobs, 1961)

Hypothesis

A working port does not necessarily prevent the urban renewal of former docks inside cities, on the contrary it must be seen as way of retaining identity to the place.

Theoretical backup

Many cities around the world have their origins and development directly connected to port activities. However pushed by changes in economy and nature of port activities many of those cities experienced the creation of vacant and decay areas.
In the last decades, a wave of projects dealt with former harbour conversions, and former ports are gradually been incorporated by the cities.
One aspect that is common in the most successful cases of renewal of port areas is the retention of certain port activities at the same time that new functions are incorporated.

Practical implications

This pattern intends to reinforce the notion that port activities are part of the cultural landscape of the cities and therefore they must continue to be part of it even after urban renewal.
Urban planners and stakeholders involved in port areas transformation must take into account that the maintenance of some of the original port activities can have positive effects. Among other things it can contribute to avoid the image of 'theme park'.

LC

See also

11- New life for old buildings
36 - Integrated waterfront
62 - City as a narrative

19

Cape Town port
Luiz Carvalho

References

Jacobs, J., 1961. The Death and Life of Great American Cities, New York: Random House

2

FIGURE 4.7 Examples of individual patterns made by EMU international students (van Dorst, 2012 & 2013)

4 A pattern image: a typological tool for quality in urban planning, the Netherlands: Gert Urhahn and Milos Bobic [26](organize information and present it in the same format)

The pattern language approach can also be understood from a broader sense that it is a tool to organize and present information in a systematic format. Each individual pattern can be a positive or successful case in the built environment (Figure 4.8). A few of them form an upper level pattern or one cluster of patterns (In this case are the various types of environments Figure 4.9). The fact that all patterns are created in the same format makes it possible to compare them, clarify, and offer insights into differences or similarities. Then a final discussion about the interconnections between the various types of environments (the pattern clusters) is put into the context of its relations with infrastructure, regional plans and locations (Urhahn & Bobić, 1994).

[26] This publication is based on a research commissioned by the National Spatial Planning Agency of the Dutch Ministry of Housing, Physical Planning and the Environment. *"The purpose of the study was to research those types of environments which were deemed to offer opportunities for the future as sites for new areas of construction."* (Urhahn & Bobic, 1994 p. 5)

FIGURE 4.8 One example of center-like environments (Urhahn, 1994)

FIGURE 4.9 Types of environment (Urhahn, 1994)

Pattern language in Architectural and urban discourses

In architecture, *the pattern language* can be used for generating architectural layouts (King, 1993) and facilitating small scale interventions. In urbanism, a PL deals with different scales and abstraction as well as becomes a communication tool among different stakeholders.

Salingaros stated in his profound paper

In practice, pattern languages arise from two very different needs: (a) as a way of understanding, and possibly controlling, a complex system; (b) as necessary design tools with which to build something that is functionally and structurally coherent.

(Salingaros, 2000, p. 155).

Expanded from his interpretation, the role of a pattern language can be as:

1   A tool for handling spatial and non-spatial data: different types of data from various domains can be organized, translated, integrated and presented in the same format, allowing for understanding.
2   A tool for presentation and communication: individual patterns integrate and visualize various types of information from different disciplines and presents research outcomes. This enables communication among designers, clients and laymen, etc. when building up their collective languages.
3   A design tool: similar to mapping, a pattern language as a design tool in urban design can also have three modalities: instrument, operation, and concept. 1) As an instrument, individual patterns are used to bridge research and design, and translate research outcomes into designers' vocabulary. A pattern language is used to structure ideas and look for focuses in design processes. 2) As an operation, individual patterns are used to explore the design processes, make individual patterns and build up the collective languages that focus, explicate thoughts, explore design concepts and generates designs. 3) As a concept, individual patterns are used as a design concept. Working with individual patterns to build up a language is a process to combine ideas and generate new ideas. In the end, a pattern language approach as a method and a concept contribute to urban design theory and broaden its scope and effectiveness.

The relevance of the Delft a pattern language approach in China

Domains regarding human behavior, environmental psychology, energy, social science, building technology, and economy, all have a close relation to urban design. The input from these disciplines provides meaningful insights for urban designers to incorporate in the urban design process. However, the research from these domains is often presented descriptively (mainly in text). Furthermore, the different ways of thinking and different types of information often make it difficult for designers to understand. The Dutch interpretation of *the pattern language approach*, as a translating tool, can convey information from any other domain into design language making the "exotic knowledge" more relevant, applicable, and accessible for urban designers. This provides possibilities to meet the current global trend to develop inclusive cities.

Next to the more general use as a translation tool, the *the pattern language approach* acts as an efficient tool to initiate the relationship between space and human behavior. A sophisticated understanding and implementation of *the pattern language approach* is rather limited in China. Since the translation and introduction of the book from Christopher Alexander, there is hardly any more reflection or research on it. Indeed, there are some scholars from architecture that pay attention to the human behavior in the design domain. However, the way they approach it is either mapping the existence of certain behaviors in the environment (descriptive) or analytical using a certain theory as a lens (mainly text). To sum up, an explicit and systematic application of a pattern language approach in China is far more limited if not absent.

Similarly with the Dutch morphological approach's reduction characteristic, individual patterns are also reductions. It can help to structure and understand the complexity of Chinese cities which have unprecedented scales and enormous relevant data. In addition, with the unprecedented urbanization rate, Chinese cities are in a constant state of never ending construction and destruction. This definitely asks for an approach that can afford flexibility as well as facilitate new emerging elements. The pattern language approach itself does not necessarily need a conclusion, a clear beginning or an order, but is a totally open and dynamic process. In the end, the efficient communication competence of a pattern language approach could effectively mediate the complex stakeholders in China.

Conclusion

This chapter with its 3 sections has answered the sub research question 3 and its background questions.

Sub research question 3:

How is *the pattern language approach* used in the urban design process?

Background questions:
1   What is the pattern language approach? What are the developments and application of it in different contexts? (Section 4.2)
2   What are the characteristics of the Dutch pattern language approach? (Section 4.3)

The investigation in Chapter 4 has set up the theoretical foundation and understanding of *the pattern language approach*. The overview on the application of the approach in the United States, England, Japan, the Netherlands, and France together show that different from *the morphological approach* introduced in Chapter 3, *the pattern language approach* usually initiates from eye-level, small scale and more concrete scenery and then slowly builds up. It is often used as a translating tool to convey information from other domains into design. It is more an approach to structure information and communicate with other people, rather than merely focus on a certain content (either energy, form or human behavior, etc). The Delft pattern language approach's characteristics, (a) reduction, (b) translating, (c) communication and (d) open and facilitating changes, have been discussed as effective to suit Chinese cities' current situation. The current situation involves (a) the complexity of enormous scale and ample data, (b) the necessities to integrate multiple disciplines into urban design as well as to bridge research and design, (c) the necessities to effectively mediate complex stakeholders in the design process as well as (d) longing for flexibility to accommodate changes.

The above conclusion will be tested further with the application of the pattern language approach in Chapter 8. Individual patterns will be used as a tool to compact various information and presenting the life styles in Wuhan, and at the same time be a design tool for exploring its practical implications in the urban design process. The pattern book itself is also a part of the design toolkit for urban practitioners to use for future city development. A workshop is set up to build up pattern languages with the individual patterns and explore the potential implication for urban design.

5   Part 2 Epilogue

Chapter 2, 3, 4 and 5 together, have set up the context and built up the theoretical frameworks for the main elements of this research, *urban design*, *the morphological approach* and *the pattern language approach*.

1. Two approaches in relation to Urban Design definition

In Chapter 2, urban design was defined as dealing with all scales, a process consisting of analysis and synthesis (Lawson, 2006) and a well-presented end product shaping the form of city and the public realm. Relate the two approaches according to the main four elements of urban design (Table 5.1).

URBAN DESIGN (UD)	THE MORPHOLOGICAL APPROACH (UM)	THE PATTERN LANGUAGE APPROACH (PL)
All scales	Bird-eye view: Initiated from large scale to small scale	Human eye-level perspective: Initiated from small scale to large scale
Process of analysis and synthesis	Reduction: design and future oriented analysis	Reduction, translating, communication: open and facilitating changes
Form	Urban form, form structure and trans-formation	Translate and convey information from any other domain into design, in other words, relate any information with form.
Public realm	Broader than public realm	Broader than public realm

TABLE 5.1 Two approaches in relation to urban design definition

The two approaches both deal with all scales, though they are often initiated differently. The UM possesses the bird-eye view and is often initiated from the large scale to small scale. The PL often holds a human eye perspective and initiated from a small scale to a large scale. Whereas, UD can start from any scale and work with multiple scales at the same time.

The two approaches are both tools to assist analysis and synthesis in the urban design process. The process of doing morphological research is one of reducing information, analyzing and synthesizing with a future oriented design thinking. Whereas, the pattern language approach plays a role in reducing information, translating knowledge from different domains into the design profession, and communicating with different stakeholders. In addition, a pattern field (as well as pattern languages) are always open and flexible to accommodate changes.

The two approaches both deal with form. UM focuses on urban forms, reveals form system and transformation. The pattern language approach is more used as a translation tool to convey information from any other profession into urban design language. It relates any domain to form.

Next to form, another object in urban design is the public realm. Urban design works on public space and public space systems. However, the two approaches can be focused on public space and the public, but not only that. They can tackle broader domains than the public realm.

2. Two approaches in relation to historical continuity and its inevitable elements

One of the inevitable elements to achieve historical continuity is sequential, legible historical layers, in which the meaning of a place is embodied. *The morphological approach* and *the pattern language approach* provide means for urban designers to systematically recognize these layers so as to distill the meaning in the physical and non-physical contexts respectively. Thoughtfully adding another layer containing the contemporary meaning (design intervention) to these recognized layers is the way to pass down, and at the same time incrementally change, tradition. This results in historical continuity and thus in permanence in urban design.

3. Two approaches in relation to the production of space

In the late 1970s, a group of Neo-Marxist scholars introduced the concept of *reproduction of social spaces* as an alternative interpretation of urban formation to oppose the quantitative geography school (Çalişkan, 2013). In Henri Lefebvre's profound book *"The Production of Space"*, the tria-lectical thinking he introduced subverts all the traditional modes of understanding and thinking. Space as his main concern is articulated in three elements: *spatial practice/perceived space*, *representations of space/conceived space* and *representational space/lived space* (Harvey, 1991; Lefebvre, 1979; 1991; Merrifield, 1993; Soja, 1996; Unwin, 2000). These three elements are incorporated and redefined later on as first, second and third space respectively by Edward Soja (Soja, 1996). See Table 5.2 for the definitions and interrelations.

Henri Lefebvre	*Spatial practice* (perceived space) "*embraces production and reproduction, and the particular locations and spatial sets characteristic of each special formation. Spatial practice resumes continuity and some degree of cohesion.*" (Lefebvre, 1991, p. 33)	*Representations of space* (conceived space) "*… are tied to the relations of production and to the "order" which those relations impose, and hence to knowledge, to signs, to codes, and to "frontal" relations.*" (Lefebvre, 1991, p. 33)	*Space of representation* (lived space) "*embodying complex symbolisms, sometimes coded, sometimes not, linked to the […] social life, as also to art.*" (Lefebvre, 1991, p. 33)
Edward Soja	First space has been explored "*primarily through its readable texts and contexts*" (Soja, 1996, p. 22)	Second space can be investigated "*through its prevailing representational discourses*" (Soja, 1996, p. 22)	Third space "*can be guided by an emancipatory practice that is consciously spatial and designed to "improve the world in some significant way*" (Soja, 1996, p. 22)
Author's Interpretation	Physical space (concrete) + actual social interaction — "*…all the material social interactions occurring within space to produce and reproduce social formation…*" (Stevens, 2007, p. 6) — both actual physical forms and social interaction can be seen and mapped	Conceptualized space (abstraction) —imagined, mental space, a space for designers and planners	Social space (sensation/action) —"*…are spaces as lived by their inhabitants through complex symbolic association and imagery;*" (Stevens, 2007, p. 6) — the experience of life in the first space mediated through second space expectation and recreated by its users.

TABLE 5.2 Definitions and interrelations of *spatial practice*, *representations of space* and *representational space* by Henri Lefebvre, Edward Soja and the author

Space is "*at once result and cause, product and producer*" and interacts with society at all levels (Lefebvre, 1979, p. 142). Society reproduces itself essentially over the process of production of spaces (Chen, 2010). Different social organizations in different levels of society participate in this process to pursue their own interests. The spatial relations are as important as the control of other means of production (Lefebvre, 1979). Lefebvre specially indicates that spatial design is one aspect of the

productive forces of society (Gottdiener, 1994). Based on the above, the designer's conceptualized space—*representations of space*— is set as the main focus in this research. They are the social codes or designers' languages through which designers discuss and understand *spatial practice* and *representational space*. It is about how to convey information from the other two domains into a designer's world and how to abstract information from the other two domains into designer's languages.

The morphological approach can be used to interpret the first space (perceived space) and convey its information into second space (conceived space), whereas *the pattern language approach* **can be used to interpret the third space (lived space) and convey its information into second space (conceived space)** (Figure 5.1)
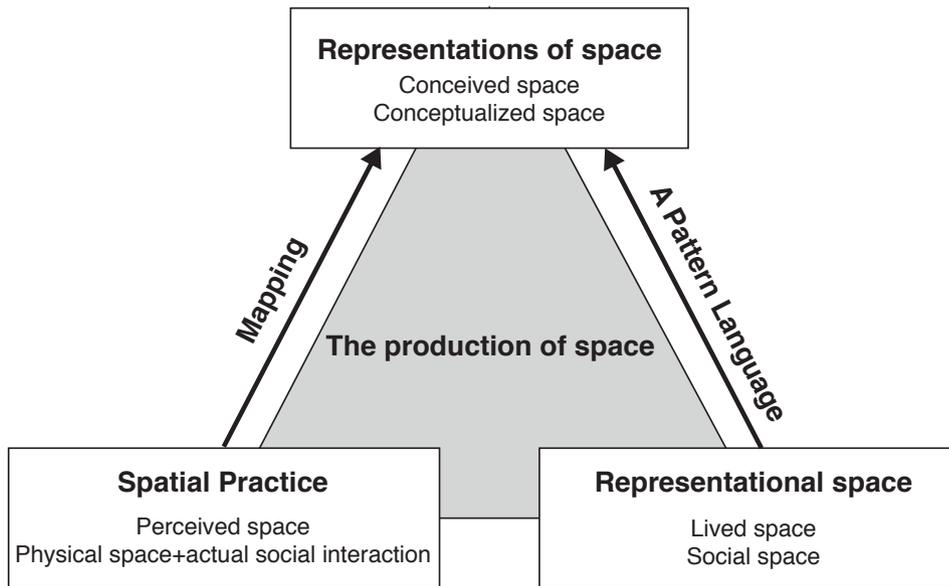
FIGURE 5.1 How the two approaches assist urban designers

These theoretical frameworks structure the following case study in Part 3.

Design with forms as well as patterns
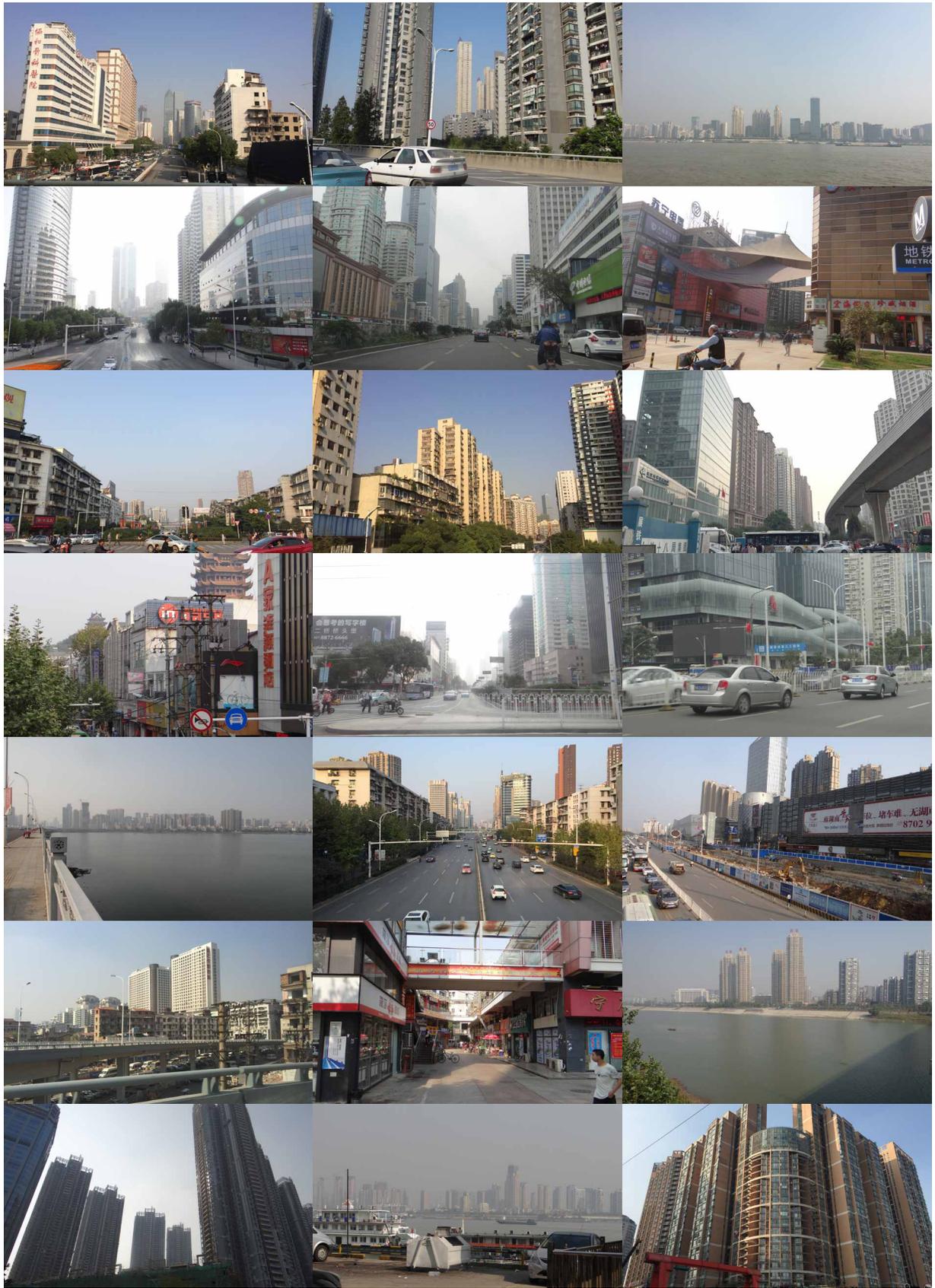
PART 3 Case studies: understanding historical continuity

The design methods *the morphological approach* and *the pattern language approach* are analyzed and compared in different contexts in the Chapter 3 and Chapter 4 respectively. For this next part, the two methods are applied in a Chinese city, Wuhan, to systematically test how these two approaches can provide practical insights in the city as well as assist urban design.

Chapter 6 gives a general introduction of Wuhan.

Chapter 7: Conceive the perceived space: mapping urban form transformation, reveal the structure of physical spaces. It is a morphological research, concerned with the urban form and its historical development. As far as we know, it is the first time that a multi-scalar historical morphological analysis of a large Chinese city has been done.

Chapter 8: Conceive the lived space: A pattern language of life style transformation, reveal the structure of public spaces. It is concerned with the local Chinese authentic public life and how these uses have developed overtime. As far as we know, this also is the first time a pattern language approach is systematically applied to study public life in a Chinese city.

By setting up the research and writing in a systematic and symmetrical manner, Part 3 provides data and insights for the Part 4 to synthesize the two approaches.
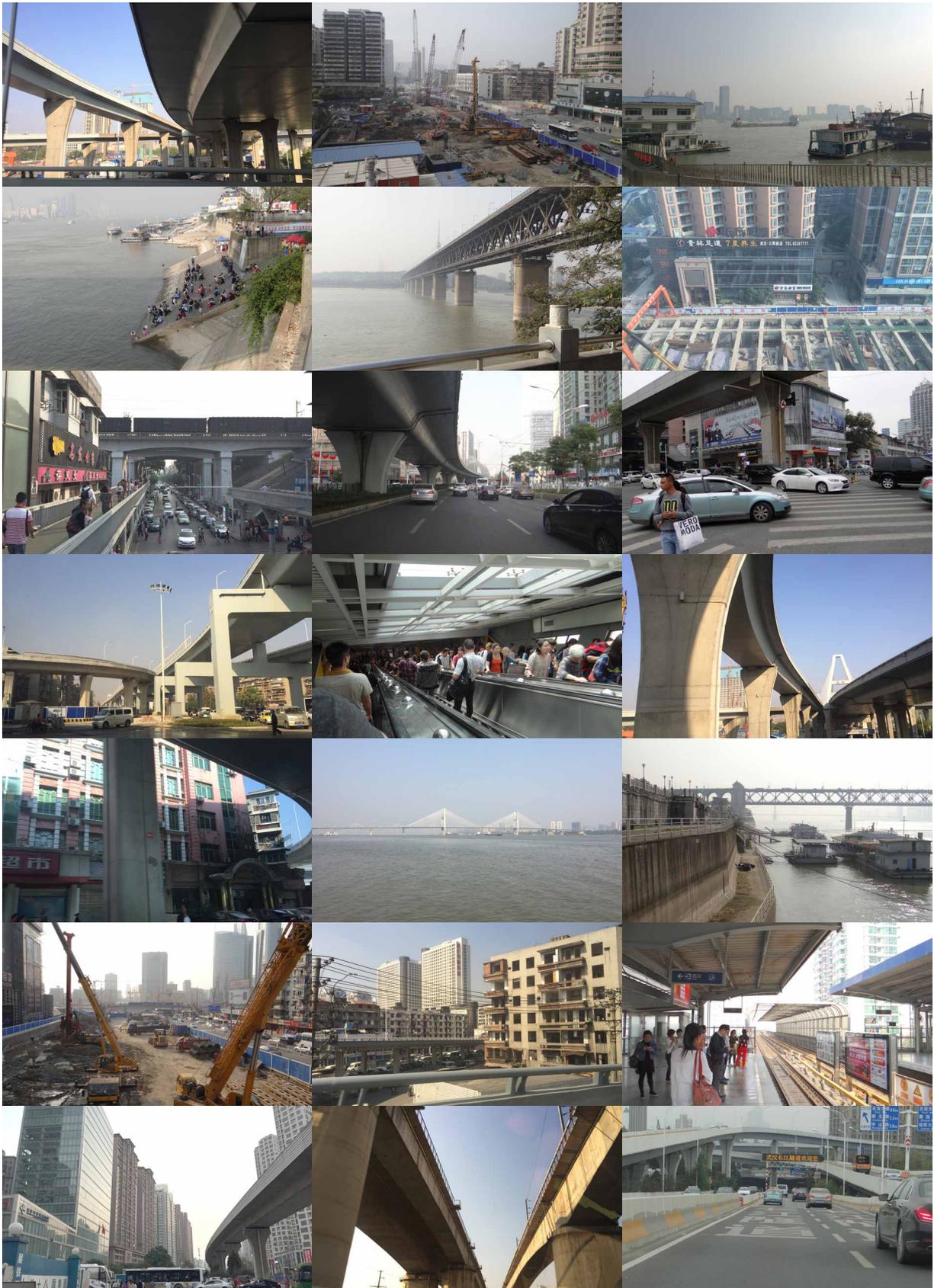
6 General introduction of Wuhan

§ 6.1 **Basic historical facts**

Wuhan used to be referred to as Han. The name Wuhan comes from the integration of three pre. existing towns: Hanyang, Wuchang, and Hankou. The city is located in China's Yangtze River Basin at the confluence of the Yangtze River, the world's third largest river, and the Han River, its biggest tributary. The rivers divide the city into three parts which correspond to the locations of the three original towns.

The first known urban settlement dates back to the Panlong Town period, nearly 5,500 years ago. (see Section 6.3). The region gave birth to the Yangtze River and the Jingchu Civilization.

Wuhan is the capital of Hubei Province. The city plays an important role in China in: industry, science and technology, and as an integrated transportation hub in Central China. Based on this, the national policy of Wuhan now is the most important of the three core cities in the middle region of the Yangtze River (Development Plan of the Urban Agglomeration in the Middle Reaches of the Yangtze River, 2015; Hubei Yangtze River Economic Zone Development Plan, 2010). The aim is not only to develop the middle region but to also apply a new paradigm for a source-efficient and environmentally friendly city. As such, Wuhan has an important responsibility to explore a suitable urbanization method with Chinese characteristics.

Wuhan's gross domestic product (GDP) reached 10,069.48 billion Renminbi in 2014 (Wuhan Economic and Social Development Statistics Bulletin, 2014), ranking as the eighth metropolitan region in China. The rate of the three main categories of production, agriculture, industry, and modern services are the following: 3.5, 47.5, 49.0. These numbers show the ongoing transformation of the city from an industrial to a service based economy (Wuhan Economic and Social Development Statistics Bulletin, 2014).

The present city administers are: the seven Inner Districts, the six New Districts, and the three National Economic and Technological Development Zones. By the end of 2014, the administrative domain of the city covers 8,494 km^2, the metropolitan area 3,261 km^2, and the (inner) city 678 km^2 (www.whtj.gov.cn). The East-west and north-south are the Metropolitan area measures about 68 km^2. The Inner city measures 34 km east-west and 30 km north-south. By the end of 2014, the resident population of the Metropolitan area was 10,338 million (Wuhan Economic and Social Development Statistics Bulletin, 2014). The urbanization rate of Wuhan is 79 .36% in 2014 (www.whtj.gov.cn; Wuhan Statistical Information Network, 2015).

At the moment, Wuhan is experiencing a critical period of growth and urban renewal.

§ 6.2 Landscape

The landscape of Wuhan is characterized by an abundance of open water and a range of hills or relatively low mountains. The urban area is generally flat, with hilly ridges from east to west in the middle and in the south. There are 166 lakes in the city, of which 40 are in the inner city. The open water of the lakes covers 10% of the city's surface (Three Lines and One Road, Protection Plan of the Third Batch of Lakes in Wuhan City, 2015). In addition, there are 158 natural hills in the city (2014 Annual Blue Book of Geographic Information, 2014).

§ 6.2.1 The rivers

The Yangtze River is the longest river in Asia and the third longest in the world. At the same time, it is classified as the world's longest river entirely within the territory of one nation. The total length of the river is 6,300 km, which runs through southwestern China. The Yangtze River serves one-fifth of the total area of the country and reaches one-third of the population. The average width of the Yangtze River in Wuhan is 1,300 m.

The Han River is the largest tributary of the Yangtze River, which runs from Wuhan, south of Hankou. It is 300 m wide during low tides and 400-700 m during flooding periods. (Figure 6.1)
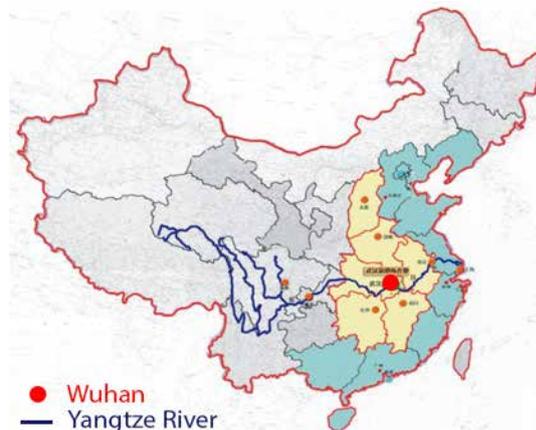
FIGURE 6.1 The Yangtze River in China (Source: Yangtze River Economic Zone Integrated Transport Corridor Planning, 2014)

The region around Wuhan is known as 'the Province of a Thousand Lakes'. All of the lakes have a regulatory function in the water management in the area. At the same time, they fulfill additional functions such as ecological conservation, fresh water storage, and aquaculture. They also provide beautiful scenic views and many opportunities for water recreation. The lakeshores offer lakeside entertain-ment with divers characteristics. In the Inner city, the lakes form a core of landscape parks such as the around the East Lake, the Moshui Lake, the South Lake and so on. (Figure 6.2)

§ 6.2.3   The mountains

The mountains create places that have undulating surfaces for the city. They are mostly part of two ridges that cut in from the east-west direction across the middle of the Inner city and the southern part of the Metropolitan area. The heights of the mountains in the Inner city do not exceed 150 m, and the slopes are generally less than 30 degrees. As the result of geological forces, the mountains have different forms, such as the smooth, round form of Tuan Mountain or the spread, lingering form of She Mountain, or the form of the Garden Mountain that consists of three parallel ridges. In the Metropolitan area, the mountain heights are between 50 and 200 m, which are higher than those in the Inner city. The highest is Dingguan Mountain, at an absolute height of 200.1 m (relative height 154.2 m). In addition, most of the mountains are clustered in ridges, such as the Longquan and Qinglongshan Mountains. Most mountains are not built on. They form parks or natural reserves in the city (Figure 6.3).
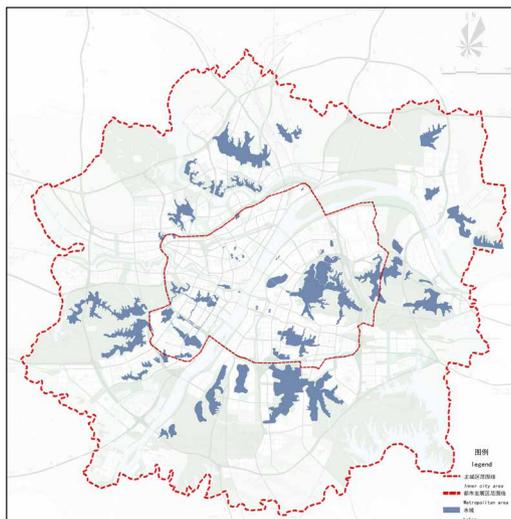
FIGURE 6.2 The main lakes in Wuhan (Source: Three Lines and One Road, Protection Plan of the Third Batch of Lakes in Wuhan City, 2015)
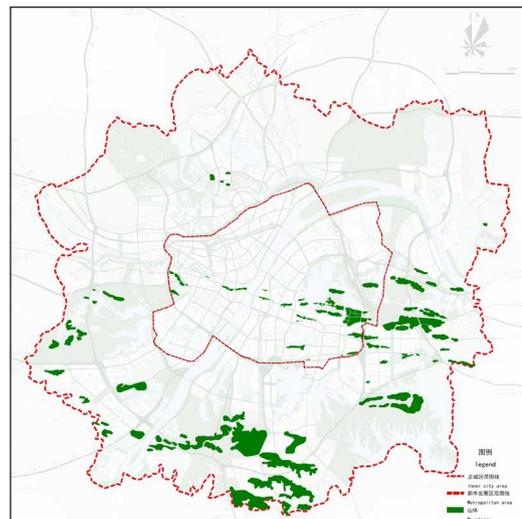
FIGURE 6.3 The 'mountains' in the Metropolitan area of Wuhan (Source: Three Lines and One Road, Protection Plan of the Third Batch of Lakes in Wuhan City, 2015)

§ 6.2.4   "Feng Shui" of Chinese city building

Feng Shui originated from primitive nature worship. It is the knowledge or philosophy used to choose the best living environment as it was developed in ancient times. Good environments are characterized by taking advantage of geographical locations in order to avoid disaster, bring happiness, health, wealth and power. In time, with experience, Feng Shui became a theory used for choosing locations for new settlements and tombs, for example, the south side of a mountain with water in the front. Many ancient Chinese cities follow this pattern (Figure 6.4).
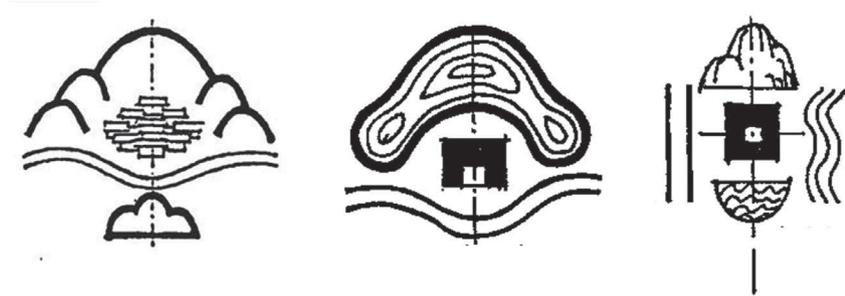
FIGURE 6.4 The Feng Shui pattern (Source: http://news.163. com/15/0404/21/AMCTH3TL00014SEH.html)

The other aspect of Feng Shui is the layout of the city itself. The palace of the—absolute—ruler and the government offices occupy the central positions. The philosophical principles of 'heaven and man unite' and 'round sky and square earth' led to the grid pattern. The rules of the layout emphasized axial symmetry which reflects upon the feudal hierarchies of China's ancient society (Figure 6.5).
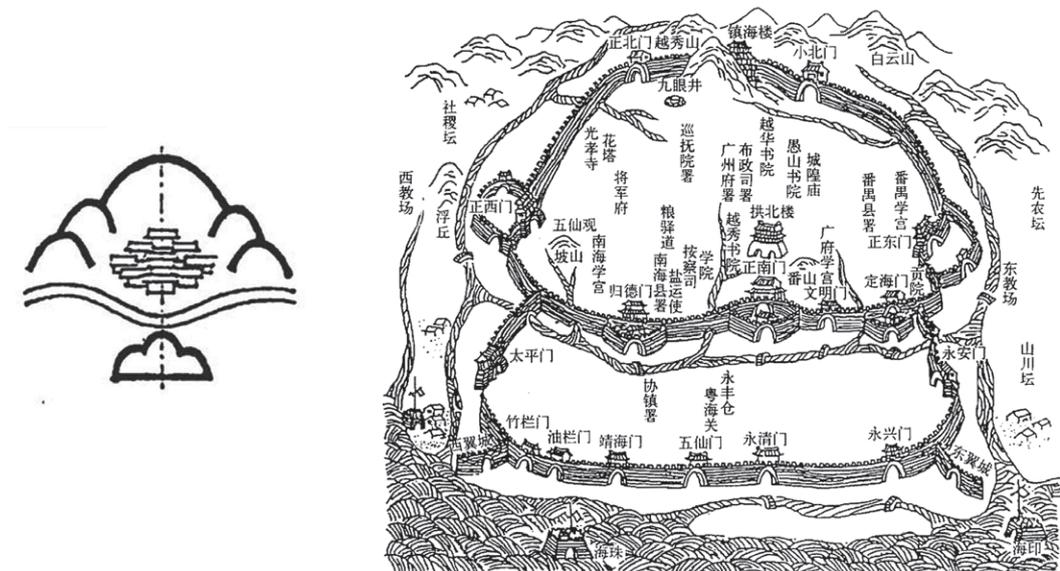
FIGURE 6.5 The example of Guangzhou in the Qing Dynasty. (Source: DONG, 2010)

Before the Hanyang River diversion between 1465 and 1487, the location and layout of Hanyang fully met the traditional Feng Shui theory (Figure 6.6).

FIGURE 6.6 Feng Shui and Hanyang. (Source: Hanyang town map, http://www.cnhan.com/gb/content/2006-11/20/content_700730. htm)

Wuchang deviates from the Feng Shui theory for its original defensive functionality but not for its location. The main Feng Shui rules for defense function are (Figure 6.7):

1   To rely on a mountain for solid defense
2   To be near the water, as a source of drinking water and a convenient means of transport
3   To build on a terrain suitable for flood control
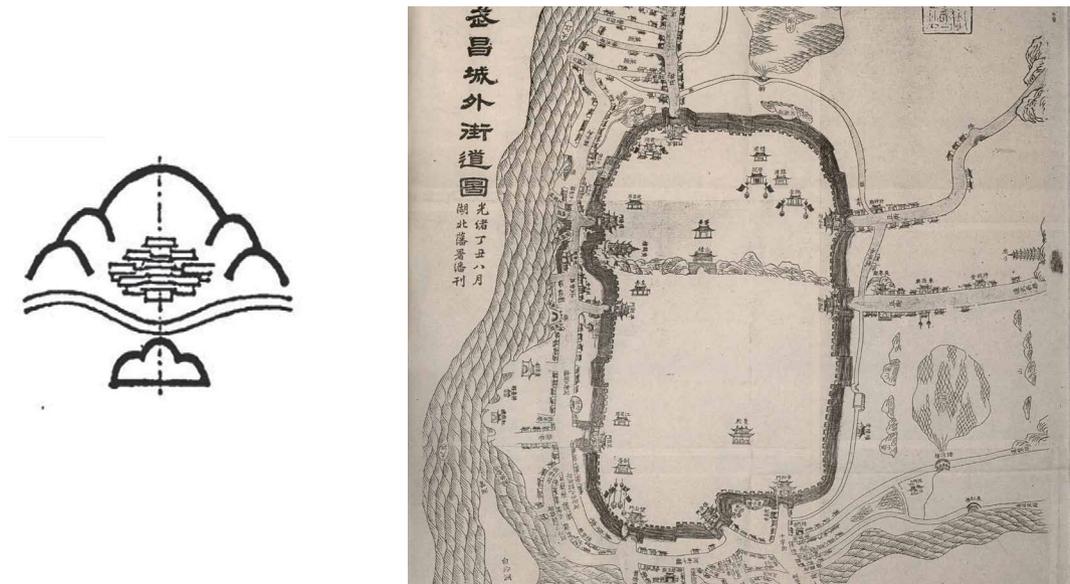
FIGURE 6.7 Feng Shui and Wuchang: the layout of both sides of the mountain range running through the city does not follow Feng Shui. (Source: The Historical Atlas of Wuhan, 1998)

For Hankou the situation is different, as its layout in the late 17th century was guided by the rivers to accommodate transport and commerce first of all.

§ 6.3 Early history

The earliest beginnings of the modern city of Wuhan can only be partially traced back though the locations are known through archeological findings. The earliest remnants of human settlements appeared in and around the area of contemporary Wuhan between 3500 and 2000 B.C. as noted by Fangyang Tai and other excavated sites on the west bank of Wuhan East Lake.

The town of Panlong was the capital of the Shang Dynasty before 3500 B.C. It is known as 'the root of Wuhan Town, the beginning of the City of the Yangtze River Ba-sin' (PI, 2006, p. 26) (Figure 6.8).
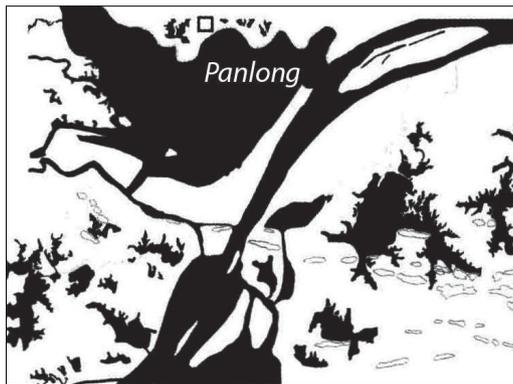
1 Location (Sources: YU, 2010)

2 Reconstruction (Source: www.bbs.cnhan. com)

FIGURE 6.8 Panlong in the Shang Dynasty

In the Eastern Han Dynasty, A.D. 173–198, Queyue City became the first military castle in the area, built on the north slope of the Gui Mountain which later became Hanyang. It was abandoned and broken down during the Three Kingdoms Period, and a new town, Lushan, was built on Gui Mountain. In A.D. 221, the town of Xiakou was built in the location of the present Wuchang. It is assumed that Wuhan began with the following three towns: Queyue, Lushan, and Xiakou nearly 1,800 years ago. Queyue disappeared, Lushan became Hanyang, and Xiakou became Wuchang (Figure 6.9).

In the early Tang Dynasty, during the year 621, the town of Hanyang was built on the south side of Gui Mountain, followed by a massive expansion of Wuchang on the other side of the Yangtze River (Figure 6.10).
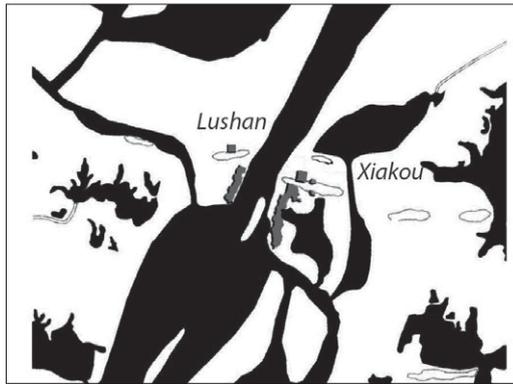
FIGURE 6.9 The locations of the towns of Lushan and Xiakou at the end of the third century B.C. (Source: YU, 2010)
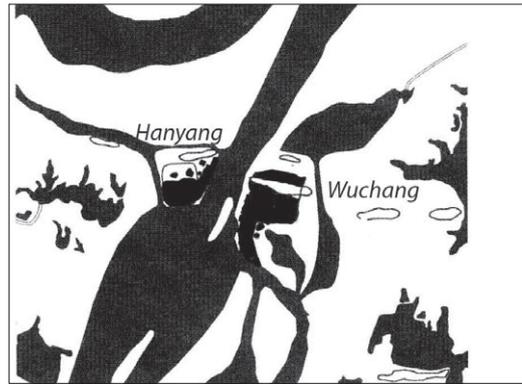
FIGURE 6.10 The locations of Hanyang and Wuchang in the Tang Dynasty, 621 (Source: YU, 2010)

In the Ming Dynasty, during the reign of Emperor CHEN-GHUA from 1465 till 1487, Hanyang was divided into two parts based on the diverging pathways of the Han River (XU, WANG et al., 1684: Huguang Annals).
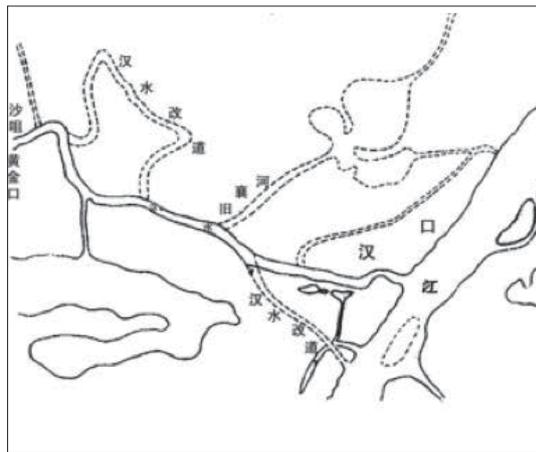
FIGURE 6.11 The diversion of the Han River between 1465 and 1487: dotted courses have disappeared (Source: bbs.cnhan.com, Qiaokou National Industrial Museum)

During the Kangxi Dynasty (1662), the northern part of Hanyang was named Hankou. With the isolation of Hankou, the new pattern emerged again with the three towns making up the later known city of Wuhan (see Section 7.3.1).

The gradual emergence of trade in the Yangtze and Han Rivers, and the building of new houses for the large number of people flowing to the city resulted in the transformation of the original Hankou settlement to include commerce, touristic facilities, and other functions. During the Ming Dynasty, it became an important logistics area for the trade of CAO grain and salt from Huai (FAN, 1822). Following the changes in the administrative management, this had resulted in the opening up of Hankou in the Zhangzhi Dong period (mid 19th century). Hankou gradually became one of China's four most famous towns in the Qing Dynasty followed by: Jingde Town in Jiangxi, Zhuxian Town in Henan, Hankou Town in Hubei, and Foshan Town in Guangdong (TANG, 2010).

Before the establishment of the People's Republic of China, extroverted development policies promoted the rapid growth of Wuhan which has eventually integrated the three towns. Each of the social, economic, political and planning factors lead to the present complex urban morphology of Wuhan. The changes in China's national planning policy played a significant role in the urban form.

§ 6.4 The emergence of planning

Urban planning in Wuhan began in the late Qing Dynasty (1644– 1912). Majority of western planning theory and practice was imported with the establishment of the Foreign Concessions: British, Russian, French, German, and Japanese since 1861. In January 1927, the National Government moved to Wuhan. The three towns: Hankou, Wuchang, and Hanyang were joined together to become Wuhan city. In 1929, DONG Xiujia, director of the Wuhan Construc-tion Works Bureau, edited the Wuhan Special City Planning Guideline, in which western zoning theory was applied. Wuhan was for the first time divided into the following distinct land use areas: industrial, commercial, administrative, residential areas, etc. In 1936, the Hankou City Construction Works Bureau edited the Hankow Metropolitan Planning Document. It was the first plan in any Chinese city that addressed 'Traffic Congestion Avoidance'. Within the document, it contained a proposal to construct Zhong-zheng Road (nowadays Liberation Road), a 60 m wide road which was later approved by the National Government.

As Hankou was an open commercial port, it attracted new urban functions which required further expansion and the city became known as the Chicago of the East. Wuhan had developed dramatically, becoming the second metropolis in China after Shanghai since the National Government moved to Wuhan in 1927 which remained until the outbreak of the Anti-Japanese War in 1935. These years are classified as Wuhan's Golden Development Era. At the time, commercial activities in Hankou even exceeded those in Shanghai (YUKIYOSHI, 1908).

§ 6.5 Urban Planning during the Wuhan Reconstruction Period (1945– 1948)

After the Hubei West War in June 1943, the provincial government finished the Wuhan Metropolitan Planning Draft. This mainly consisted of policies and planning envisioning Wuhan as an international metropolis. On September 18, 1945 the Sixth War Zone of the Anti-Japanese War accepted the Japanese surrender at Zhongshan Park in Hankou and Wuhan received its official administrative title. City restoration and construction were listed as fundamental tasks for Wuhan as to continue growing as part of the national political, economical and cultural node (Wuhan Urban Planning Administration, Wuhan City Planning Annals, 1999).

In November, the provincial government published the Wuhan Regional Planning Committee Organization Regulations and announced the establishment of the Wuhan Regional Planning Committee, China's first regional planning institution. The publication of the regulations and the establishment of the Committee marked the beginning of the 'Mega Wuhan Plan'. The initial intention of this plan was to solve the flooding problem in the city. The areas around the lakes in the eight counties surrounding Wuhan were designated as the main parts of the flooding control system.

For effective flood prevention, this plan extended to the land and water connections between the municipalities in the region. The surrounding villages and towns would develop as small cities, known as 'satellite cities', or 'garden villages', to support the construction of Mega Wuhan, which was also intended to avoid becoming a complex and boundless character which defined most big cites. The Mega Wuhan Plan proposed to build in total 120 big, medium and small sites to make up the Wuhan Metropolitan area. This was contained within the Wuhan City Land Use and Traffic System plan of 1947 (Wuhan Urban Planning Administration, 1999). The main towns of Wuchang, Hankou, and Hanyang, and their surrounding cities constitute a 'mother.and-child' relationship. While maintaining a considerable correlation between them and without losing their independence and individual character, this development is called 'multi-point development'. This can be seen as the main guiding principle for the development of metropolitan Wuhan. By the end of 1947, the Wuhan Regional Planning Committee was dismissed, which meant the end of the Mega Wuhan Plan.

§ 6.6   **Four periods of urban development after 1948**

After the establishment of the People's Republic of China in 1948, four main periods of urban development can be distinguished:

1   Key Construction (1949–1965),
2   Slow Development (1966–1977),
3   Reform and Opening Up (1978–1990),
4   Rapid Development (1991–now).

In the first key construction period from 1949–1965, which were the result of the major industrial tasks given to Wuhan by the national government, the infrastructure arrangements of both the First and the Second Five-Year Plan and the first Master Plan of 1954 were established using the basic patterns of modern Wuhan. For example, the building of the Wuhan Yangtze River combined a highway and a railway bridge for the first time which linked two of the three towns to each other and had formed an urban cluster across the river. (XU, et al., 2010)

During the second period between the years 1966–1977, urban development slowed down and planning policy remained in the same state.

The third period from 1978–1990, focused on economic development towards a market economy, which lead to changes in the types of industries and a new urbanization model. Industry changed from traditional to technological, and gradually formed many new clusters (LI, 1989). However, since 1978, the national urbanization paradigm shifted its focus from urban development to the development of cities in coordination with their surrounding rural areas. The Wuhan administrative area expanded to 8,494 km² and incorporated four counties: Huangpi, Xinzhou, Hanyang, Wuchang (DONG, 2009). Meanwhile, the master planning focused on the configuration of residential land use, living services and facilities.

During the fourth period, 1991–present, Wuhan faced a second spur of rapid expansion, following DENG Xiaoping's Southern Tour Speech. Reform was focused on the construction of a socialist market economy for China, and there was a shift of emphasis from the southern coastal cities to the eastern

and central cities, such as Shanghai-Pudong and Wuhan. This became the catalyst for a series of strong development patterns for the local economy, along with the new possibility to lease land for commercial development since the 1990 Land Leasing system was installed. The rapidly growing economic and technological development was led by industry in four sectors: aerospace, high-tech industries, automobile production, and steel plate manufacturing.

Currently, China is gaining access to the World Trade Organization and the 'New Normal' policy. By the beginning of the 21st century, Wuhan has become inevitably involved in the globalization process. The aim of the Wuhan 2049 Strategic Vision of 2013 is to transform into a more competitive and more sustainable world city, which is comprised of being dynamic, lots of urban greenery, low carbon footprint, active civil communities with higher livability, a more inclusive and richer cultural environment, a more efficient urban transport system, and an international position in innovation, trade, finance, and modern manufacturing.

7 Conceive the perceived space: Mapping urban form transformation – reveal the structure of physical spaces

Introduction

Line up with Chapter 3 where morphological approaches are reviewed worldwide and a specific emphasis is made in the Delft approach, this chapter chooses Wuhan as a case to investigate the sub question 4 and its background questions:

Sub research question 4:

How can *the morphological approach* assist urban designers in the urban design processes to achieve historical continuity?

Background questions:

1. How to use the morphological approach to analyze the physical urban form in Wuhan? (Section 7.2)
2. What are the urban form transformations of Wuhan on different scales (Metropolitan area scale, Inner city scale, Hankou riverside scale)? (Section 7.3)
3. What are the spatial structural elements of Wuhan on these three scales? What are the practical implications of the spatial structural elements? What are the spatial characteristics of Wuhan? (Section 7.4)

The research elaborated here was commissioned by the Wuhan Land Use and Urban Spatial Planning Research Centre (WLSP), the research institute of the municipal Planning Bureau of the city of Wuhan, as a pilot project for research cooperation with the Department of Urbanism of the Faculty of Architecture and the Built Environment, Delft University of Technology. The research was presented previously in the scientific report *Mapping Wuhan— A Morphological Analysis of the Spatial Structure and the Urban Transformation of Wuhan*, by Professor Henco Bekkering and CAI Jiaxiu, in both English and Chinese. The research was completed in cooperation with a larger group of people: Joran Kuijper (TU Delft), and WLSP staff: CHEN Wei, HUANG Huan, ZANG Ke, CHEN Wei, XU Zhenmin, HE Lei, JIN Mengyi, and DU Xingyu. The TU Delft team provided the research methodology and software, proposed the overall research framework, analyzed the base materials and researched these, and produced the final report. WLSP was in charge of data collection, including historical and contemporary maps, aerial photographs, and other base materials such as books, either in high-density digital or in printed format.

Section 7.2 introduces the research context. It first clarifies research objectives and content and introduces the research method concerning the different degrees of reduction techniques, base maps and scales used. This is completed through definitions and a first explanation of the core of Delft approach, homogeneous areas and secondary connections. The specific technique applied in this

research Geo-referencing and working backwards in time. To clarify this methodology further, then seven research steps are articulated below.

Section 7.3 presents an atlas consisting of four series of analytical maps. These maps together with explanatory texts reveal the physical transformation and structure of the urban form of Wuhan over time.

In section 7.4, thirteen spatial structural elements over three scales are concluded and explained regarding their meaning to the structure of the city as a whole and their practical implication to the future city transformation and extension. It concludes *fragmentation* as the city's main physical characteristic and further explanation of its practical implication is made. The possible application of homogenous areas and secondary connections in practice is listed as a reaction to the existing *fragmentation*.

In section 7.5, a reflection on the thinking process while working on different scales is made.

Section 7.6 discusses the relevance of this research for the future of the city and recommendations for further research.

Section 7.7 concludes this chapter.

§ 7.2 Setting the scene: mapping through scales

§ 7.2.1 Research aim and content

The aim of the research is:

1 To critically reflect on how morphological approach assists urban designers along the process.
2 To convey information from literatures, historical maps, aerial photographs, the sequence of Master Plans, and contemporary maps into analytical maps that act as design instruments on different levels of scales.
3 To understand the urban form of Wuhan through its history up to the contemporary situation.
4 To (partly) reveal the spatial structure and discover the formal structural elements of Wuhan.

The content of the research:

This research uses one of the representative methods in the Delft morphological approach—reduction drawings to map homogeneous areas (see Section 7.2.2) in time on three scales: metropolitan area, inner city and Hankou riverside. On these three scales the historical developments of the urban form and structural elements are revealed. (see Section 7.3.1, 7.3.2, 7.3.4) Then a further reduction technique is used based on the transformation of the homogeneous areas to reveal the urban spatial structure of Wuhan (see Section 7.3.3).

The Delft morphological approach is applied in this research. The three main working methods are reduction, homogeneous areas and secondary connection, and Geo-referencing and working backwards in time.

The Delft morphological reduction drawings (see Section 3.3.2 and 7.2.2-1) of different moments in the history of the city, result in analytical maps and descriptions that show and explain the historical development and structure of the urban form at important moments of change. Homogeneous areas are identified and are the grain of resulting analytical maps (see Section 7.2.2-2). The reference maps that indicate historical developments are oriented to recent cartography on a GIS platform with a plug-in geo-referencer, GDAL, based on which we started mapping and working backwards in time (see Section 7.2.2-3).

1. Reduction drawings

In this research, the morphological reduction drawing (see Section 3.3.2) is used to reduce information and leave out the non-structural elements. What is omitted depends on the scale of analysis. The extraction highlights the essential elements of urban form. This reveals a certain logic and structure through the drawing process. The maps series is a process, as well as the well-presented products. In particular, the following steps of reduction are applied:

First reduction: choose land use map instead of figure ground map on the large-scale morphological analysis. (Figure 7.1)

Figure ground maps are typically used as base maps in morphological research (see Section 3.3). This tradition is based on analyzing relatively small towns or cities in the Western context. However, in the case of Wuhan, a large-scale metropolis with a population of more than 10 million, the figure ground map provides excessive information. This creates a disturbance in the map reading process of understanding the structure of the city as a whole. The reasons are explained as following:

1-Building footprint
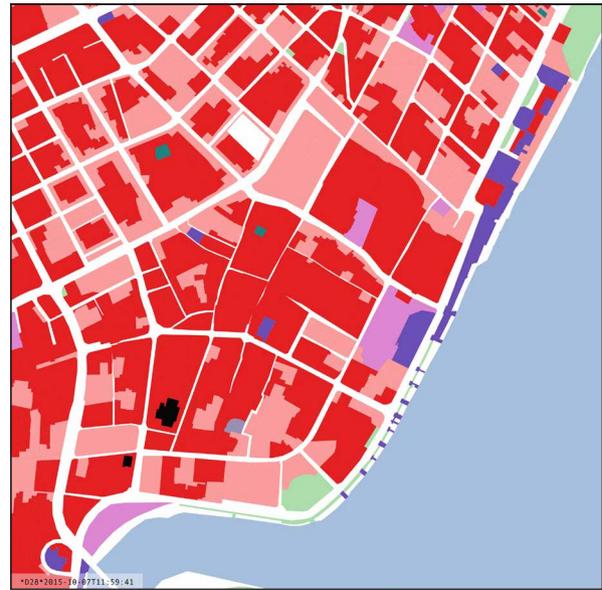
2-Land use data

3-Homogeneous areas based on building footprint
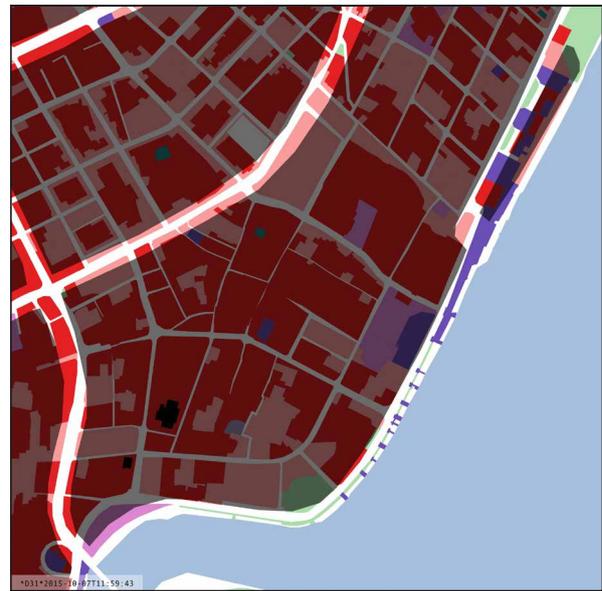
4-Homogeneous areas based on land use data

FIGURE 7.1 Hankou riverside building footprint, land use data and identified homogeneous areas

Figure 7.1 shows a figure ground map and a land use map of a part of Hankou riverside that define homogeneous areas accordingly. Both maps offer spatial information, but on different scales (Figure 7.1-1 and Figure 7.1-2). The figure-ground is on the scale of the individual building in its relation to open space. In contrast the land use data does not indicate open space within urban blocks, even though it does show patterns of spatial distribution. Rather these maps show built-up areas in black and publicly administered space, the space in front of the buildings, in white. This difference shows very clearly when the homogeneous areas on the two scales are compared (Figure 7.1-3 and Figure 7.1-4). The homogeneous areas defined based on the figure ground map are much more detailed and fragmented, which is not effective to reveal the structure on the city or metropolitan scale.

By necessity, the series of maps produced holds interpretations and knowledgeable guesses by the researchers.

As such, choosing land use data as the base for large-scale analysis results in a considerable reduction of spatial information, but the spatial distribution still shows the morphological characteristics of the city. This is the first step of reduction. An additional reason for this is the availability of the figure ground data. It is nearly impossible to get the entire city's figure ground data as a foreign institution due to the issue of confidentiality.

Second reduction: combine the different land use categories

Still, the base map of the 2013 urban land use in GIS format contains too much information to allow for the recognition of the spatial urban structure. Though with an experienced eye and intimate knowledge of the city it is possible to see the basic structure concealed in this image (Figure 7.2-1). When in the same data all urban land use is turned black—combining information of different types of land use that separately do not contribute to the understanding of morphology of the city—the map becomes somewhat clearer, but there is still too much information to easily recognize the spatial urban structure (Figure 7.2-2).
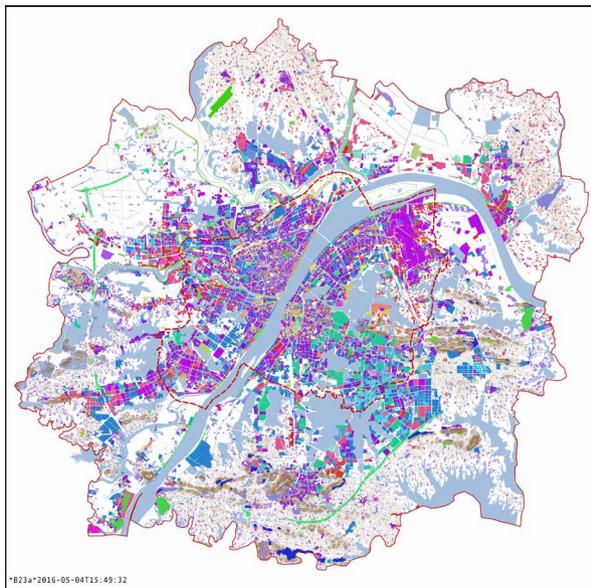
1-Urban land use in GIS format 2013
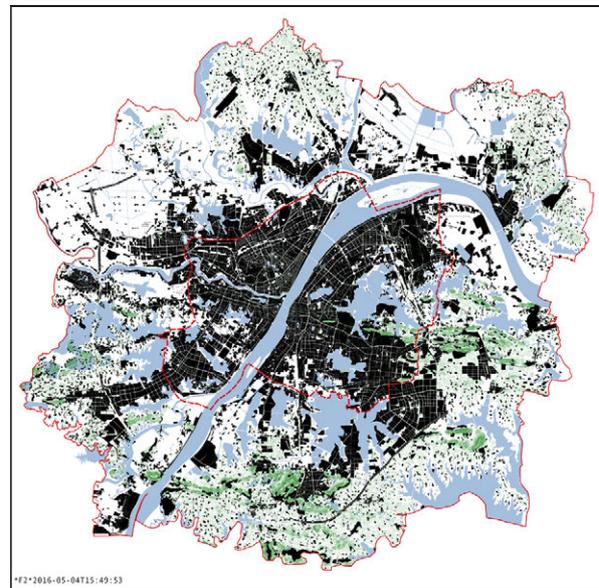
2-Urban land use in GIS format 2013 : reduced information

FIGURE 7.2 Second Reduction on the scale of the Metropolitan area

Third reduction: identify homogeneous areas (Figure 7.3)

To further reduce the information, the GIS map is traced by hand. The capacity of the human eyes and brain to zoom-in and zoom-out allows for interpretation on different scales and across scales at the same time. (Figure 7.3-1) The process involves expert interpretation and abstraction of the map data into what is called homogeneous areas (see Section 7.2.2-2 and Figure 7.3-2). It is intended to be a simplification that brings the spatial structure of the city, the urban form or morphology, to the forefront.

1-Hand drawing process of identifying homogeneous areas on the Inner city scale by Professor Henco Bekkering
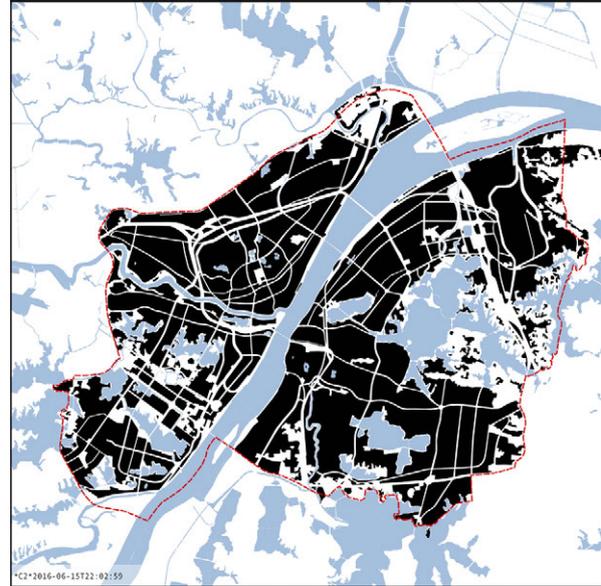
2-Homogeneous areas 2013

FIGURE 7.3 Third Reduction on the scale of the Metropolitan area

2. Mapping homogenous areas and secondary connections

To identify homogeneous areas is the core of the Delft School of morphological research (Examples see Figure 7.4).

HOMOGENEOUS AREAS ARE DEFINED AND TRACED THAT ON THE MAP SHOW INTERNAL CONSISTENCY AND ARE EITHER DIFFERENT FROM NEIGHBORING AREAS OR CLEARLY SEPARATED FROM THOSE.

The secondary connections[27] show the internal structure of the homogeneous areas as well as the connections to the surrounding areas— a next level of the structure of the city. They can be seen as the middle scale of the city.

For the meaning of homogeneous areas and secondary connections for understanding the structure of the city see Section 7.4.1-3 and 7.4.2. Three types of homogeneous areas are identified on the metropolitan scale (see Section 7.4.1) and eight types of homogeneous areas are identified on Hankou riverside scale (see Section 7.4.3-9). For the practical implication of homogeneous areas and secondary connections see Section 7.4.4.

1-Land use data and homogeneous areas

2-Homogeneous areas only

3-Land use data and homogeneous areas + secondary connections

4-Homogeneous areas + secondary connections

FIGURE 7.4 Wuchang and Hongshan Square

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27   Adding secondary connection is for the first time applied in the Delft morphological school. In this research it is only done for the Inner city and Hankou riverside, not for the Metropolitan area. It is a result of making a step down in scale, showing more spatial structural information. When the applied reduction technique is too much, we tend to make too big homogenous areas, then the secondary connections are needed to indicate the spatial structure, both internal and external. In the act of reducing information by sketching the edges of the homogeneous area, there is a kind of inbuilt logic of size. If the homogeneous area becomes too big, the human eyes and brain will automatically look for reasons to make them smaller. Or if they are too small, we tend to enlarge them. In the end, we make them relatively comparable size. Once it is done, when we look at the adjacent homogeneous areas, we figure that there are more structures relevant that need to be shown.
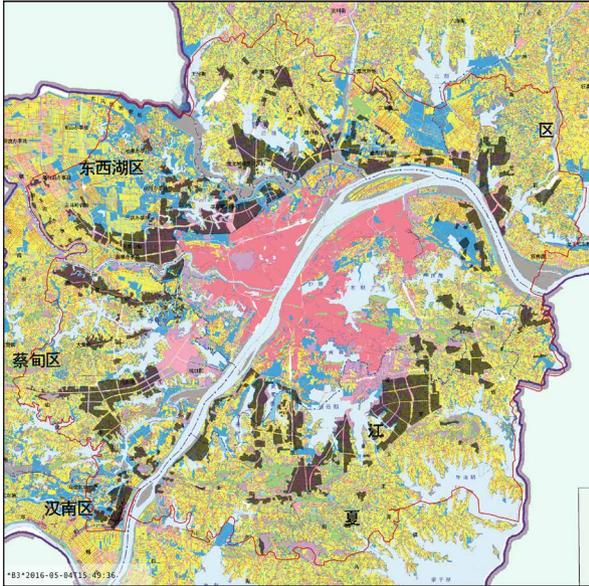
1-Metropolitan area georeferencing the 2006 map on the homogeneous areas in 2013
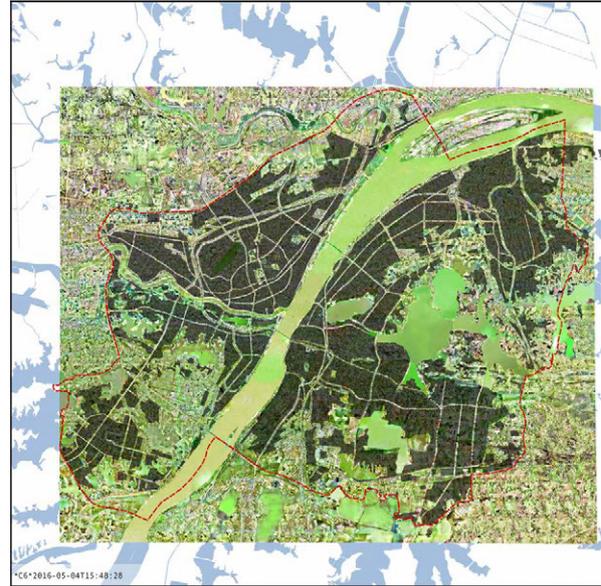
2-Inner city georeferencing the 2000 aerial photograph on the homogeneous areas in 2006
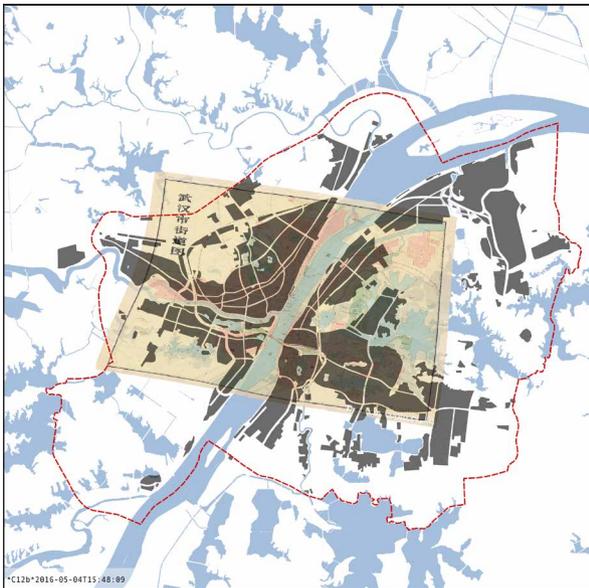
3-Inner city georeferencing the 1970 map on the homogeneous areas in 1990
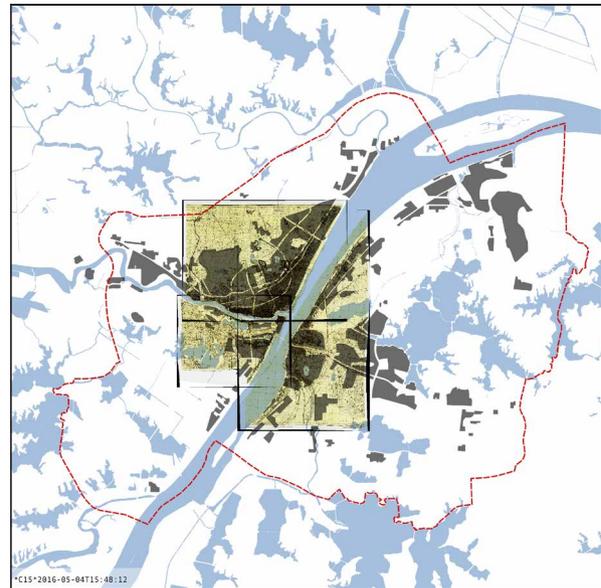
4-Inner city georeferencing the 1950 map on the homogeneous areas in 1970

FIGURE 7.5 Georeferencing

The selected historical maps and aerial photographs are positioned and overlaid on the contemporary map in the computer. The different map projection techniques over time have resulted in historical maps not quite fitting the contemporary base map. Thus, there is a need for certain degrees of deformation because of these differences. This is done with specific software: QGIS with the Georeferencer plugin. The geo-referencing did not result in distortion of the modern maps with minimal to no difference in cartographic projection techniques (Figure 7.5-1+2). The earlier historical maps show a less reliable topographical form, which requires a few tests with the geo-referencing. For instance, the early found 1970 map is (too) heavily distorted when geo-referenced on the 1990 map (Figure 7.5-3). This requires us to look for another more accurate 1970 map that indicates the actual situation at the time. Another example is the map in 1950, which looks precise, but proved difficult to fit to the maps of later years. The solution was to cut this map into three separate parts over the Yangtze and Han Rivers. The pieces of the cut map then fit quite well. (Figure 7.5-4)

Working backwards in time describes the order in which the analytical maps are constructed. For maps of the earlier stages of urban development areas are distracted that were then not yet built up, leaving the elements that were already built up. In addition, parts of the existing city that have been transformed are 'restored' to their earlier form. For determining the internal changes in the city, it is necessary to compare the maps is with aerial photographs of approximately the same year as in the **timeline** (Determining the timeline is an important step in this research. Please see Section 7.2.3-3). This approach is applied to all three maps series on the different levels of scale: the scale of the Metropolitan area, the Inner city, and Hankou riverside.

For instance, the base map for all three series is the contemporary one that is based on the data of the land use situation in 2013 in GIS format. This map has the most reliable and generally accepted cartographic projection. One map earlier in the timeline, for the year 2006, subtracting the areas that had no urban land use from the 2013 map creates the map of 2006. This shows the transformation of the city between 2006 and 2013 (Figure 7.6). Additional attention is given to urban transformation inside the city. And so on for the next earlier map in the timeline, etcetera. As mentioned before, historical maps will deviate from the contemporary map in varying degrees—sometimes considerably. By working backwards in time the cartographic differences can successively be eliminated and the maps in the series become directly comparable by overlaying them on top of each other. Additionally, that it is possible to trace and figure out the continuous and the lost historical patterns, which are meaningful for the city future development.
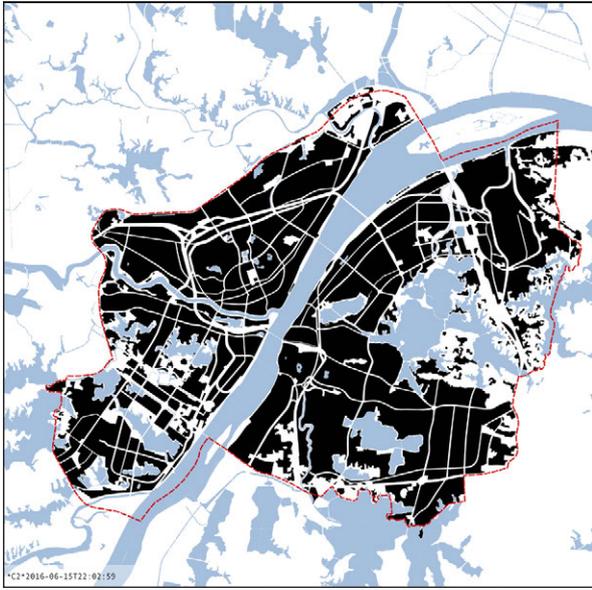
1-Inner city homogeneous areas 2013
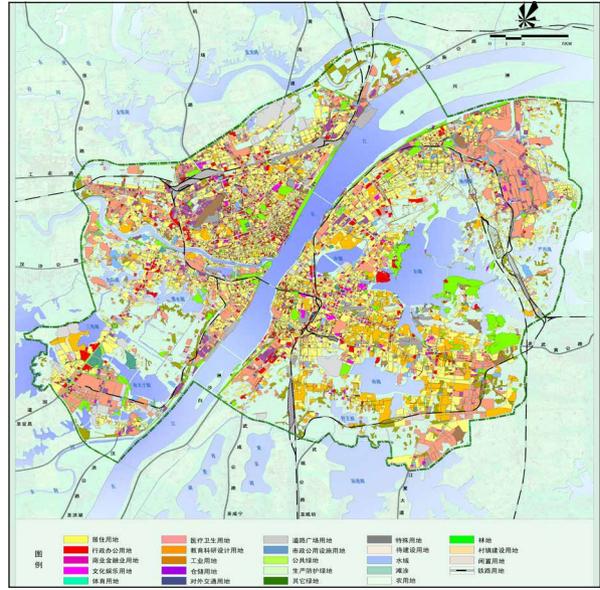
2-Inner city 2006 situation ready to be georeferenced (Source: Wuhan Master Plan 2006)
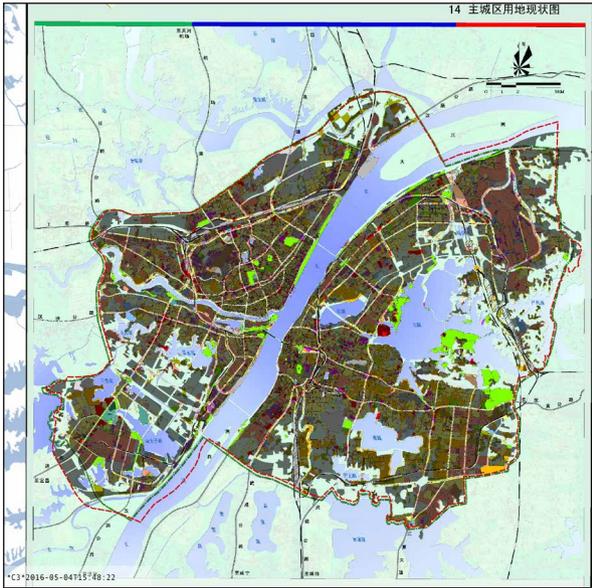
3-Inner city georeferencing the 2006 map on the homogeneous areas in 2013
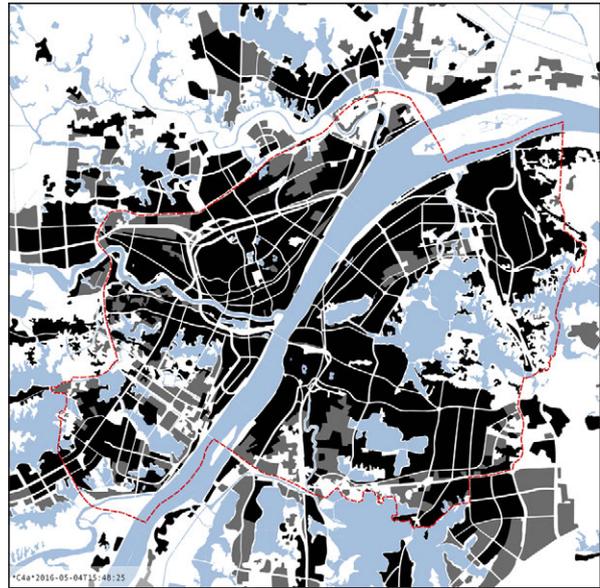
4-Inner city homogeneous areas from 2013 ->2006

FIGURE 7.6 Georeferencing and working backwards in time 2013->2006

Research steps of mapping

Instructed by the above methods, the research is built up in seven steps:

1   Data collection
2   Reading reference maps and selecting relevant information
3   Selecting maps and setting the timeline
4   Determining scales, mapping format and legend
5   Compiling and overlaying maps
6   Drawing the analytical maps with homogeneous areas
7   Conclusions and writing the report

1. Data collection

In order to achieve accuracy and depth of research, five types of data are used: historical maps, contemporary maps, aerial photographs, the sequence of historical and contemporary Master Plans and relevant literatures indicating historical developments in the city.

2. Reading reference maps and selecting relevant information

More than 300 maps are found, read, and categorized. Approximately 300 maps is too much information for this research and a refined selection of maps is needed. The historical moments are selected when significant spatial changes appeared in the urban area. For each historical moment several maps are selected for later research. The ones that seem geographically reliable when compared to the contemporary map are then prepared to run a geo-reference in GIS (Figure 7.7-1). The maps that show too much deformation to give a reliable result, but contain rich and important information for understanding the historical situation, are augmented by checking details in the contemporary city, such as names of main city gates, squares, and streets that have physically disappeared, but have left their names in the original locations (Figure 7.7-2).
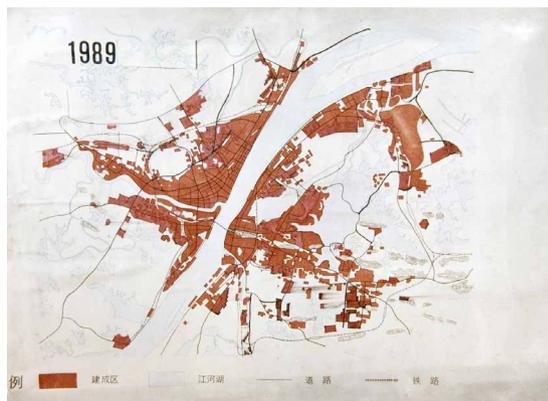
1-1989 map of inner city (Source: Wuhan Construction Archives)
FIGURE 7.7 Selecting maps
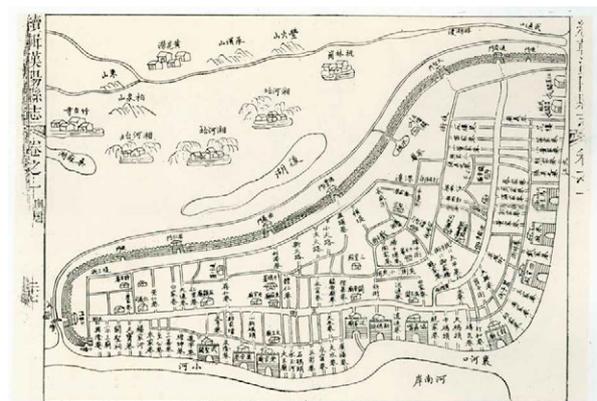
2-1868 map of Hankou (Source: The Historical Atlas of Wuhan, 1998)

3. Selecting maps and setting the timeline
....

According to step 2, the most meaningful maps are selected that as a series demonstrate the most important structural spatial changes in the city. The maps form a timeline that starts in 1870, the first date for which reliable cartographic data was available. The amount of time between successive periods on the timeline diminishes according to the increasing speed of urban development in time (Figure 7.8).
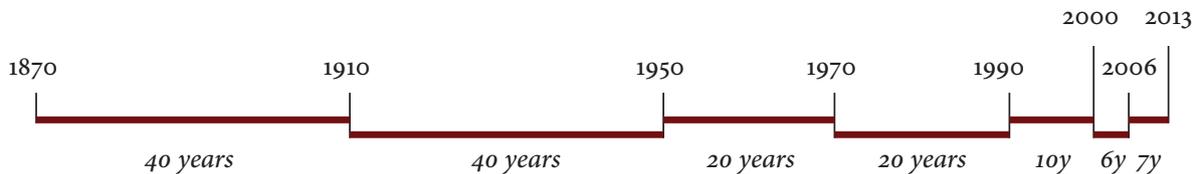
FIGURE 7.8 Timeline

4. Determining scales, mapping format, and legend
....

Scales:
....

The research is conducted on three scales to allow for an increased depth of analysis and understanding.

The Metropolitan area, within its administrative border: an area of 3,261 km2 (www.whtj.gov.cn), measuring east-west and north south approximately 68 km.(Figure 7.9)

The inner city of Wuhan, within its administrative border: an area of 678 km2 (www.whtj.gov.cn), measuring approximately 34 km east-west and 30 km north-south.(Figure 7.10)

Hankou riverside boundary: Northwest up to Jing Han Road where the previous Jinghan Railway was, West to Qiaokou Road where the previous old city wall starts, North to Wuhan Road where the Japanese concession's approximate boundary was, East and South to the rivers. (Figure 7.11)

The Metropolitan area and the Inner city are in accordance with their administrative borders. The border for Hankou riverside is on its former town wall (now the railroad tracks) and so includes the authentic historical areas of Hankou as well as the former Foreign Concessions.

Urban development in the Metropolitan area outside the Inner city has been almost completely based on detailed urban planning and design that is realized as planned and has not (yet) been transformed. The morphological analysis on this scale is therefore relatively simple and does not need great detail.

The situation in the Inner city is more complex, as its urban form has gone through many transformations in history. For this reason the scale of analysis needs to be smaller.
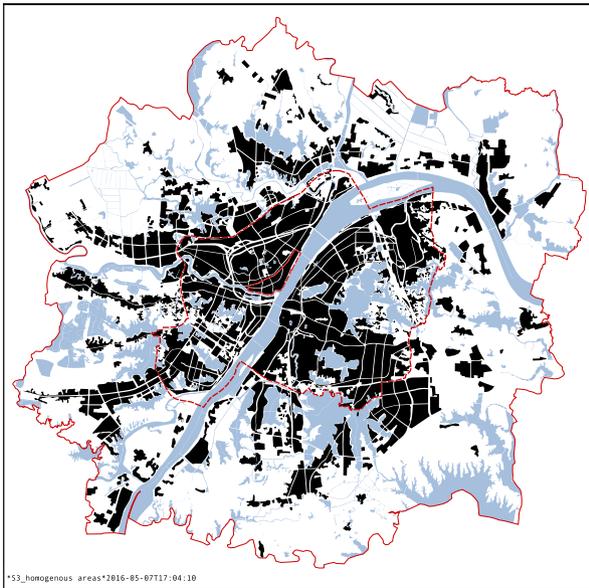
FIGURE 7.9 Metropolitan sacle
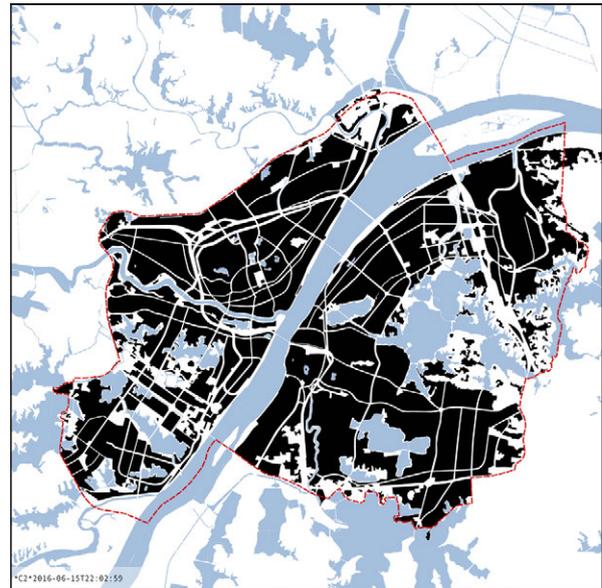
FIGURE 7.10 Innercity scale

FIGURE 7.11 Hankou riverside scale

The third level of scale in the analysis, applied to the Hankou riverside, demonstrates the difference in spatial characteristics between the 'traditional' parts of the city with closed building blocks and the 'modern' parts of the city with freestanding buildings (often slabs or towers) in so called flowing space. This is an important difference to highlight, as Chinese cities have had a long history of building according to the second, Modernist characteristic. This results from the danwei system of large, enclosed compounds with combined functions of production, dwelling, and urban facilities that was introduced in the 1950s and the cities began to grow. Though the danwei system has been abandoned as a form of organizing living, working, and facilities in one compound, in many places the spatial

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characteristics, if not the actual building complexes, still remain. In addition the contemporary way of building large residential complexes with freestanding buildings in compounds is often comparable to this as to its spatial characteristics.

Mapping format:
....

For several technical reasons the format for mapping at the scale of the Metropolitan area and the Inner city is GIS, which, as mentioned before, was the format of the overall available land use data of the contemporary city. First, WLSP and the Wuhan Municipal Bureau of Land Planning currently use this format for their mapping, archiving, and monitoring; this allows for the integration of different kinds of data. This means that not only is the basic data for the research available in this format with high accuracy and in great detail, but that the results of the research can be easily incorporated in the existing mapping and monitoring systems of WLSP. Second, GIS has the software plugin Georeferencer GDAL that deforms maps to fit to each other that is mentioned below. Without this, step 5 would be impossible or very complicated and laborious, and the results less precise.

Legend:
....

The GIS format has direct consequences for the legend of the maps, as the GIS data is based on land use, not figure-ground drawings (see Section 7.1.2-1). The maps show black for areas with many different forms of urban land use, and white for open space.

On the analysis of the Hankou riverside, showing the building footprint is more appropriate due to the scale of the area researched, and the available base material makes this possible. The small scale of the Hankou riverside allows for the technique of reduction drawings to indicate more differentiated homogeneous areas (see explanation below in Section 7.1.3-6), thus categorizing the spatial characteristics of the district (See also Section 7.2.4 and 7.3.5). On the scale of the Inner city and the Metropolitan area, land use data is aggregated first into urban uses, and then much larger homogeneous areas. This is intended to show how the different fragments of the city have strong spatial characteristics of their own that differentiate each from the surrounding areas. On the scale of the Metropolitan area, the data is reduced even further, again aiming to show urban fragments with different spatial characteristics (See Section 7.2.1 and 7.2.2).

In the maps series the rivers and mountains are kept the same throughout the timeline even though the banks and borders of the water have changed over time by both natural forces and human intervention. This is done for two reasons: first, it helps to easily compare the maps to one another; and second, the available data that indicates the details of change are not always reliable.

5. Compiling and overlaying maps
....

The selected historical maps, master plans, and arial photographs are positioned and overlaid on the contemporary map in GIS using the plugin Geo-referencer GDAL that deforms maps to fit to each other (see Section 7.1.2-3).

To support the correct interpretation of the maps, aerial photographs of the different periods are used when available. The aerial photographs show spatially relevant detail and help identify (the changes in) the homogeneous areas that are the constituting elements of the maps.

6. Drawing the analytical maps with homogenous areas

By applying the technique of morphological reduction, new analytical maps of the city are drawn, based on the contemporary GIS format map of land use for the entire Wuhan Metropolitan area and the building footprint data of Hankou riverside. Experience in earlier comparable research indicates that it is most effective to 'work backwards in time', starting with the map of the present situation with reduced morphologically information (see Section 7.2.2-3).

7. Conclusions and writing

The final results highly depend on the researchers' capacity to read and interpret relevant information in contemporary and historical maps and the client's reflections on the resulting maps. Equally determining for the depth of the research is the amount and accuracy of the available data: historical maps, aerial photographs, contemporary maps, and the sequence of Master Plans. Writing has developed gradually during the project, in working sessions and discussions between the partner institutions.

§ 7.3   Atlas: Mapping Wuhan on three levels of scale

§ 7.3.1   Inner city transformation 1870-2013

The series of analytical maps of the Inner city in this section is presented in historical order. This is not the way in which the maps were made: they were made working backwards in time (see Section 7.2.2-3), but the historical order emphasizes the growth of the city.
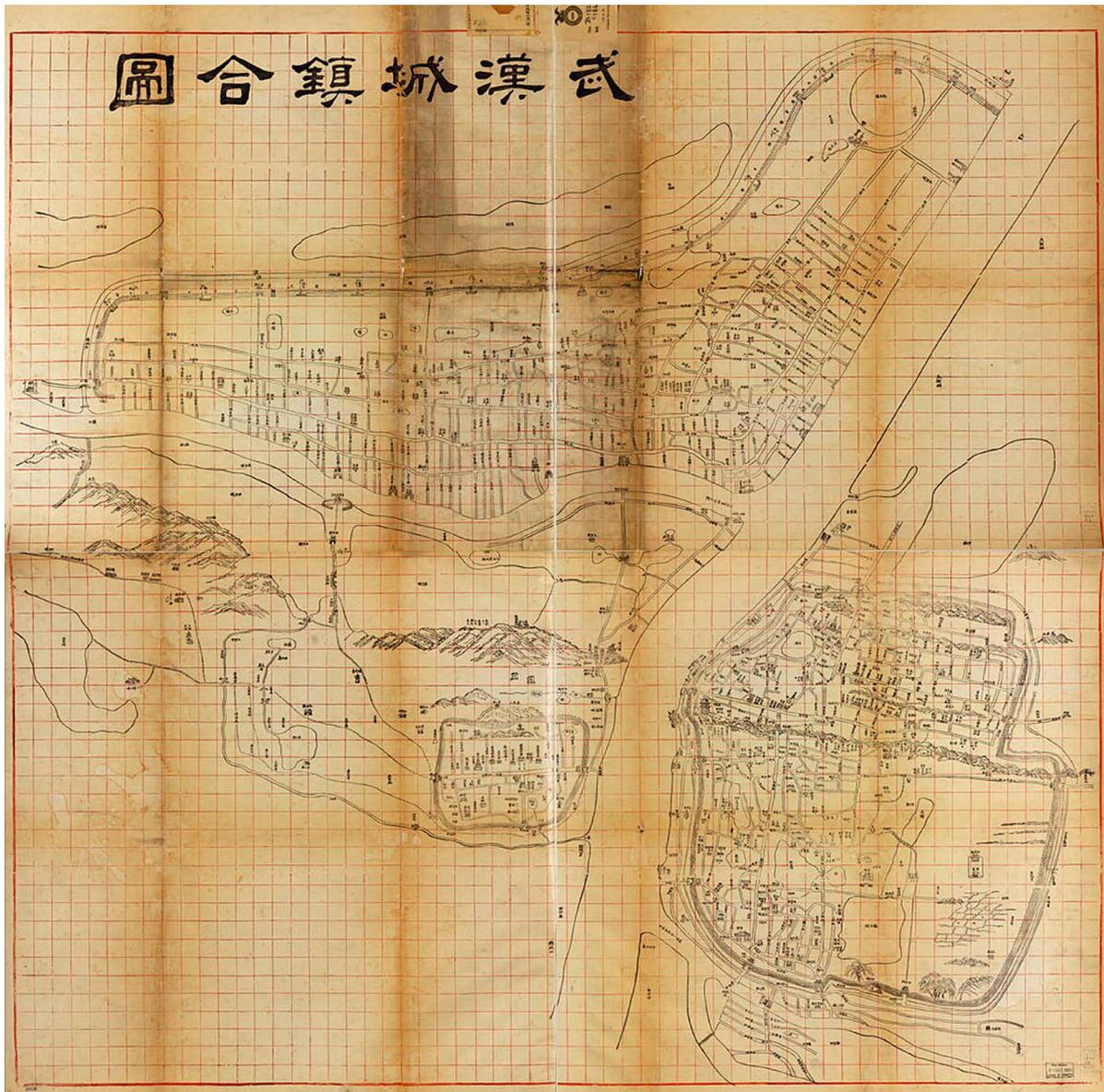
FIGURE 7.12 1890 map of the three original towns: Hanyang, Wuchang, and Hankou (Source: The Historical Atlas of Wuhan, 1998)

1870: The origins of Wuhan: Hanyang; Wuchang; Hankou

The historical maps of the 19th century and earlier are more like drawings than actual maps. The reconstruction of the map of the three original towns, Hanyang, Wuchang, and Hankou, thus involves comparing these maps to each other and to the contemporary base map. A map of 1890 does show the three towns together, divided by the rivers. (See Figure 7.12.) When trying to georeference this map on the contemporary map of the city, however, the map is distorted to such a degree that the result is unreliable.

This map was clearly the base for the 1890 reconstruction map published by W.T. Rowe in his 1989 book Hankou. Conflict and Community in a Chinese City.(Figure 7.13)
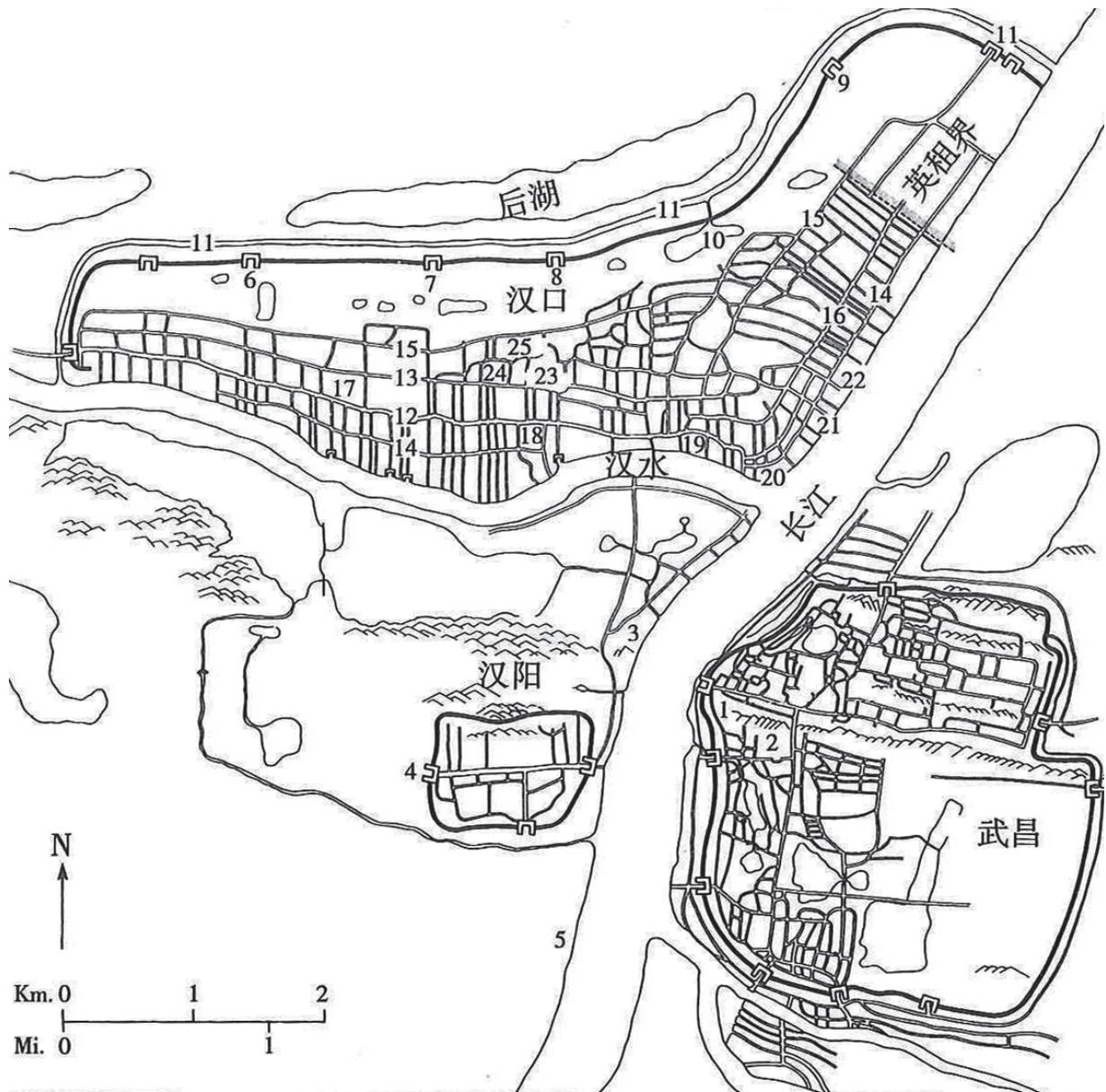
FIGURE 7.13 1890 reconstruction map by W.T. Rowe (Source: Hankou. Conflict and Community in a Chinese City, 1989)
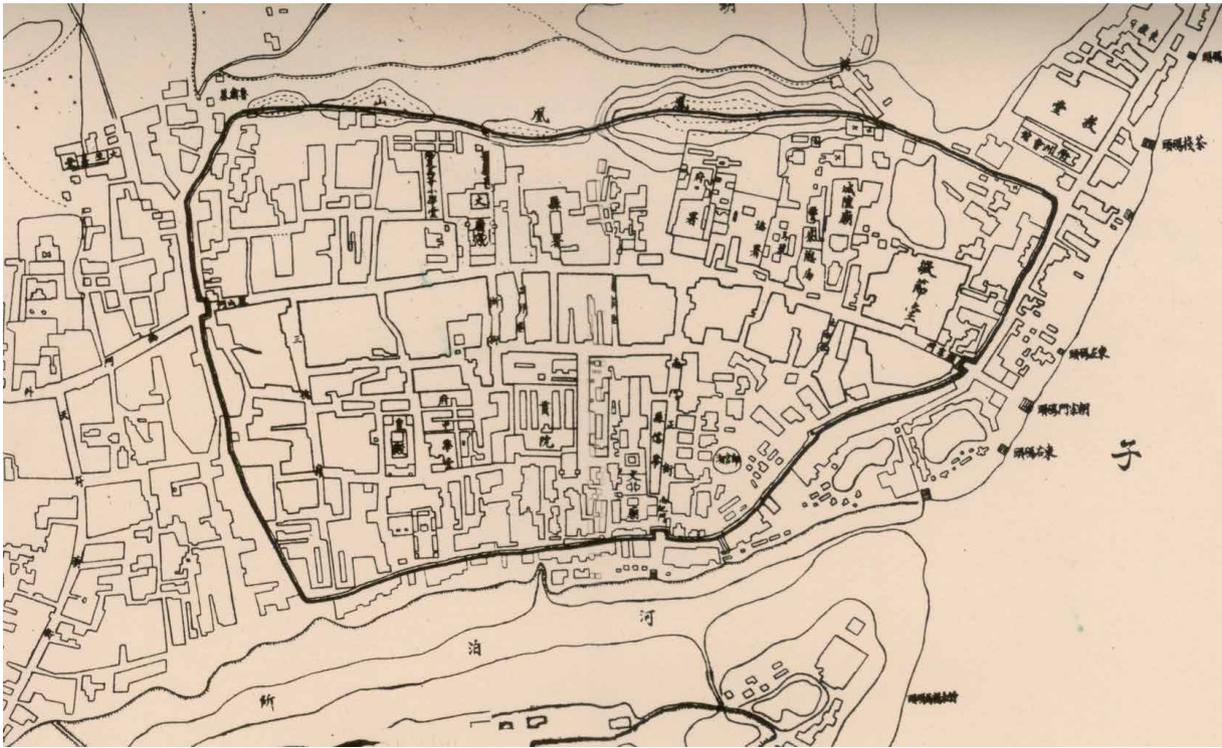
FIGURE 7.14 1909 map of Hanyang (Source: The Historical Atlas of Wuhan, 1998)

Our reconstruction is mainly based on four historical maps so as to achieve a much higher accuracy:

1909 map of Hanyang (See Figure 7.14)

1909 map of Wuchang (See Figure 7.15.)

1868 and 1918 maps of Hankou (See Figure 7.16.)

FIGURE 7.15 1909 map of Wuchang (Source: The Historical Atlas of Wuhan, 1998)
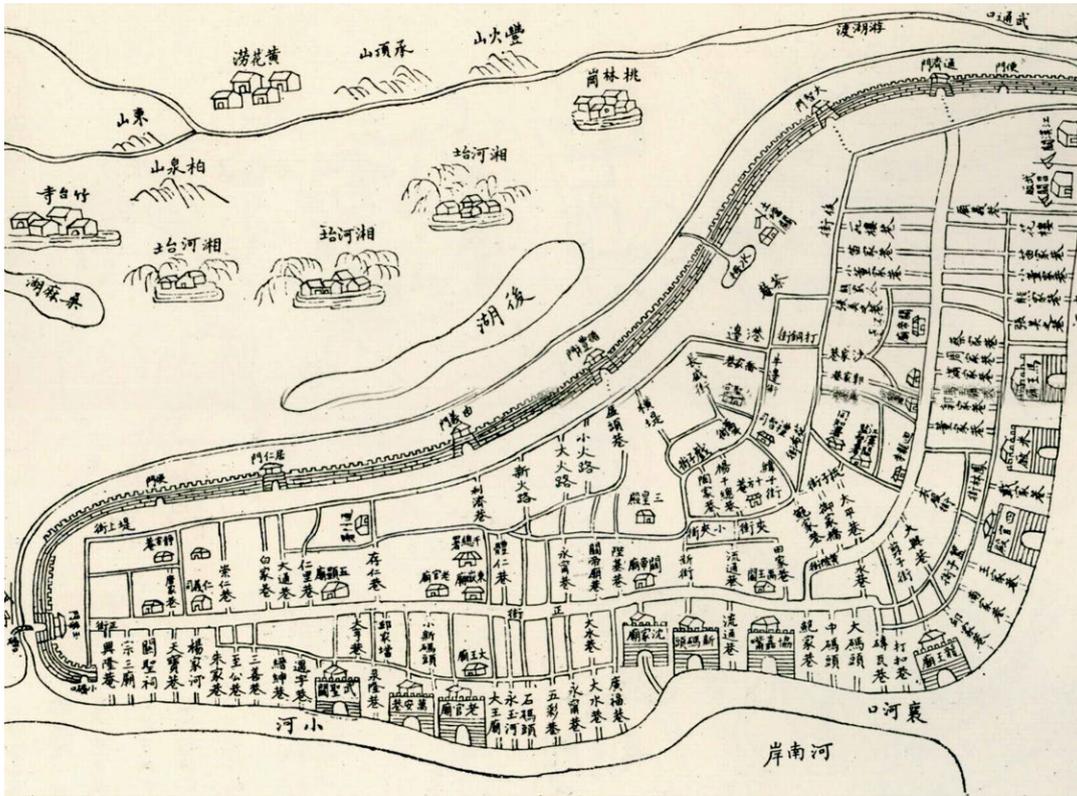
1 1868
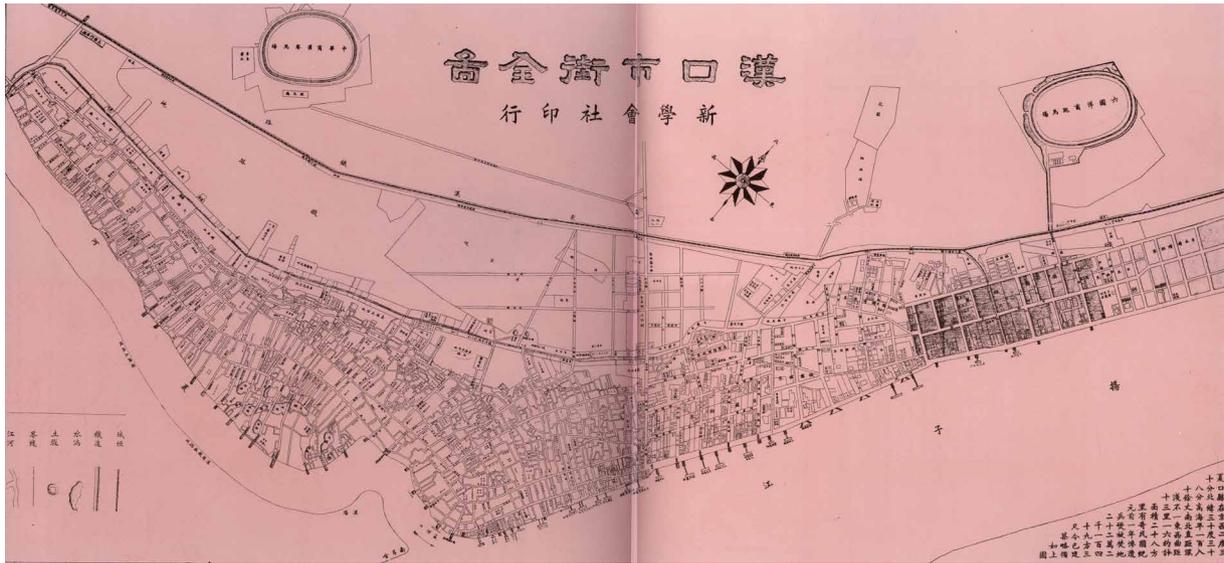
2 1918

FIGURE 7.16 1868 (upper) and 1918 (lower) maps of Hankou (Source: The Historical Atlas of Wuhan, 1998)

FIGURE 7.17 3 historical maps georeferenced on the map of 1910

The dates of these maps are not very near the year 1870, but they are reasonably reliable when compared to the contemporary map. To reconstruct the 1870 situation, we compared these maps to other historical maps, in themselves less geographically reliable, but allowing us to decide on details. The three maps are georeferenced on the map of the next period: 1910. (See Figure 7.17.) Like the other maps of the Inner city, this map shows homogeneous areas. These homogeneous areas are relatively large, because the spatial characteristics of the urban areas at this time were similar.

To further check the results of these maps, specific elements like gates and main streets are compared to the names of streets and squares in the contemporary city.
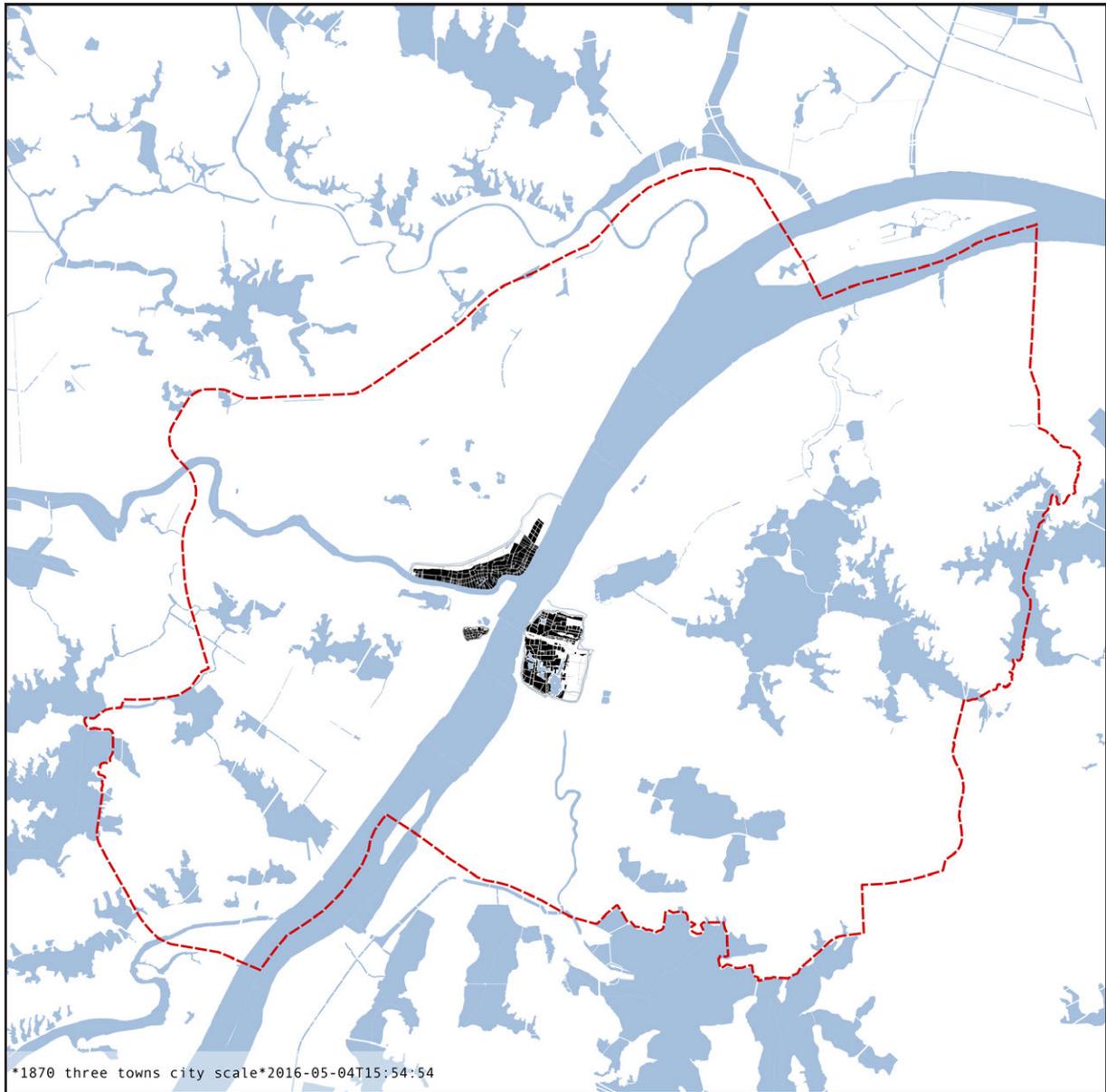
FIGURE 7.18 1870 three towns reconstruction map on the scale of the contemporary Inner city

It was possible to reconstruct the map in considerably more detail then than in Rowe's . (See Figure 7.19)

The three towns are of different age and each has its own characteristics. Hanyang, established in 621, and Wuchang, established in 223 are both protected by a wall and a moat. Their urban tissues are rather alike, but Wuchang is a much larger town than Hanyang, and has an unbuilt zone running east-west because of the mountain range that crosses it. Wuchang also has much more water in the form of small lakes and ponds inside its walls, and a considerable area as a military reserve with much open space and multiple large buildings. Hankou came into existence when between 1465 and 1487 the Han River was diverted from its course south of the town to the north side. (See Chapter 6, Section 6.3.)

*1870 three towns*2016-05-04T15:54:55
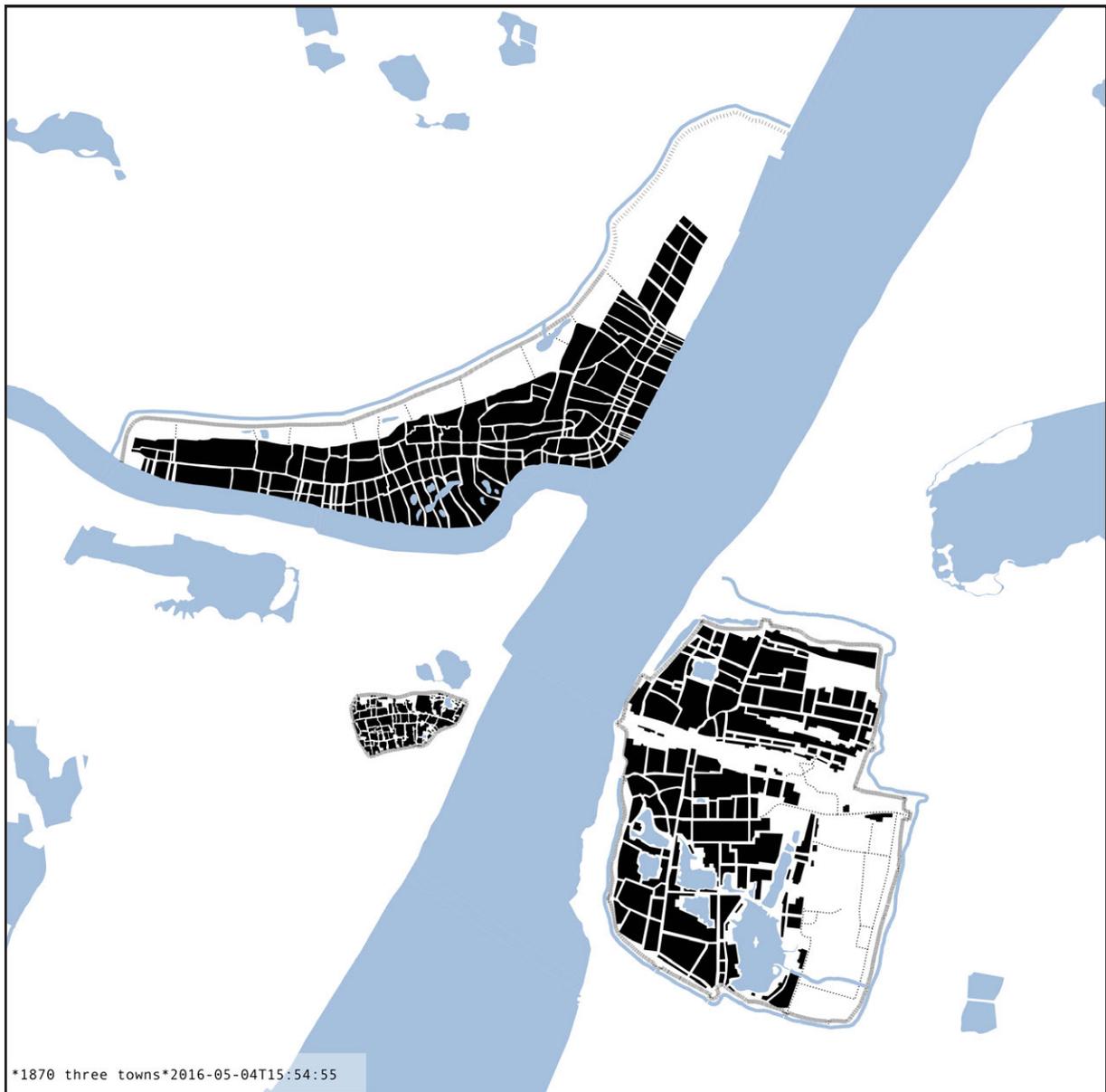
FIGURE 7.19 1870 three towns reconstruction map of Hanyang, Wuchang and Hankou

It became separated from the walled town of Hanyang. Hankou was a port town, so even when it had a wall towards the north, it was always open to the Yangtze and the Han Rivers. In 1861 the political situation led to the establishment of the Foreign Concessions. These were located as an extension of Hankou downsteam along the Yangtze River bank towards the north. The town wall was extended to include these areas.

When represented on the scale of the Inner city, it shows how small these three towns were compared to the contemporary city. (See Figure 7.18)
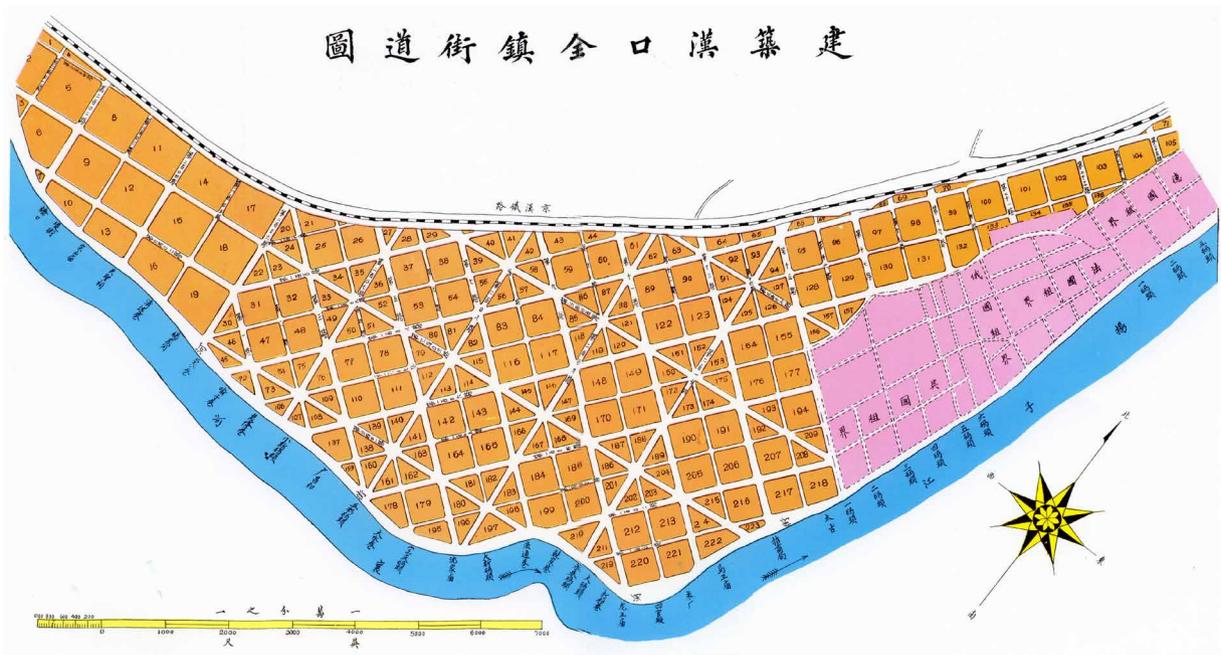
1 *Reconstruction plan for Hankou 1912 (Source: Planning Wuhan – 100 Years, 2009)*
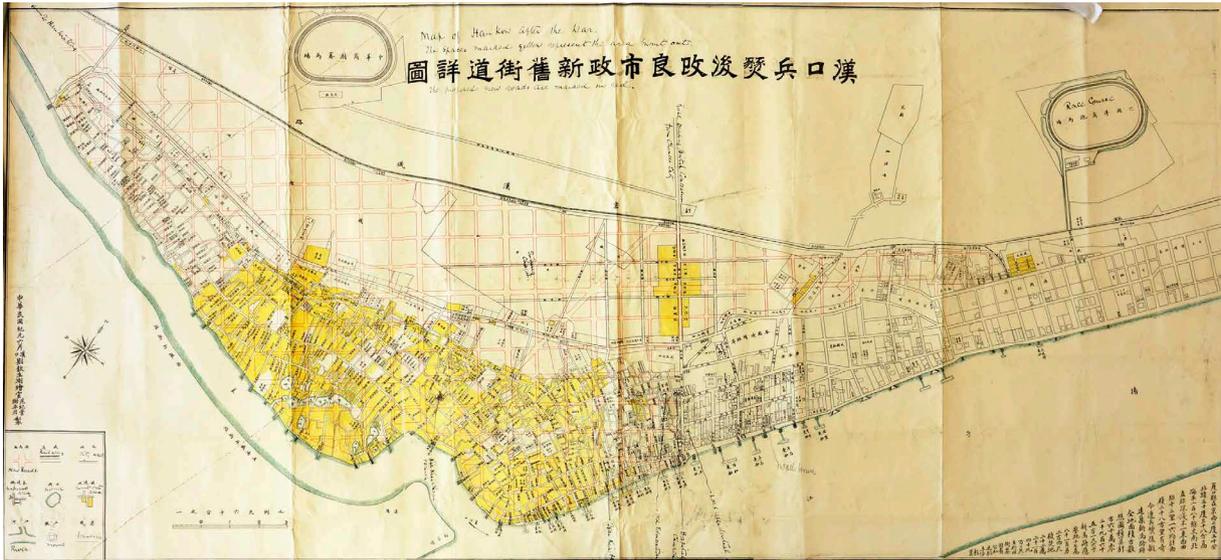
2 *Reconstruction plan for Hankou 1911 (Source: Archives and Special Collections, Library, School of Oriental and African Studies, University of London; reference CWM/LMS/15/14/037)*

FIGURE 7.20 *Reconstruction plan for Hankou*

We found a reconstruction plan for Hankou dated 1912 that shows how even in the beginning of the 20th century plans were made that would have required total demolition of the historical urban tissue of the town. (See Figure 7.20-1)

Another reconstruction plan for Hankou, somewhat surprisingly dated a year earlier, indicates that back then there was already a discussion on the degree of demolition that would be acceptable. (See Figure 7.20-2.) We were alerted to this plan by Dean Dr. TAN Gangyi of the School of Architecture and Urban Planning of the Huazhong University of Science and Technology in Wuhan.
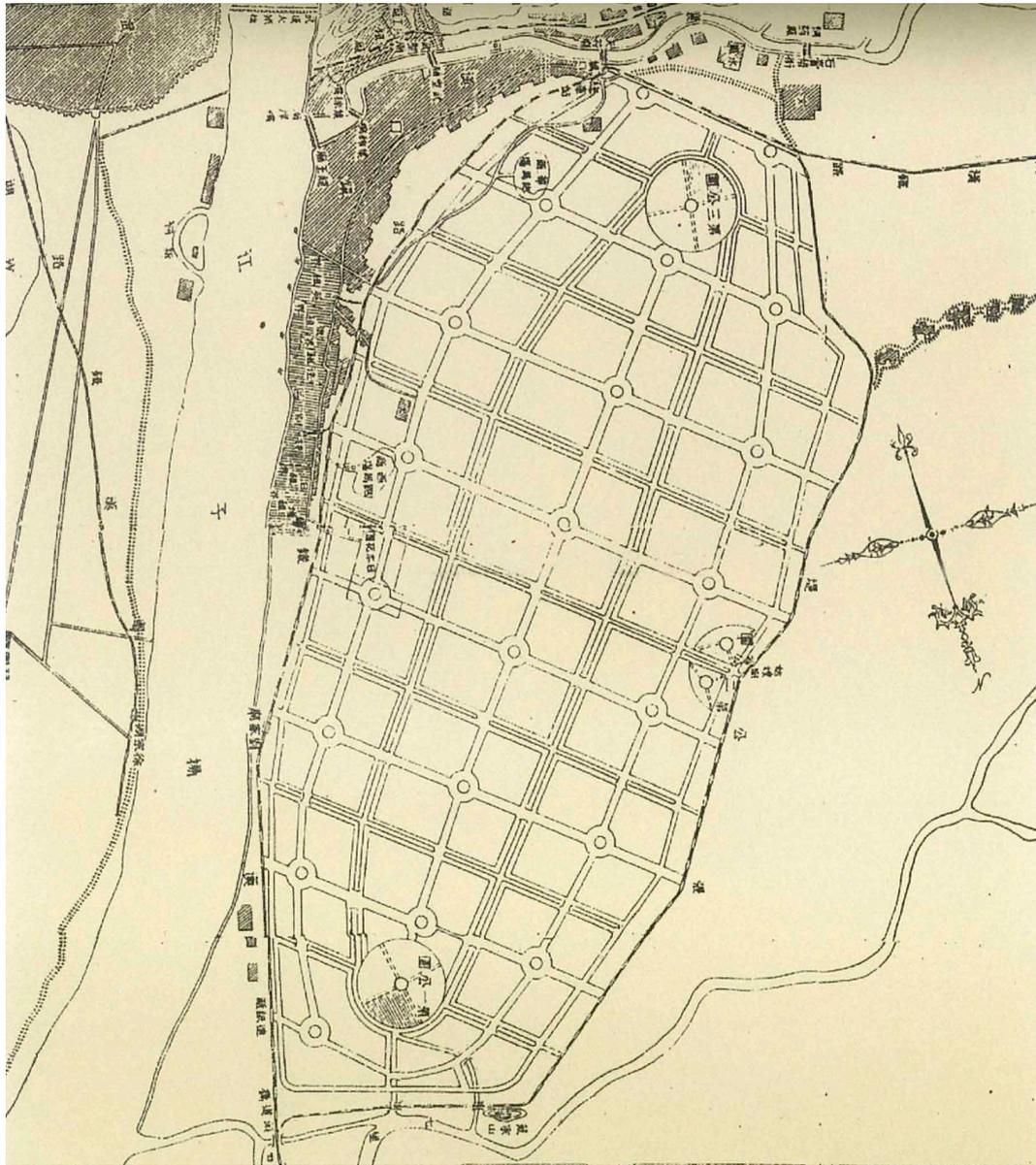
FIGURE 7.21 Reconstruction plan for Wuchang 1923 (Source: Planning Wuhan – 100 Years, 2009)

For Wuchang, too, a reconstruction plan with an overall grid was made in 1923 requiring complete demolition. (See Figure 7.21)

Fortunately, these plans were not executed; especially the 1912 plan for Hankou would not only have destroyed the old town, but have resulted in an urban environment where it would be hard to find one's orientation, and with many inconvenient triangular building plots.

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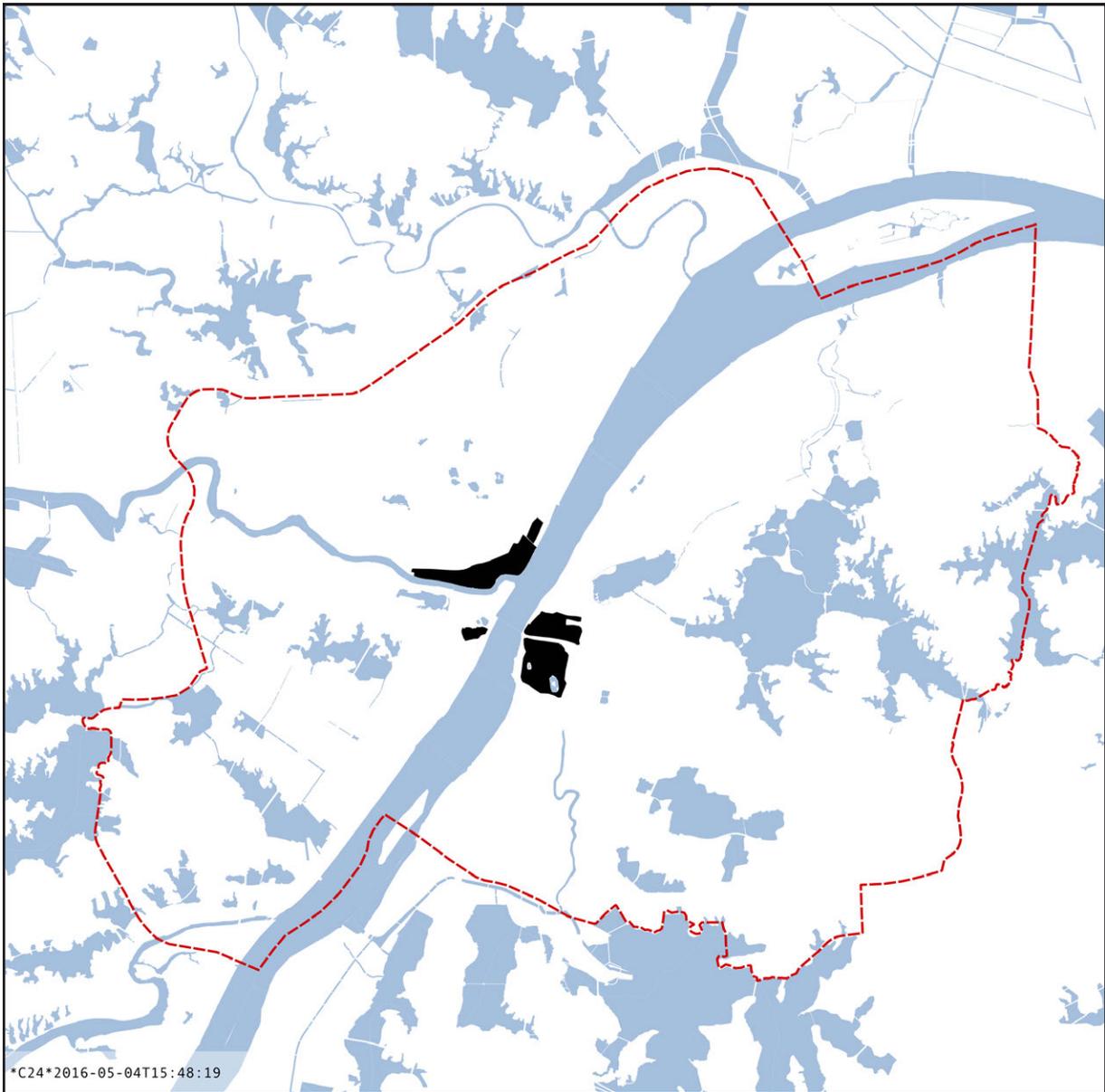
FIGURE 7.22 Inner city homogeneous areas in 1870

Inner city 1870 → 1910
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The three towns with their distinctive character constitute all of the urban area in 1870. Since 1861 Hankou includes the area of the Foreign Concessions.

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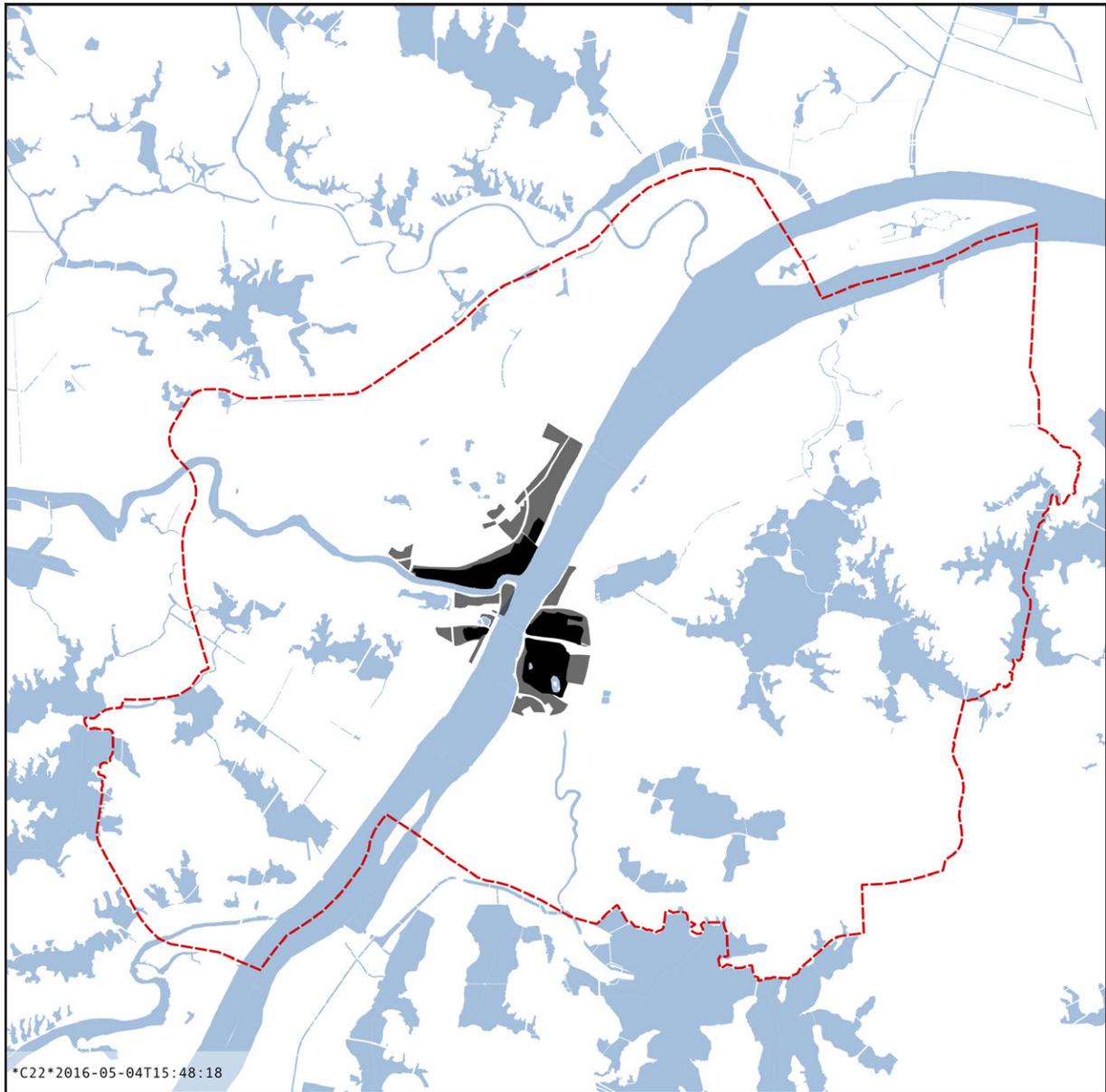
FIGURE 7.23 Inner city homogeneous areas from 1870 to 1910

In the period from 1870 to 1910 the considerable urban growth resulted from ZHANG Zhidong's industrial policy. Among other new factories, the large complex of the Hanyang Ironworks is situated north of Hanyang on the Han River. In Hankou the Foreign Concessions grew downstream along the Yangtze River as well as inland. Both Hanyang and Wuchang develop areas immediately outside their walls. Some of the authentic urban tissue from this time that has not been destroyed, and the Foreign Concessions still contribute to the identity of the contemporary city.
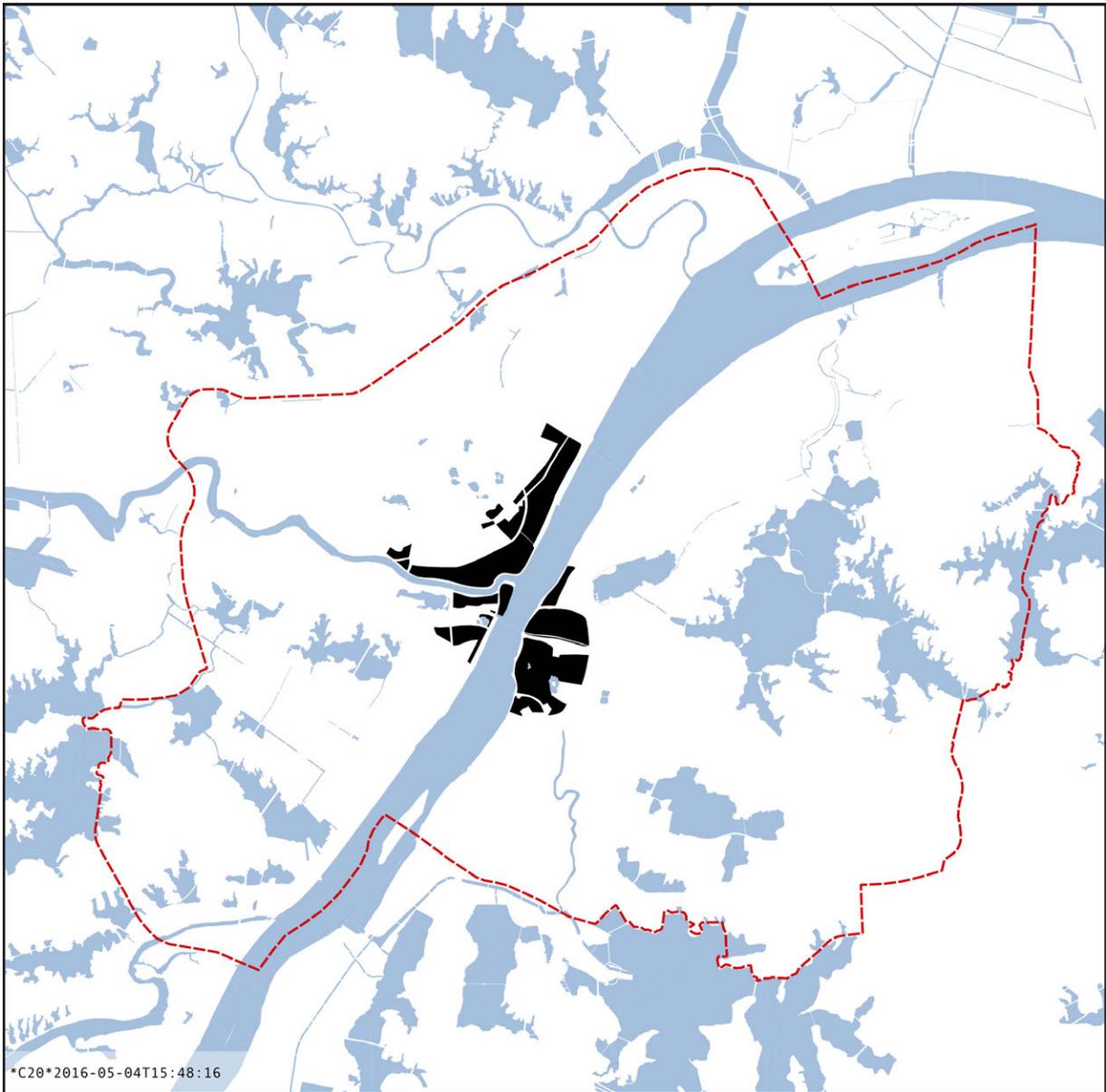
FIGURE 7.24 Inner city homogeneous areas in 1910
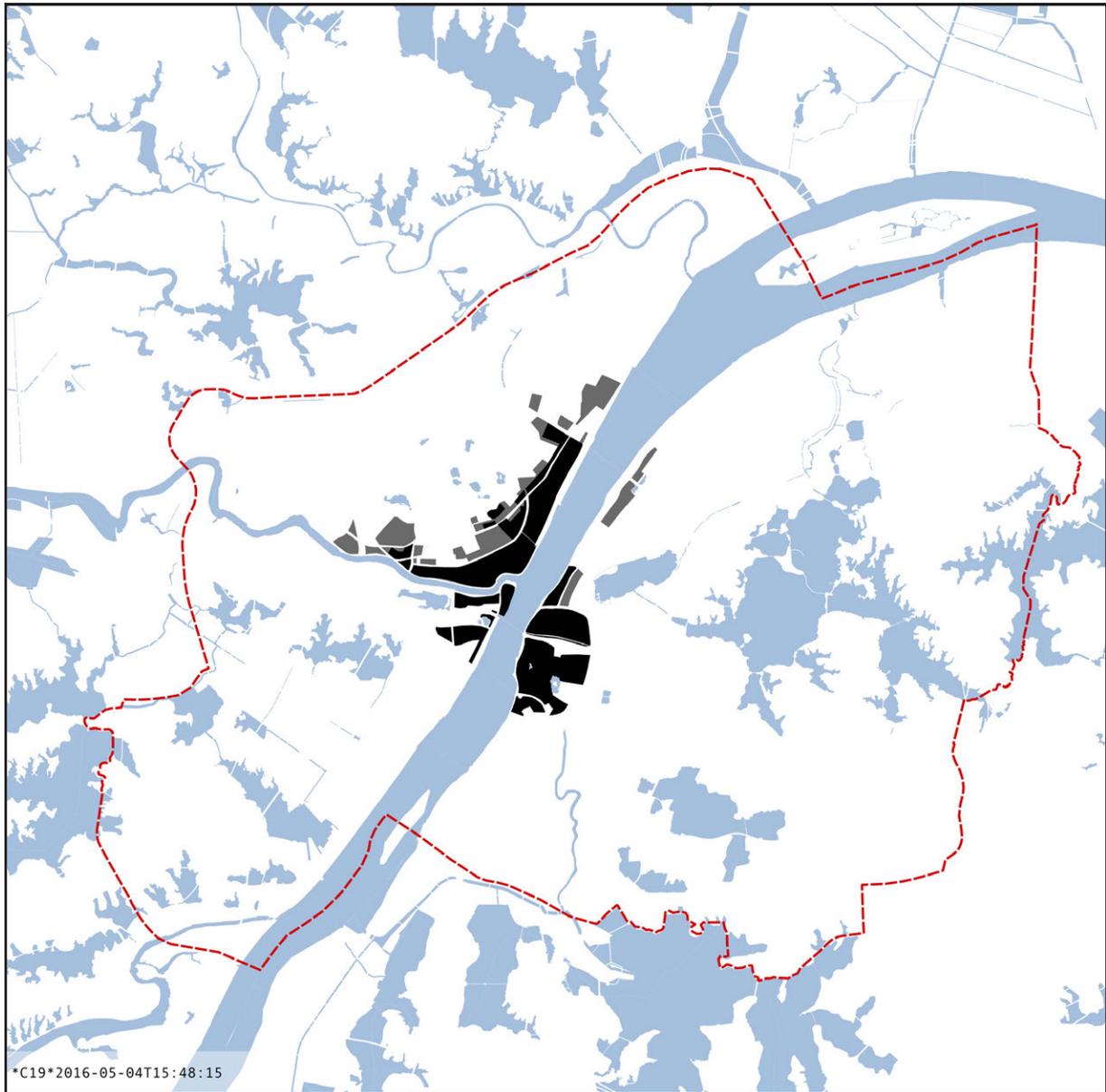
FIGURE 7.25 Inner city homogeneous areas from 1910 to 1950

Inner city 1910 → 1950

The relatively modest urban development in the period from 1910 to 1950 is based on the New Urban Theory that came out of the May 4th Revolution of 1919. The emphasis was on solving the housing problem, resulting in the expansion of Hankou. Wuchang shows some further growth outside its wall towards the north. Its wall was eventually completely destroyed in 1929. Downstream on the Yangtze River a few new sites are developed. The three towns are more and more fusing together, and business and university districts are established. Wuchang becomes a 'city of culture'.
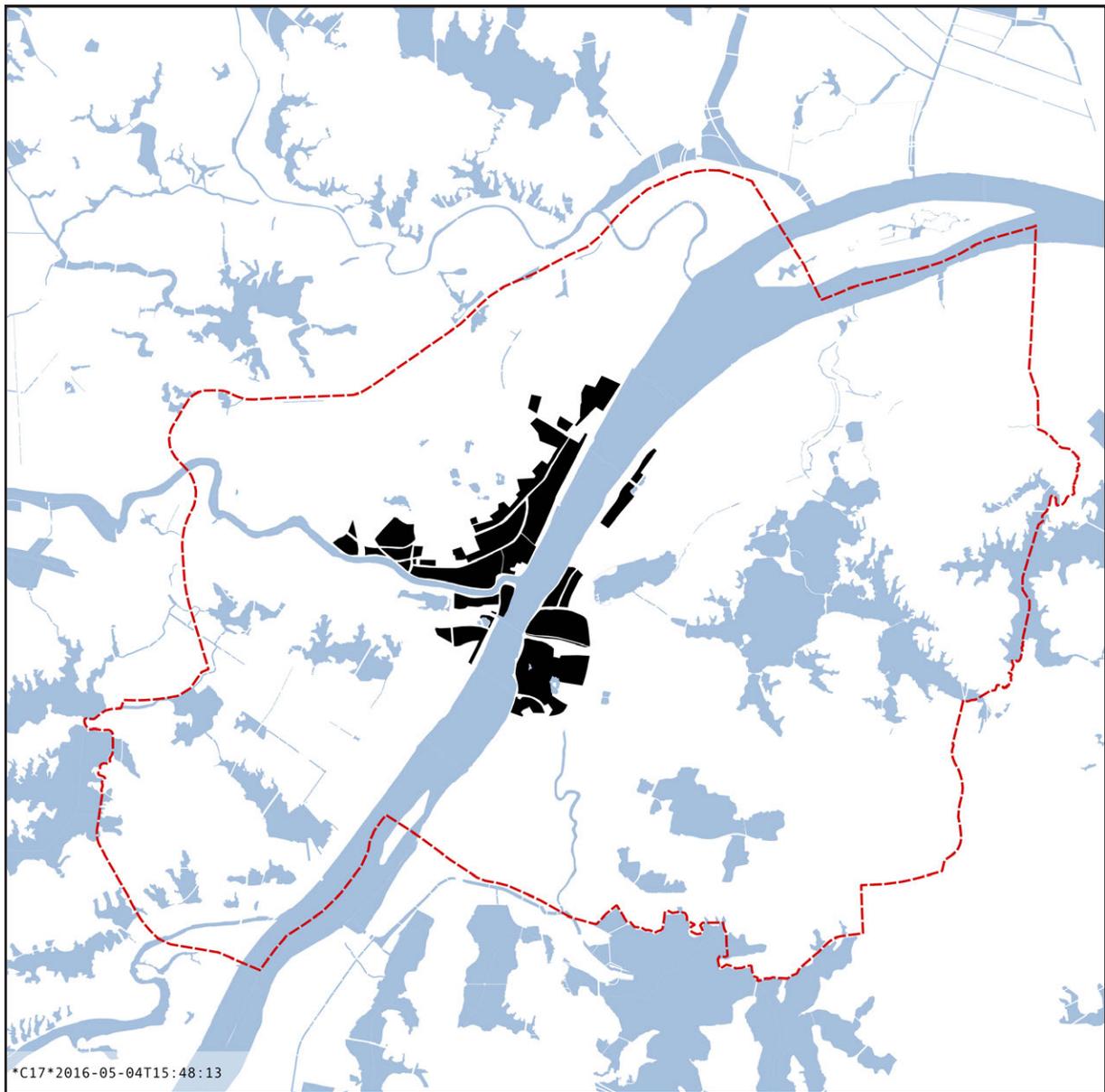
FIGURE 7.26 Inner city homogeneous areas in 1950

Inner city 1950 → 1970

Between 1950 and 1970, the urban areas were growing around the three original towns. East of the Yangtze River, growth from Wuchang occurs at considerable distances in the north and the east. As part of MAO Zedong's Great Leap Forward, important heavy industry was spread over the country. The biggest of these new factories was Wuhan Iron and Steel and was built in the northeast a significant distance away from the city. The strong growth of Wuhan is directly related to the industrial development, a multitude of new factories, and industrial projects like the establishment of the Wugang and Wuzhong companies.
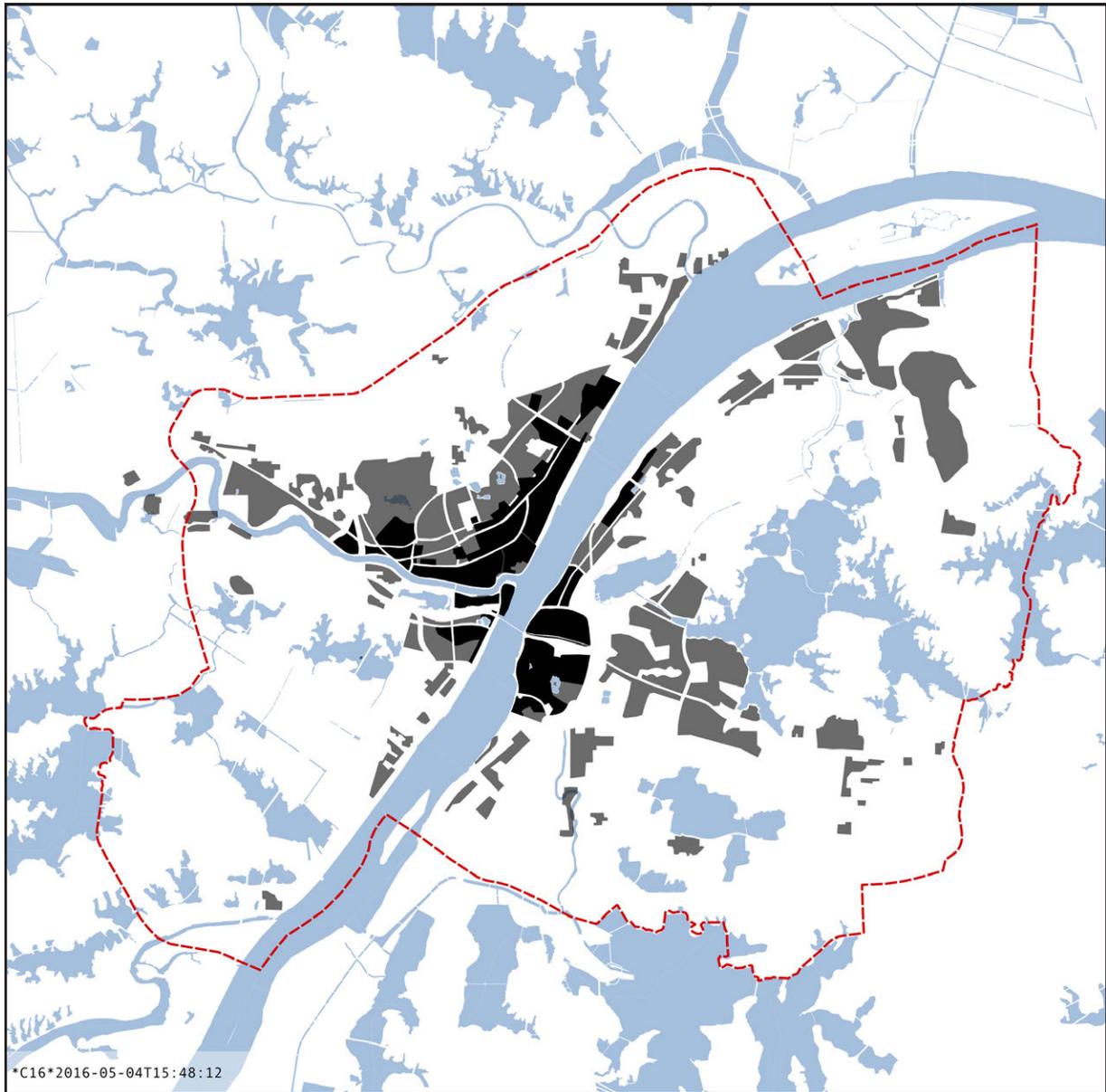
FIGURE 7.27 Inner city homogeneous areas from 1950 to 1970

These projects are generally organized and built to include dwellings and facilities for its workers in guarded compounds called 'danwei'. This took away the attraction of the old town environments. The planning principle is named "big scattered, small concentrated". This system is adapted from Russia, as is the Russian form of master planning with strong design features; for instance the new neighborhood of Hongshan Square of that time and of Russian design has a business center around the central square and avenues that radiate from it. Many of the elements of this period are still recognizable in the contemporary city, adding to its character and identity.

New traffic infrastructure is implemented according to the Second Five Year Plan. This includes roads and bridges like the Jianghan Bridge over the Han River (1956), the Wuhan Yangtze River Bridge (1957), Heping Road, and Zhongshan Road.

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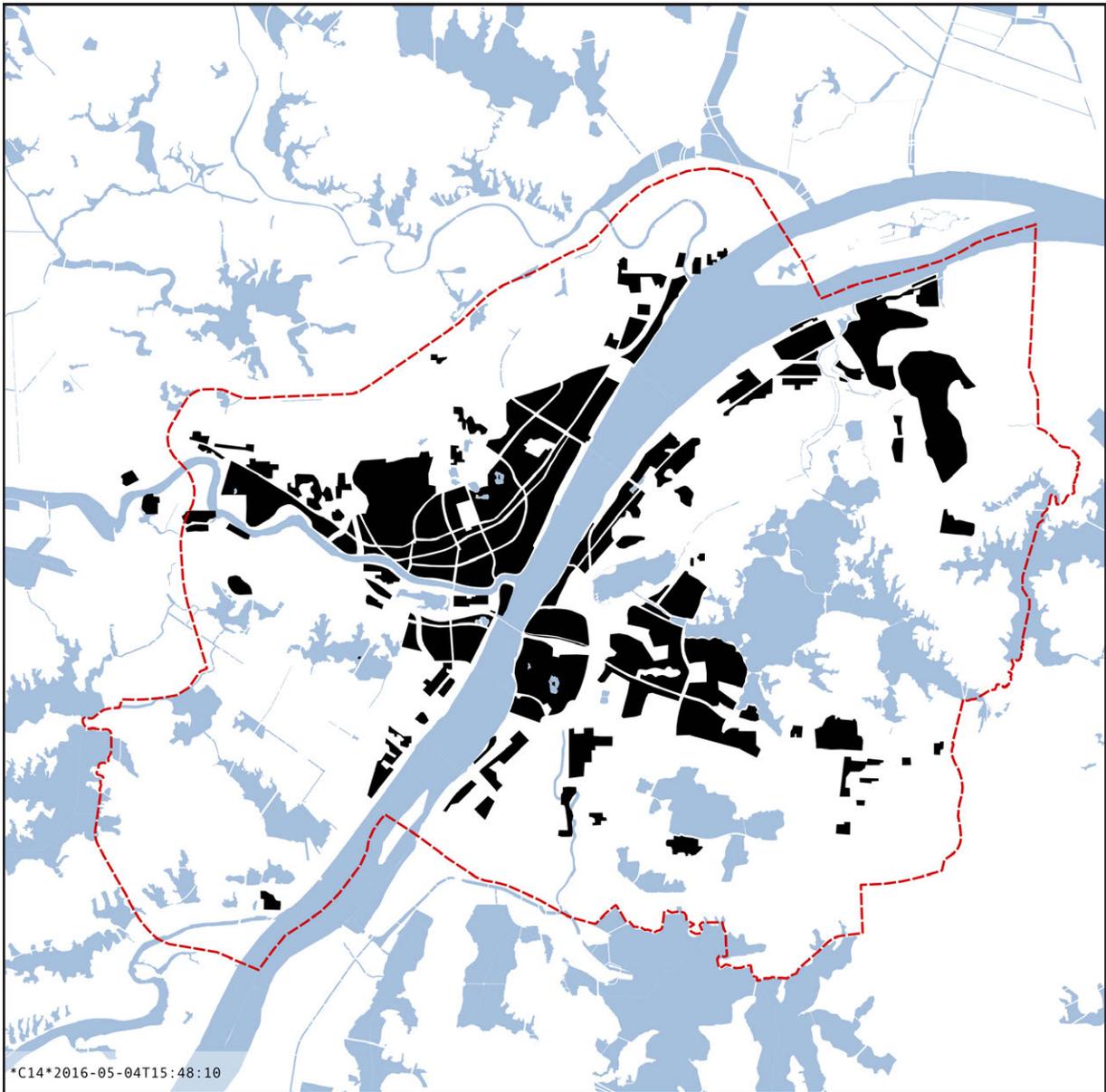
FIGURE 7.28 Inner city homogeneous areas in 1970
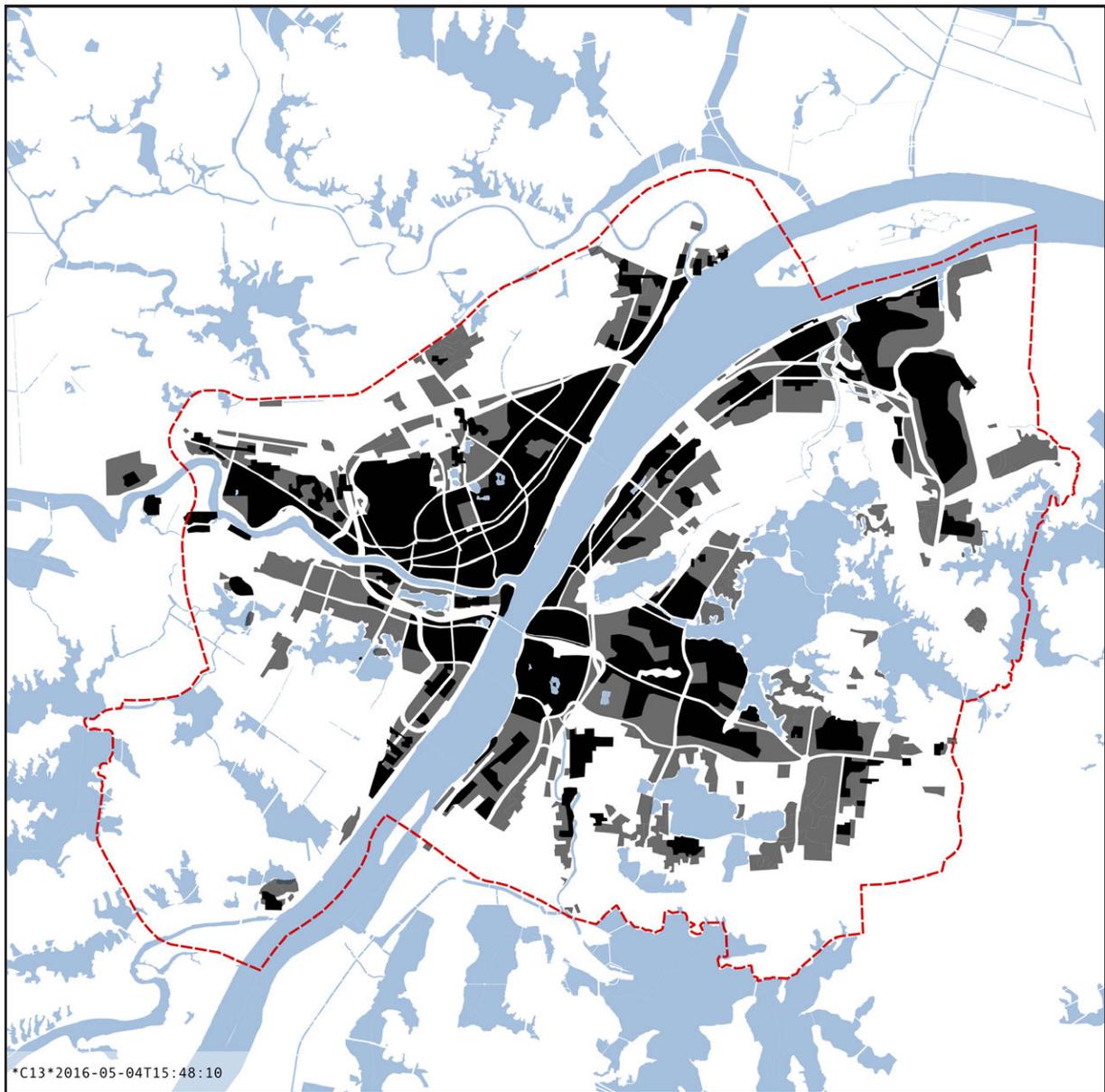
FIGURE 7.29 Inner city homogeneous areas from 1970 to 1990

Inner city 1970 → 1990

The DENG Xiaoping's Reformation and Opening Up Policy drove economic and urban development from 1970 to 1990. Fast building first followed the main roads. New centralities are established and new buildings concentrated around these centralities; for example the Zhongbei Road District in Wuchang and Wushang in Hankou. Most of the development is immediately adjacent to existing urban areas. At the same time construction of new large infrastructure has begun; like the Concert Bridge over the Han River (1978).

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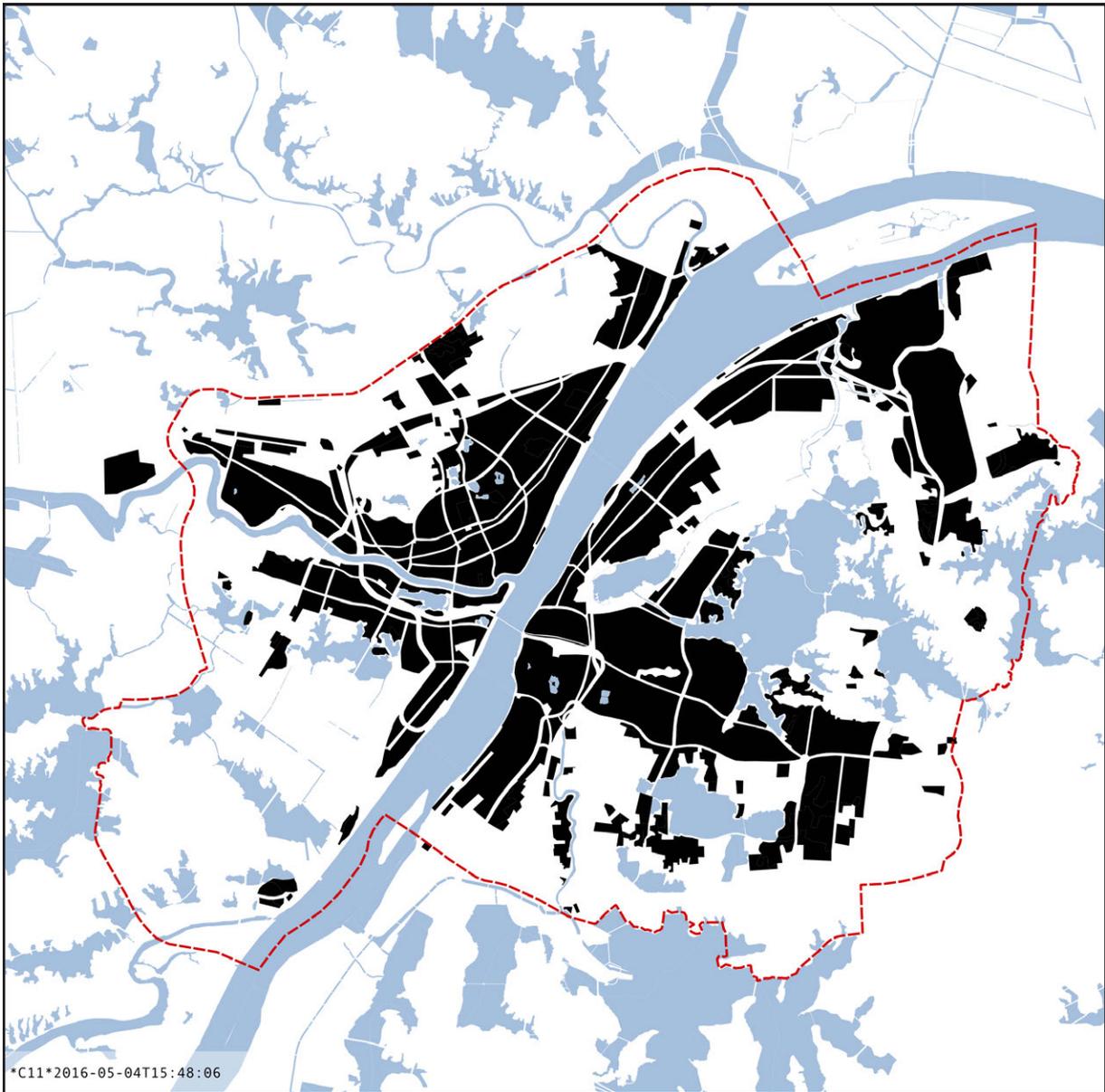
FIGURE 7.30 Inner city homogeneous areas in 1990

Inner city 1990 → 2000

In the period from 1990 to 2000, parallel to filling in open spaces in the Inner city, urban development occurs outside the borders of the Metropolitan area. As this period is only 10 years long, it shows the acceleration in urban development that took place. Service industry is located in the urban centers, strengthening their position. New Economic and Technological Development Zones are created and they are driving forces for expansion; like Guanggu and Zhuankou.
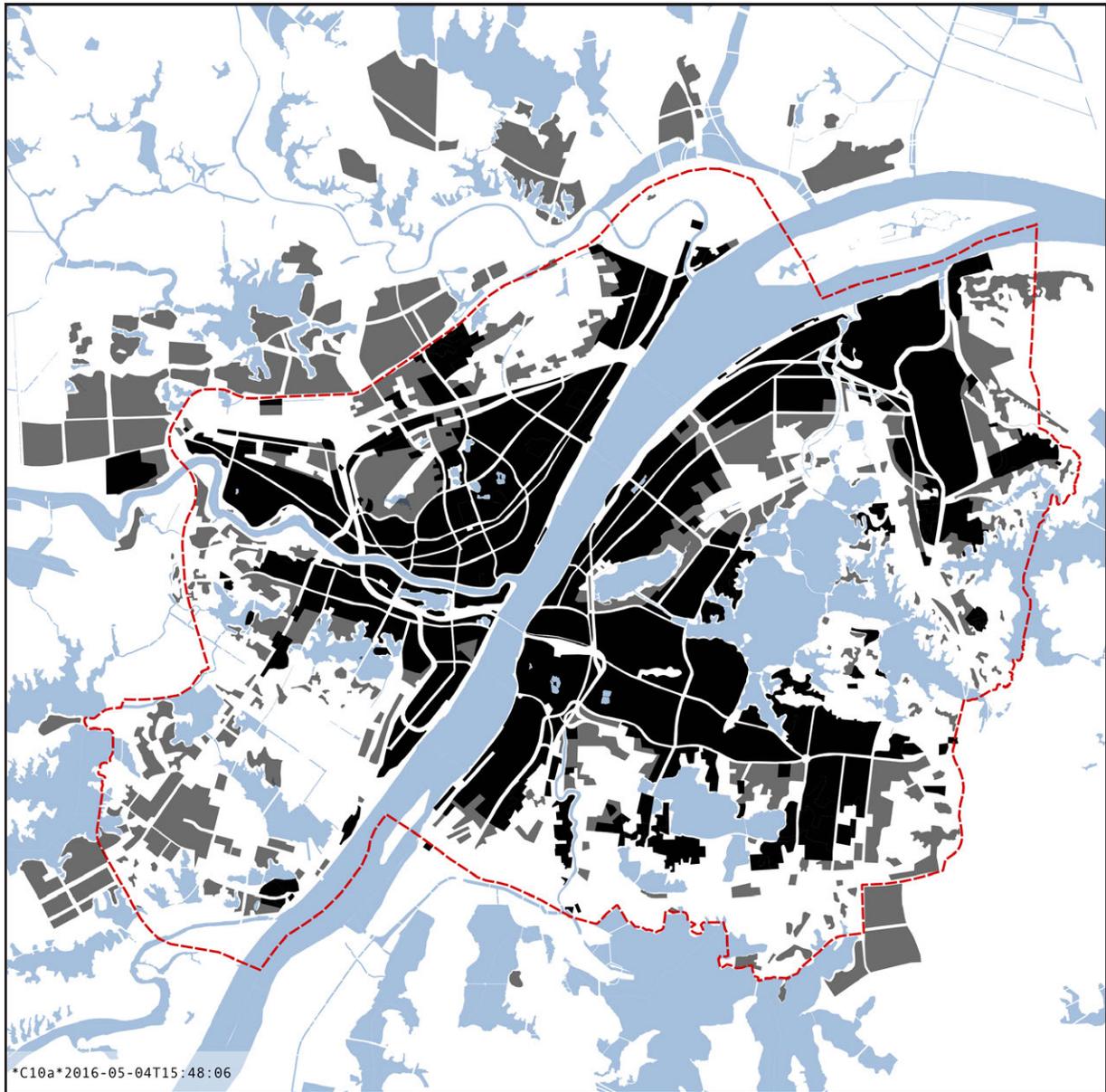
FIGURE 7.31 Inner city homogeneous areas from 1990 to 2000

The bridges Wuhan Yangtze River Highway Bridge or Second Wuhan Yangtze River Bridge (1995), and the Lake Bridge over the Han River (1998) are the first of a series of new bridges that integrate the three areas separated by the two big rivers.
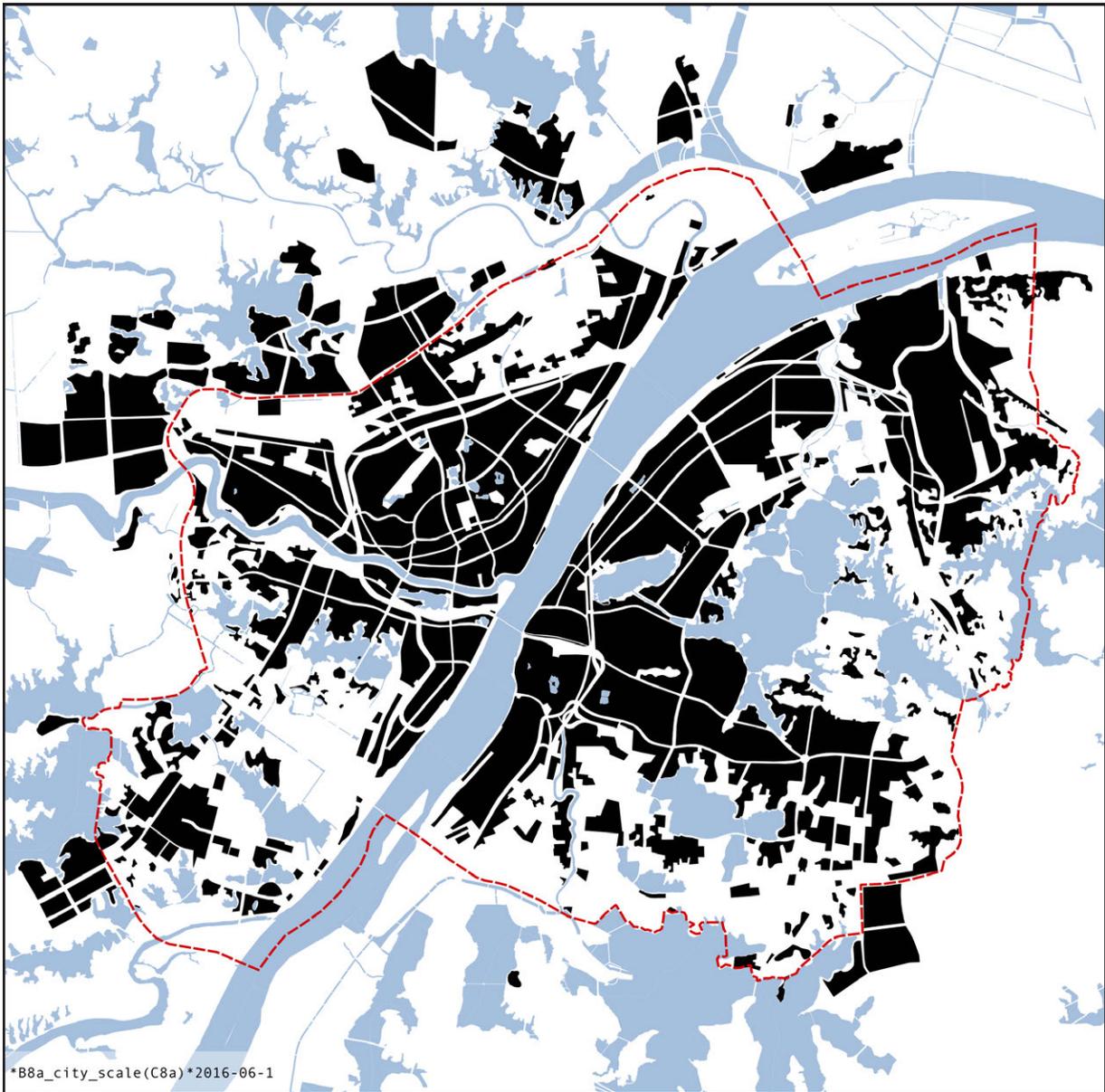
FIGURE 7.32 Inner city homogeneous areas in 2000

Inner city 2000 → 2006

Growth continues in the period from 2000 to 2006, at a somewhat more modest pace. The spatial structure of 'Ring + Radians' is conceived and built to support the future growth of the city. The Central Business District is established, and the Economic and Technological Development Zones develop quickly as small industry is moved out of the Inner city to these new areas. Many of the open edges of the Inner city area are filled in.

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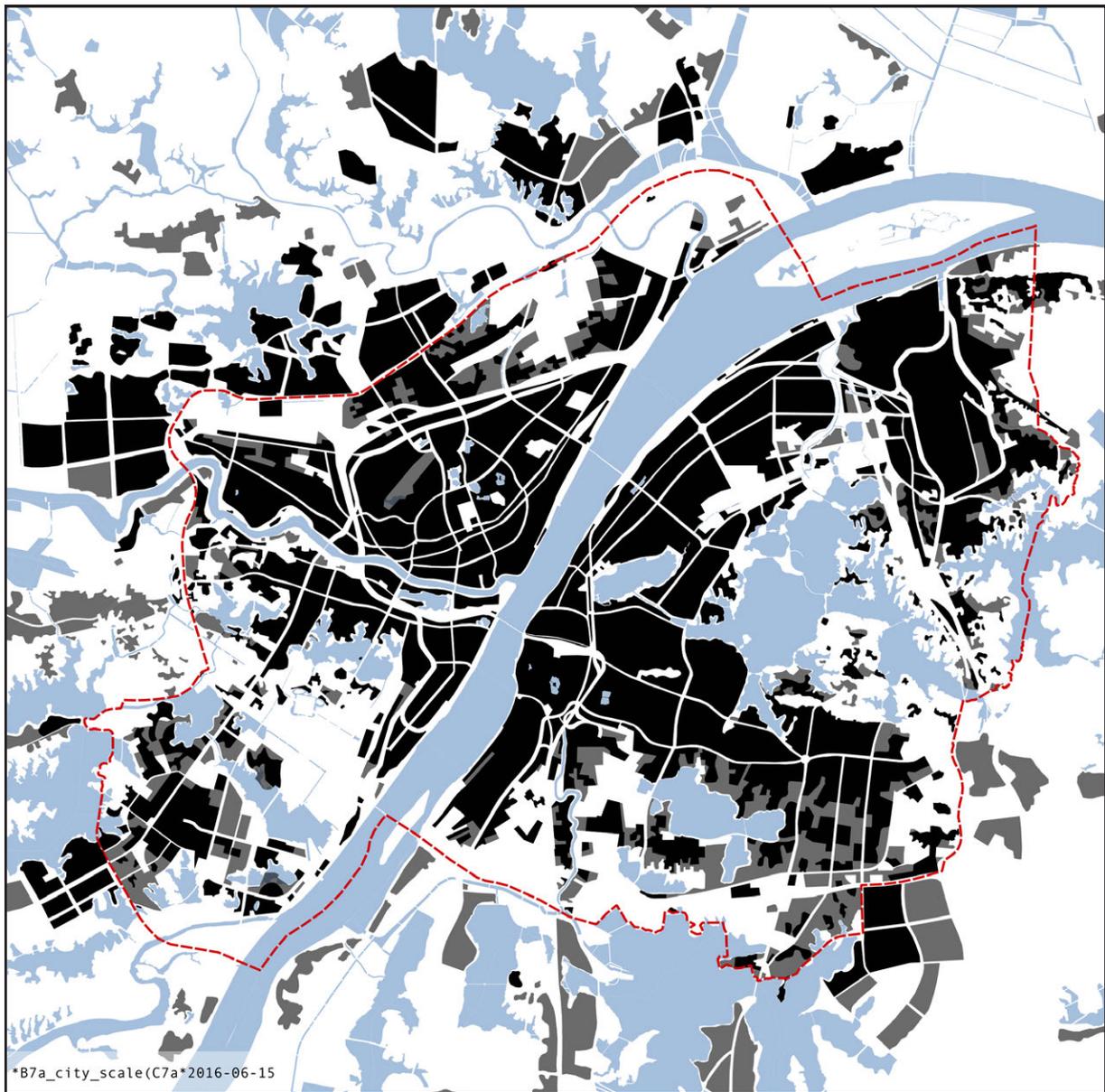
FIGURE 7.33 Inner city homogeneous areas from 2000 to 2006

The building of new infrastructure is intensified. Four new bridges are built: the Qingchuan Bridge over the Han River (2000), the Wuhan Baishazhou Bridge over the Yangtze River (2000), the Changfeng Bridge over the Han River (2000), and the Junshan Yangtze River Bridge (2001). The development of a metro system begins with the first section of Line 1 opening in 2004.

FIGURE 7.34 Inner city homogeneous areas in 2006

Inner city 2006 → 2013

From 2006 to 2013 growth speeds up again. Inside the borders of the Inner city the last remaining non-urban land use is developed. The change from a mono-centric to a poly-centric spatial structure is completed.

FIGURE 7.35 Inner city homogeneous areas from 2006 to 2013

More large-scale infrastructure is realized. New bridges are: the Wuhan Yangluo Yangtze River Bridge (2007), the Tianxingzhou Yangtze River Bridge (2009), and the Seven Yangtze River Bridge (2011). After 2013 two more bridges and a tunnel are added: the Wuhan Parrot Island Yangtze River Bridge (2014), and the Futura Bridge over the Han River (2015). The Wuhan Yangtze River Tunnel is opened for traffic in 2008. Line 2 of the Metro system is operational in 2012; the final stretch of Line 1 and all of Line 4 are operational in 2014.
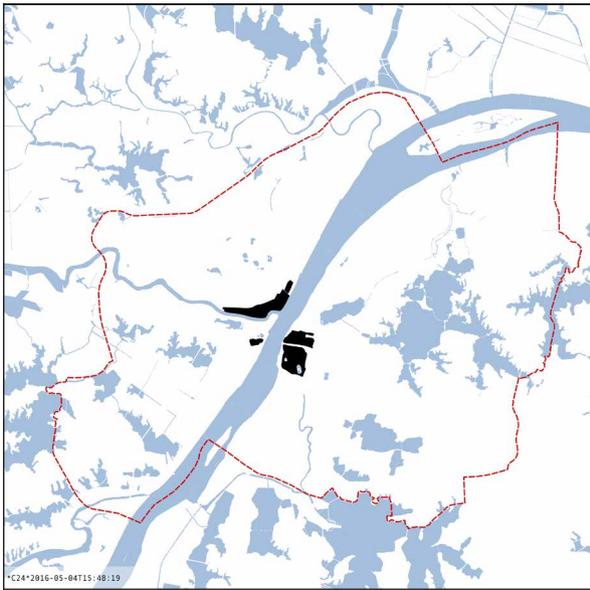
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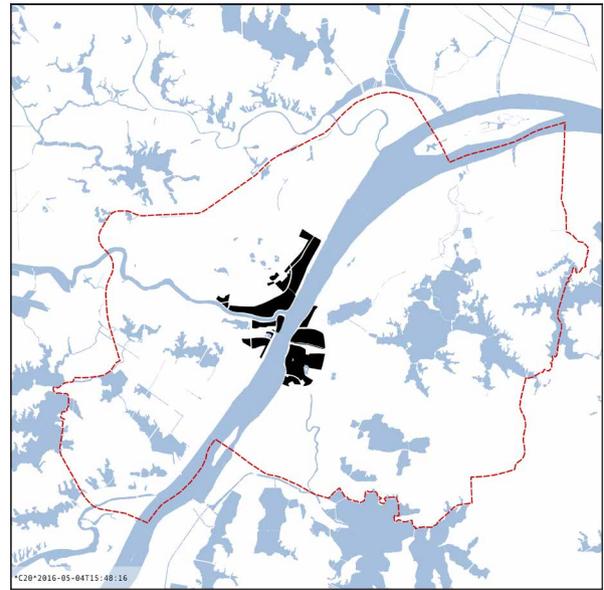
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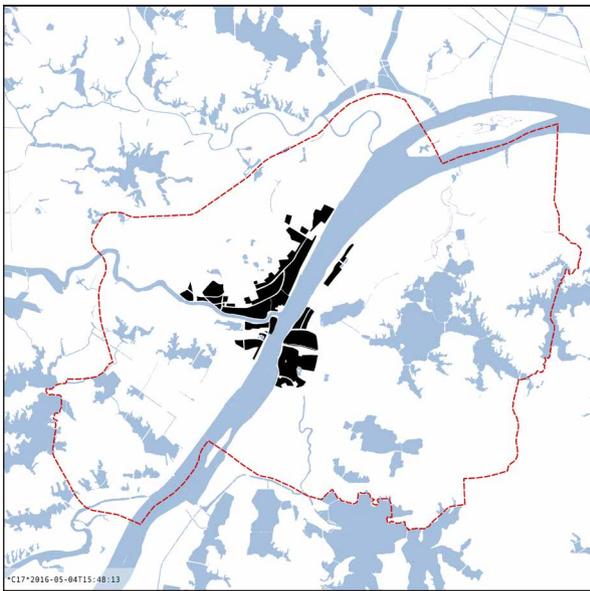
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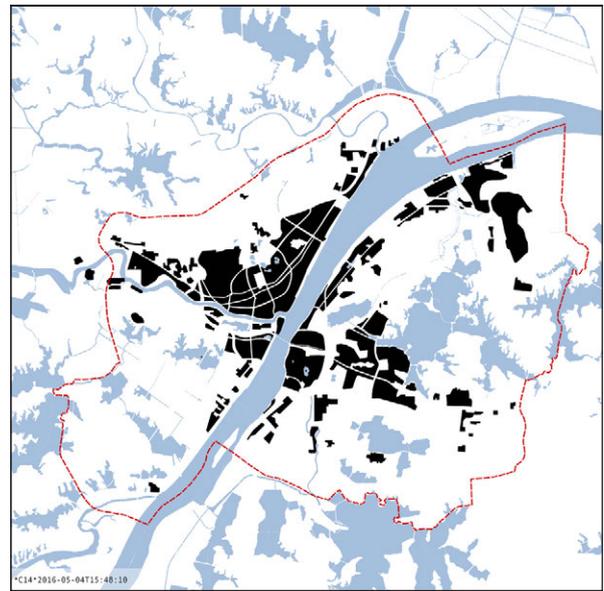
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FIGURE 7.36 Inner city transformation 1870 to 2013

Figure 7.36 gives an overview of inner city homogeneous areas transformation from 1870-2013.
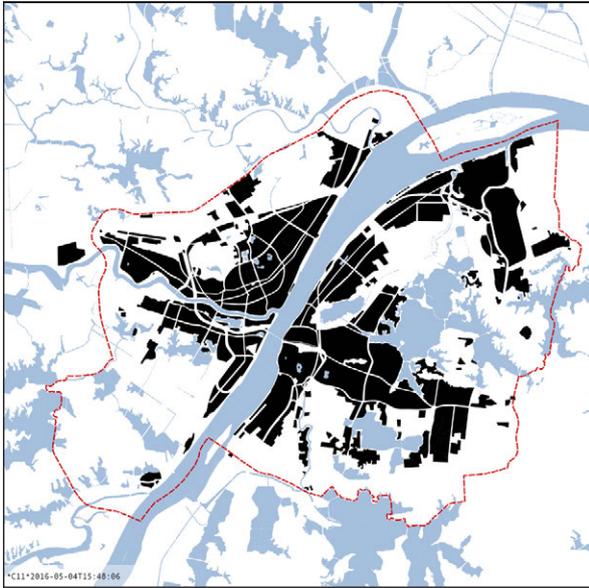
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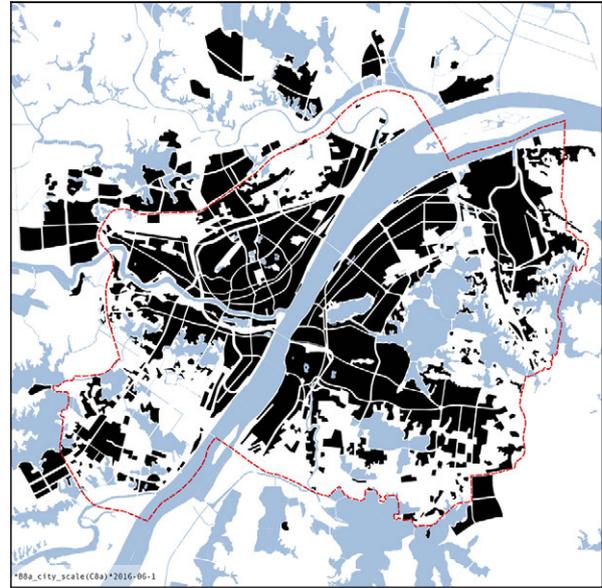
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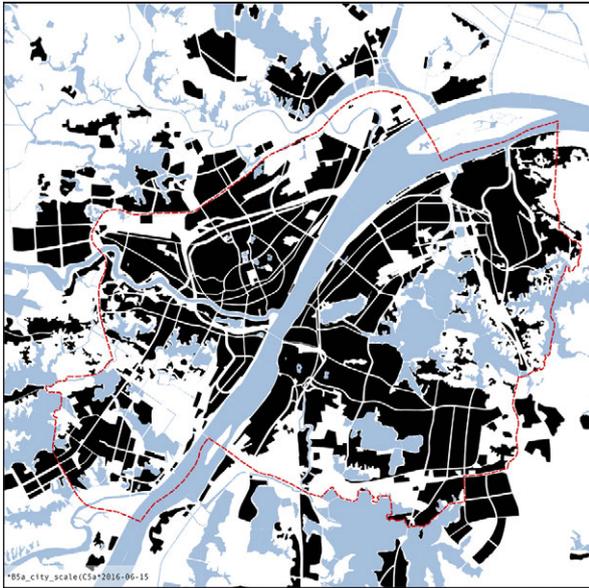
7-2006

8-2013

§ 7.3.2 Metropolitan areas transformation 2000-2013

The following series of analytical maps shows the situation of the urban form in the Metropolitan area. The series starts in 2000, as there was no urban development outside the Inner city area before that year.

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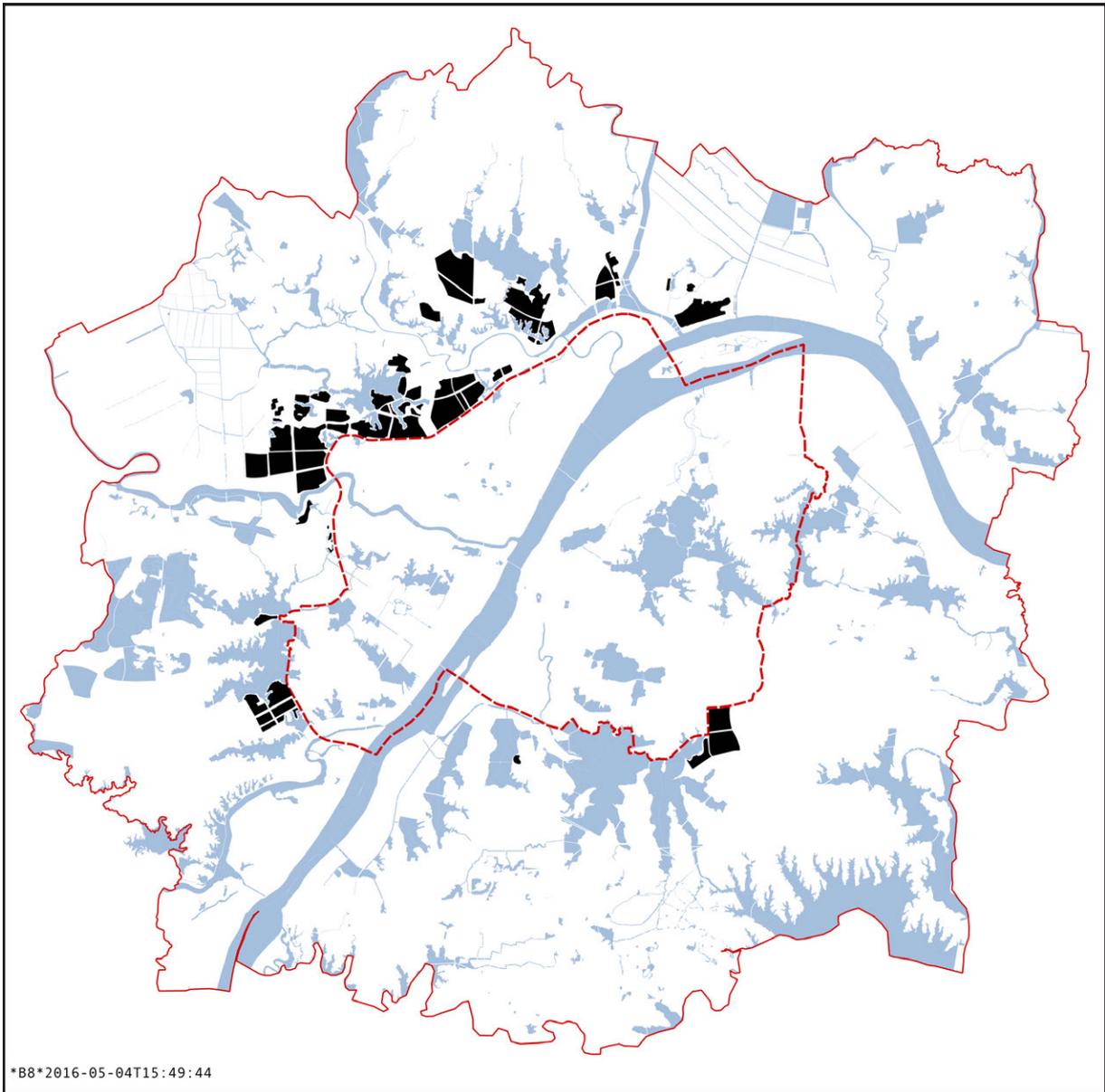
FIGURE 7.37 Metropolitan area homogeneous areas in 2000

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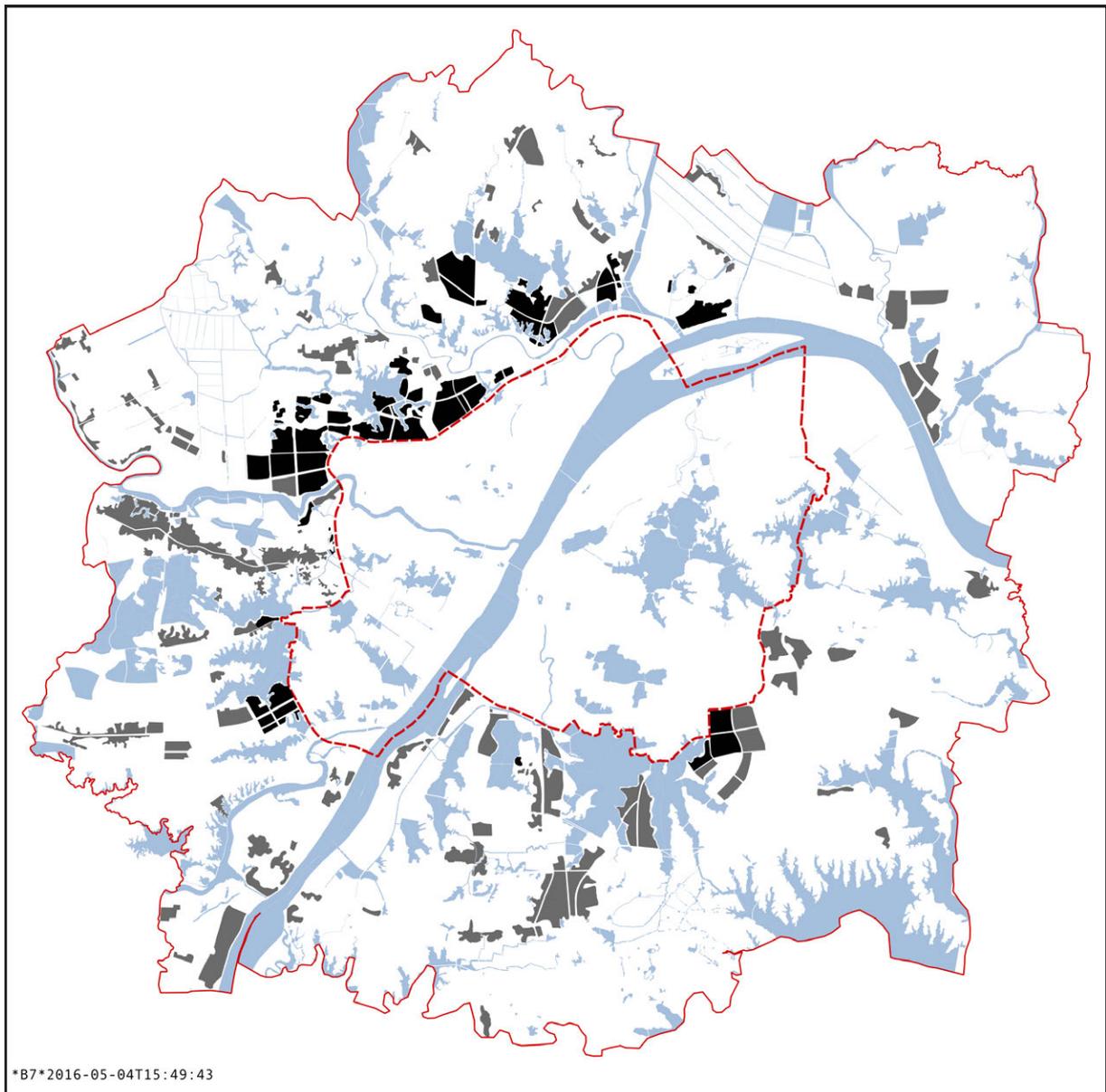
FIGURE 7.38 Metropolitan area homogeneous areas from 2000 to 2006

Metropolitan area 2000 → 2006

Urban growth outside the Inner city borders, that started in 2000, continues mostly in linear developments following road infrastructure.

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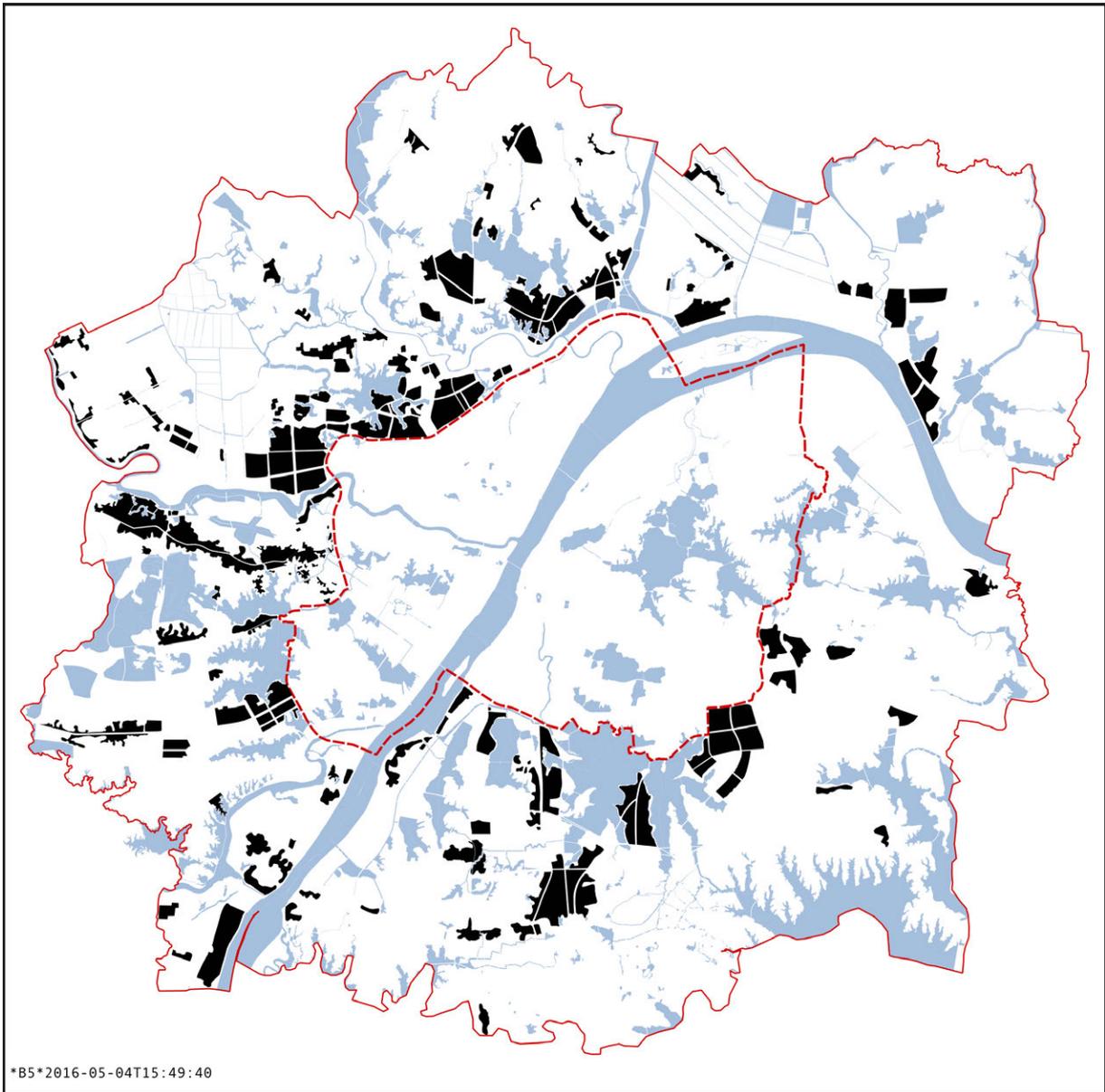
FIGURE 7.39 Metropolitan area homogeneous areas in 2006

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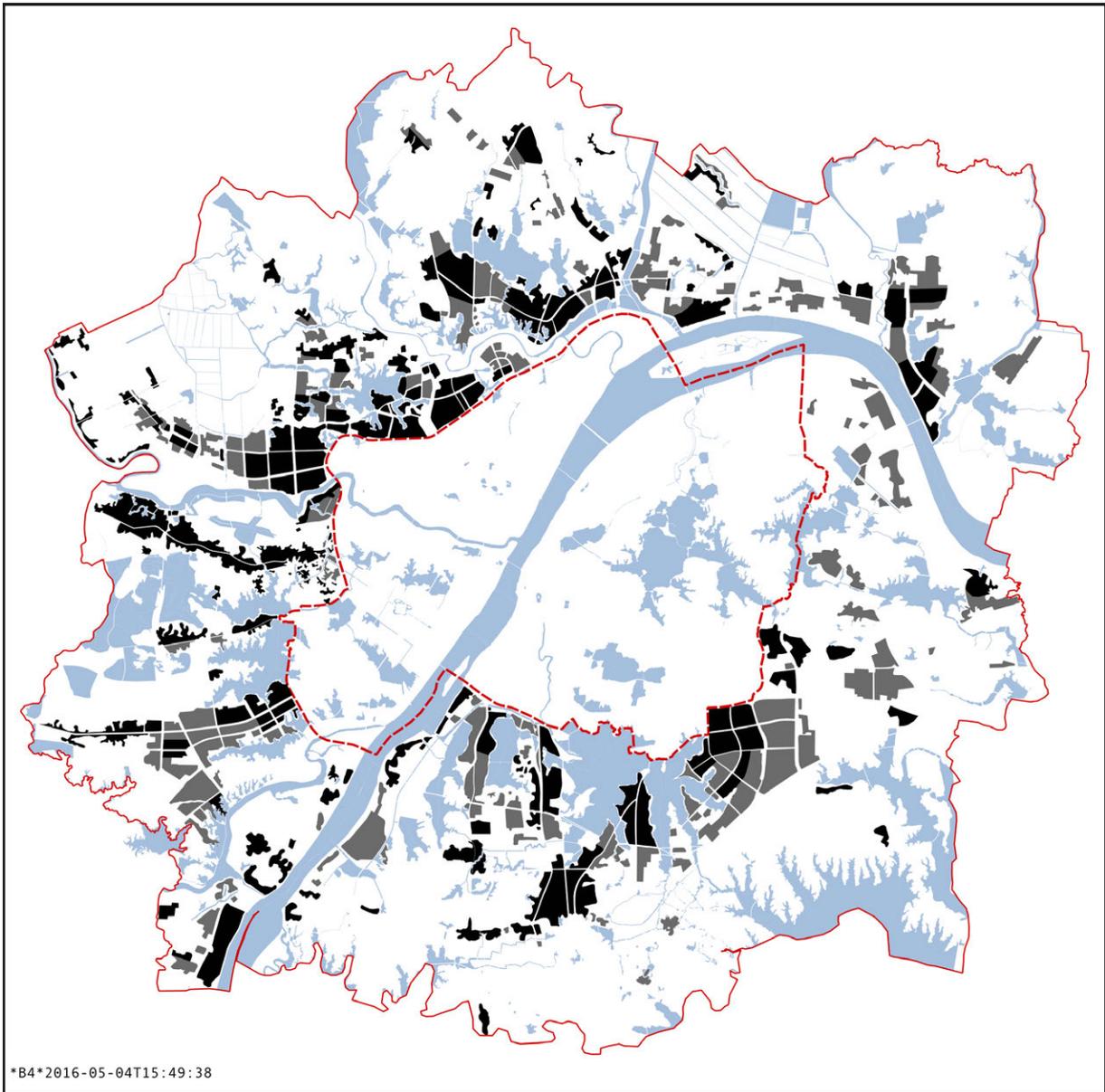
FIGURE 7.40 Metropolitan area homogeneous areas from 2006 to 2013

Metropolitan area 2006 → 2013

The pattern of urban growth continues, strengthening the outward linear developments.

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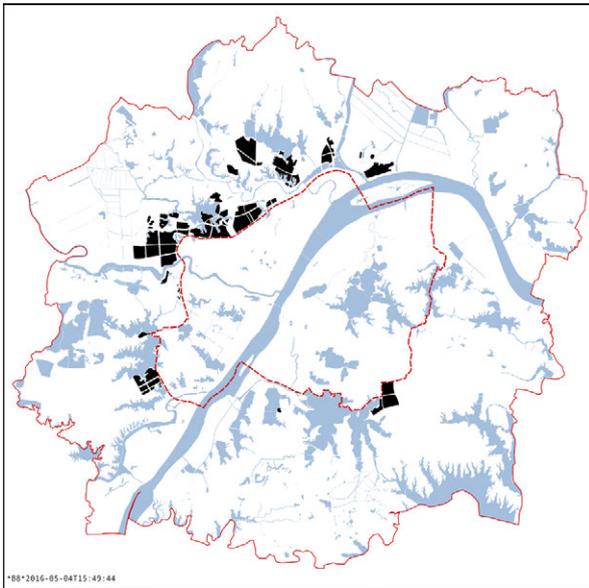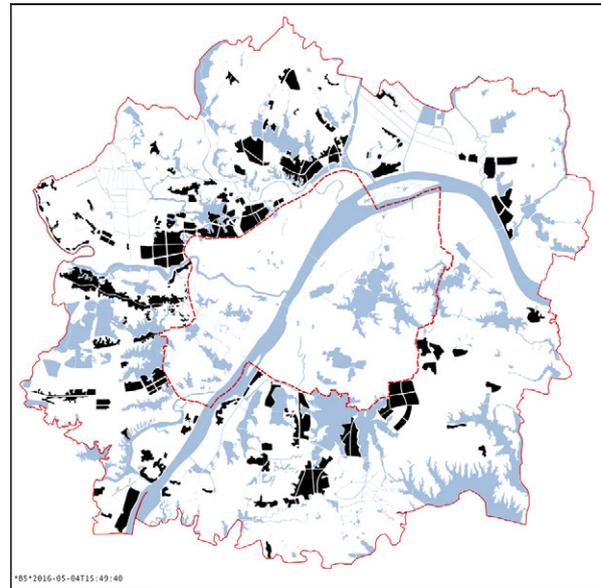
1-2000   *2-2006*

FIGURE 7.41 Metropolitan area transformation
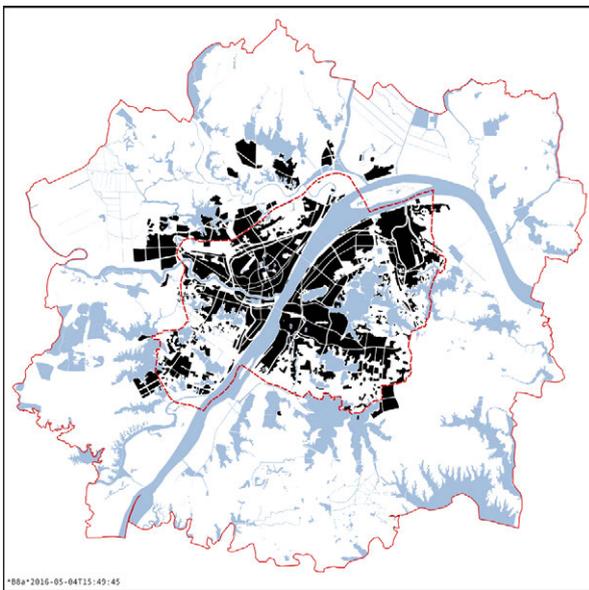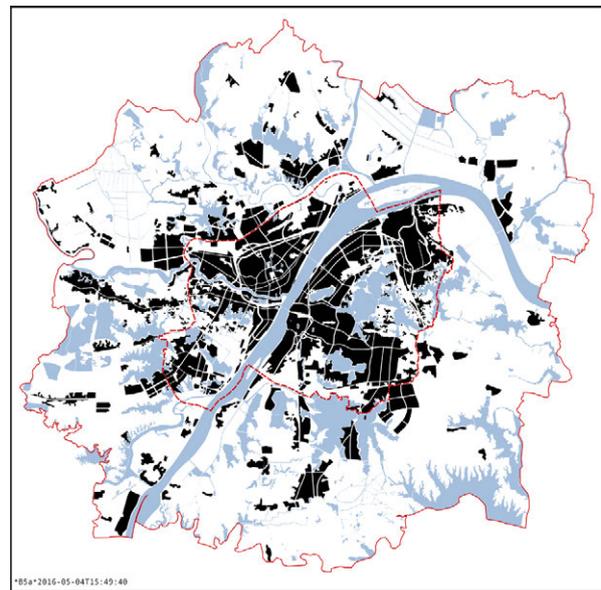
1-2000   *2-2006*

FIGURE 7.42 Metropolitan area + inner city transformation

Figure 7.41 gives an overview of urban growth outside the Inner city borders from 2000 to 2013.

Adding up the inner city, Figure 7.42 shows the entire Wuhan metropolitan area transformation from 2000 to 2013.
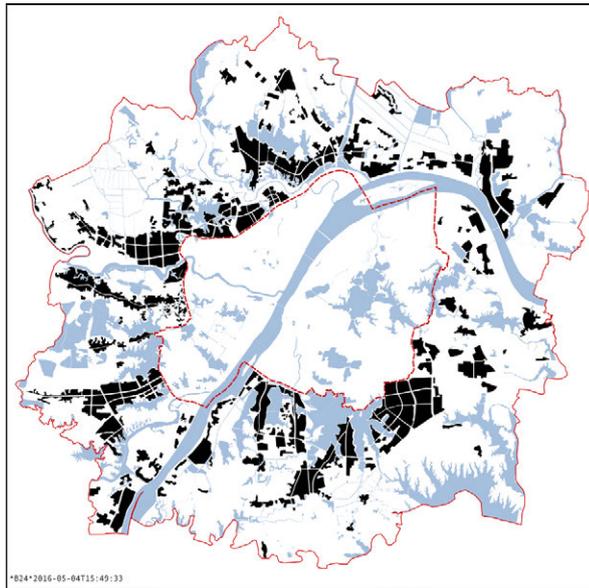
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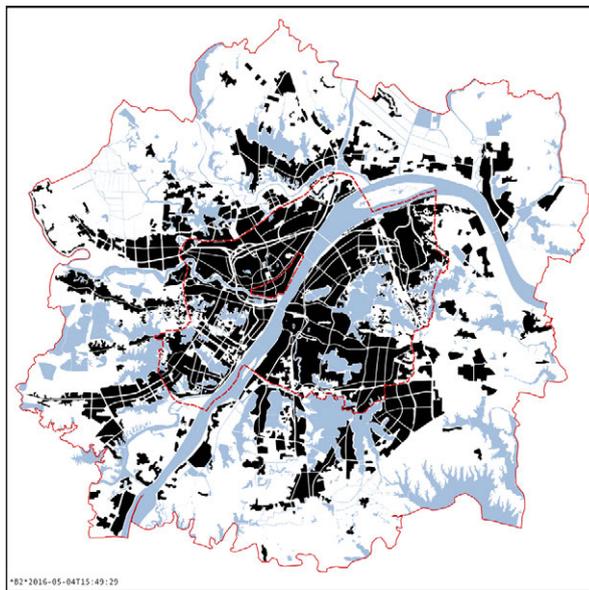
3-2013

Urban structure transformation 1870-2013

The following series of sketches are interpretations of the overall urban form and its transformations and extensions: finding the urban spatial structure of Wuhan.

FIGURE 7.43 Urban spatial structure in 1870

1870

In 1870 three towns are located at the point where the Han River, the most important tributary of the Yangtze River, flows into the main stream, each on their own side of the two rivers. Hanyang and Wuchang are compact towns protected by and contained within their walls and moats. Hankou is a partially walled port town with a linear structure along and open to the banks of the two rivers, but protected by a wall towards the north and west. Each of the three towns develop independently of each other.

FIGURE 7.44 Urban spatial structure in 1910

1910

In 1910 Hanyang jumped to the riverbank in the north with the establishment of Hanyang Ironworks. Wuchang is still a compact walled town with considerable open spaces within. Hankou has developed further linear growth downstream along the Yangtze River to the north.

FIGURE 7.45 Urban spatial structure in 1950

1950

In 1950 the situation in Hanyang shows little change. Wuchang has expanded to the north, downstream along the Yangtze River. In Hankou, the center shifts to the north with the development of Foreign Concessions.

FIGURE 7.46 Urban spatial structure in 1970

1970

In 1970 the center of the three towns has moved further downstream along the Yangtze River with linear growth on both banks. Hankou also grows westward along the Han River. Around each of the towns there are new locations for industry. Wuchang grows towards the north along the bank of the Yangtze River.

FIGURE 7.47 Urban spatial structure in 1990

1910

In 1990 Hanyang stays behind. The Wuchang side develops into a horseshoe spatial structure that bends between the local topography of the lakes and mountains. Hankou develops into a compact city inside its natural boundaries of the two rivers and the dike that protects against flooding from the north, but with linear extensions into the countryside.

FIGURE 7.48 Urban spatial structure in 2000

2000

In 2000 the surroundings of Hanyang becomes like an extension of Hankou after the new Concert Bridge over the Han River is built in 1978. The horseshoe structure of the Wuchang side becomes stronger. The commercial center of Hankou becomes the most powerful and development grows along the anti-flooding dike in the north.
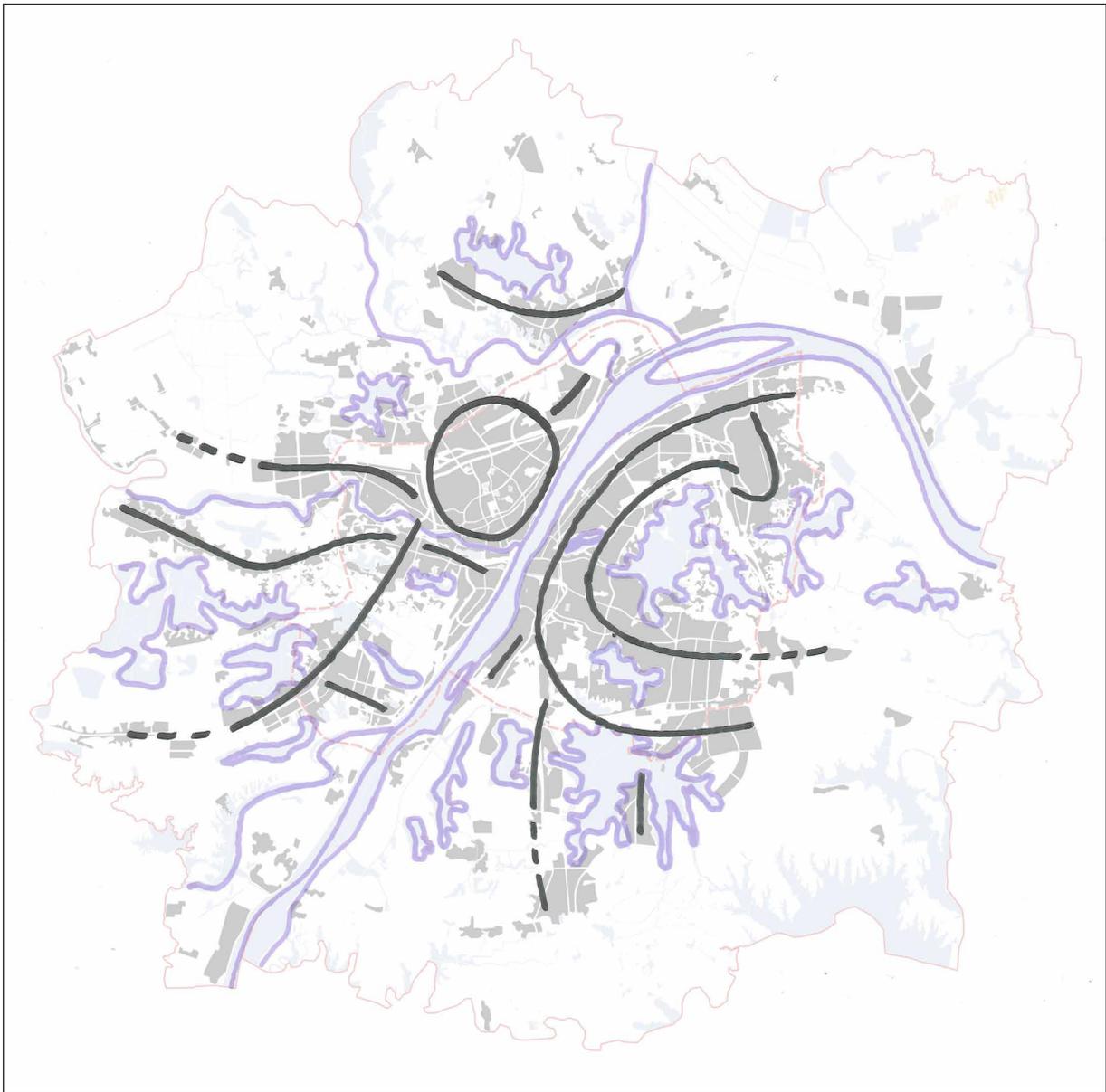
FIGURE 7.49 Urban spatial structure in 2006

2006

In 2006 Wuchang and Hankou together form the core of the city. Hanyang continues its linear development as an extension of Hankou. In addition to the horseshoe structure Wuchang also develops linear elements far from its center. The compact core of Hankou crosses over the dike to the north.
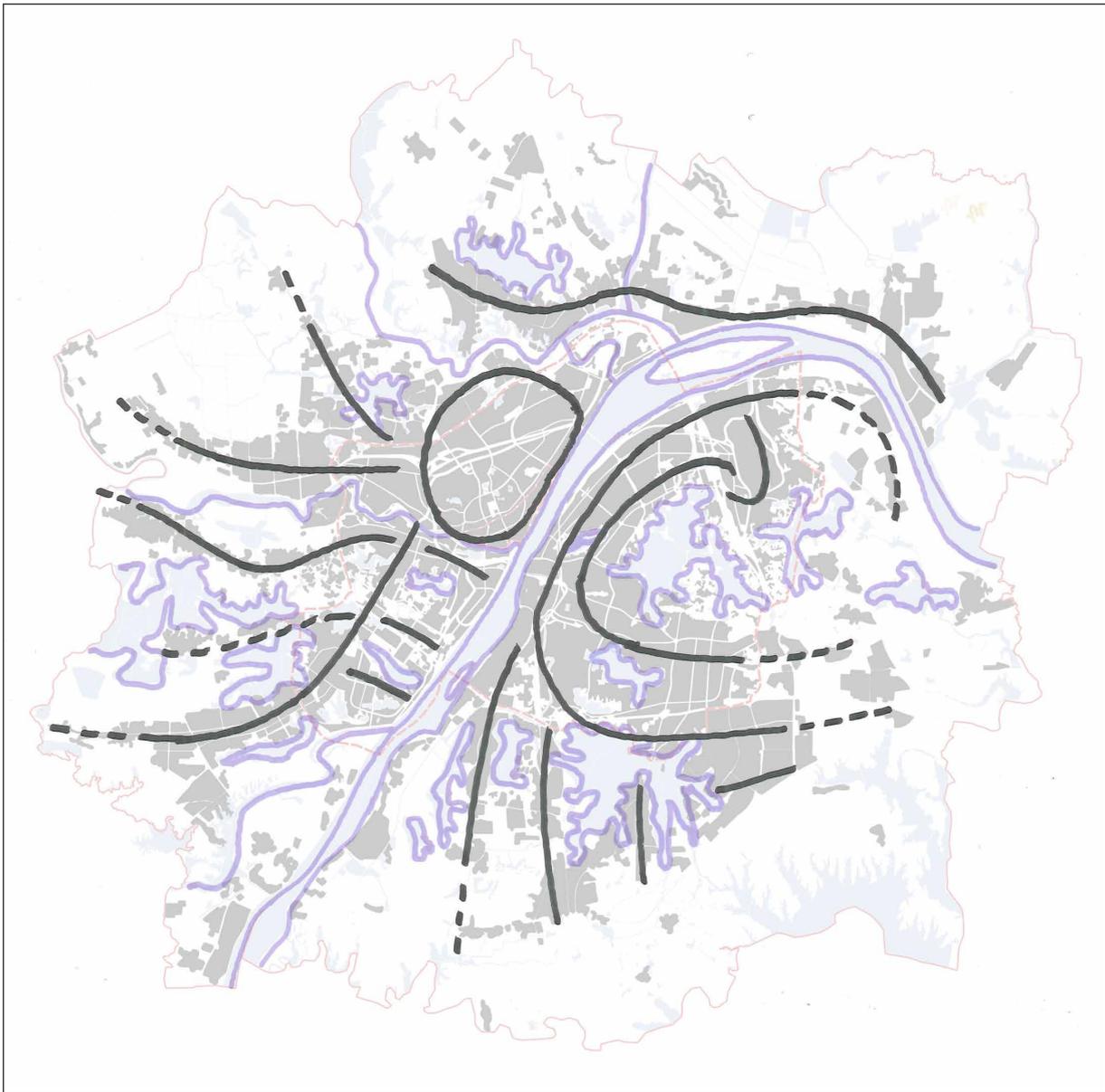
FIGURE 7.50 Urban spatial structure in 2013

2013

In 2013 the dual core is strengthened with increasing density. Extensions are being built on the outskirts of the Metropolitan area, including linear development on the north side of the Yangtze and Fu Rivers.

Strikingly, the areas of and around the original three towns have distinctly different basic spatial structures, though not the same as their original structures nor continuous through history. The Hanyang side displays a finger city of linear developments. The Wuchang side forms a horseshoe around the lakes with far out linear developments. The Hankou side is a compact city between rivers with linear developments extending into the landscape.

TOC
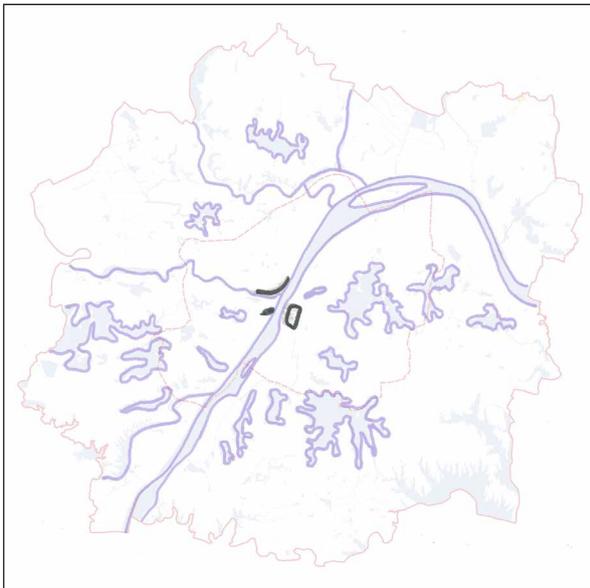
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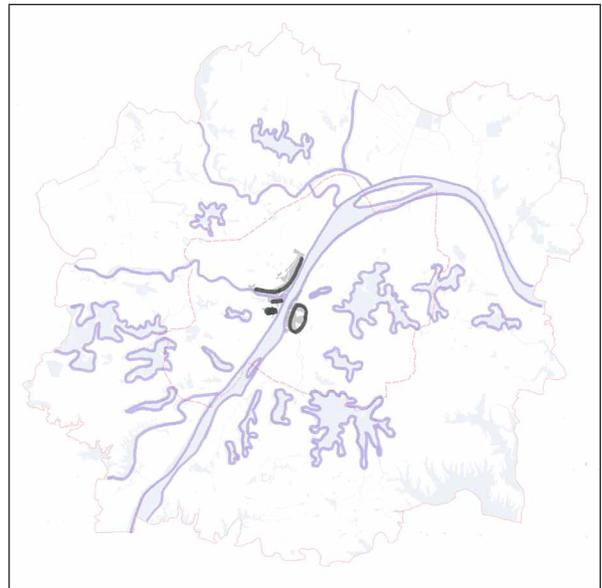
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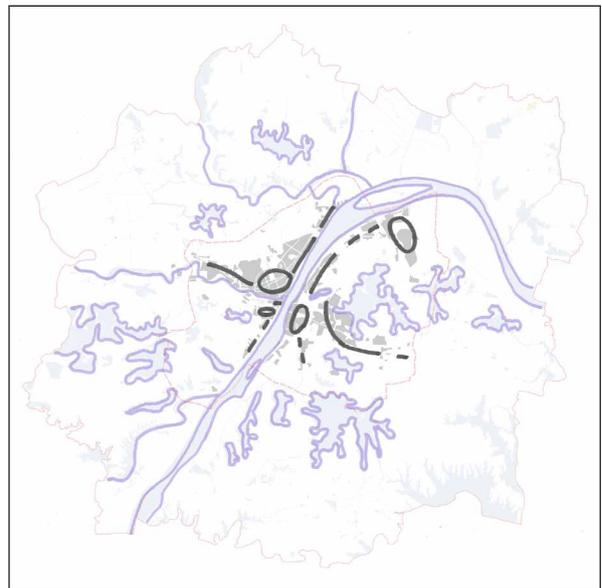
4-1970

FIGURE 7.51 Urban structure transformation 1870 to 2013

Figure 7.51 gives an overview of Wuhan urban structure transformation from 1870 to 2013.
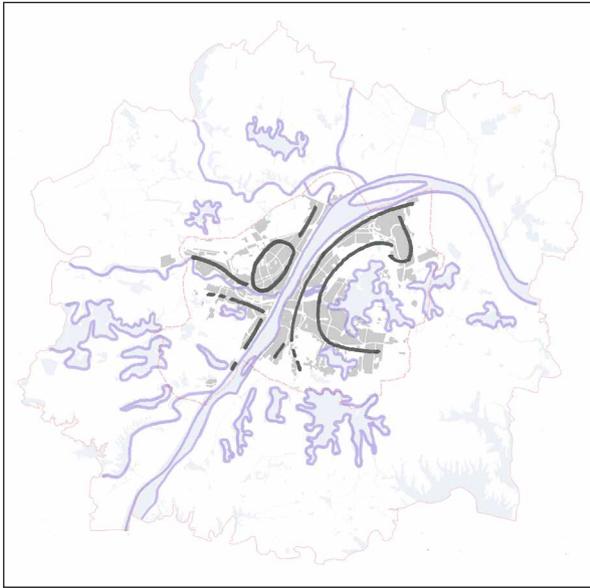
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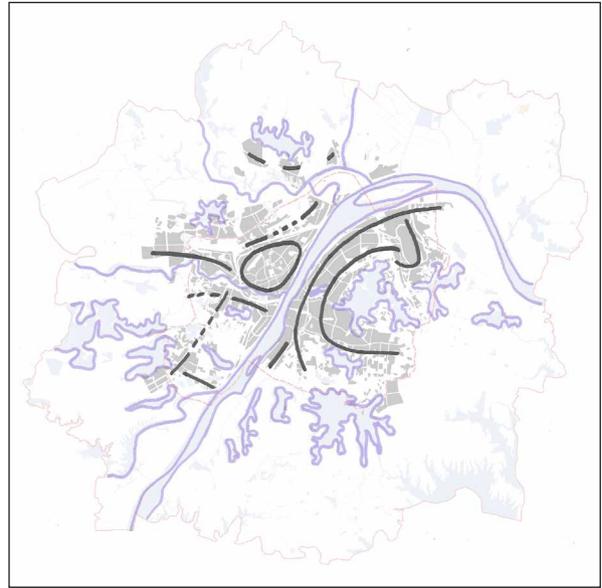
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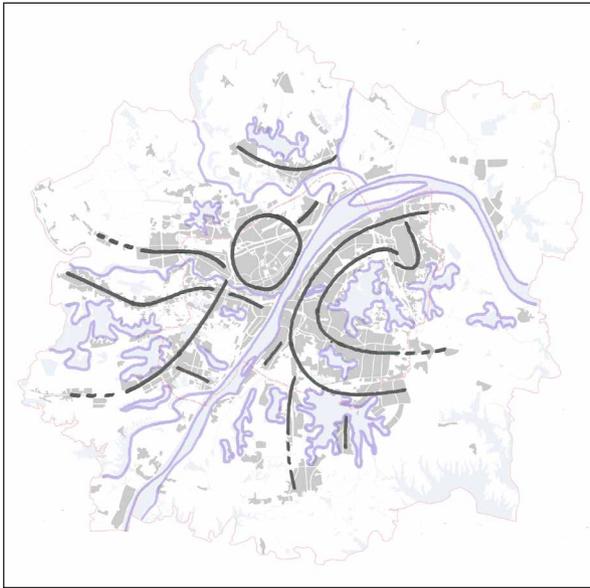
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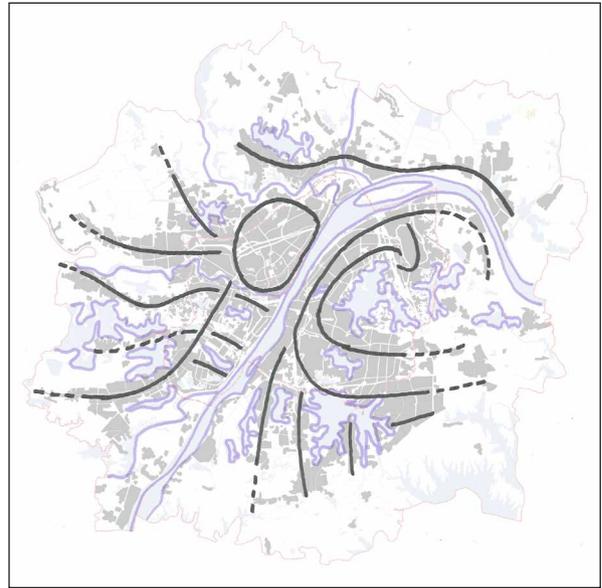
8-2013

§ 7.3.4   Hankou riverside transformation 1870-2013

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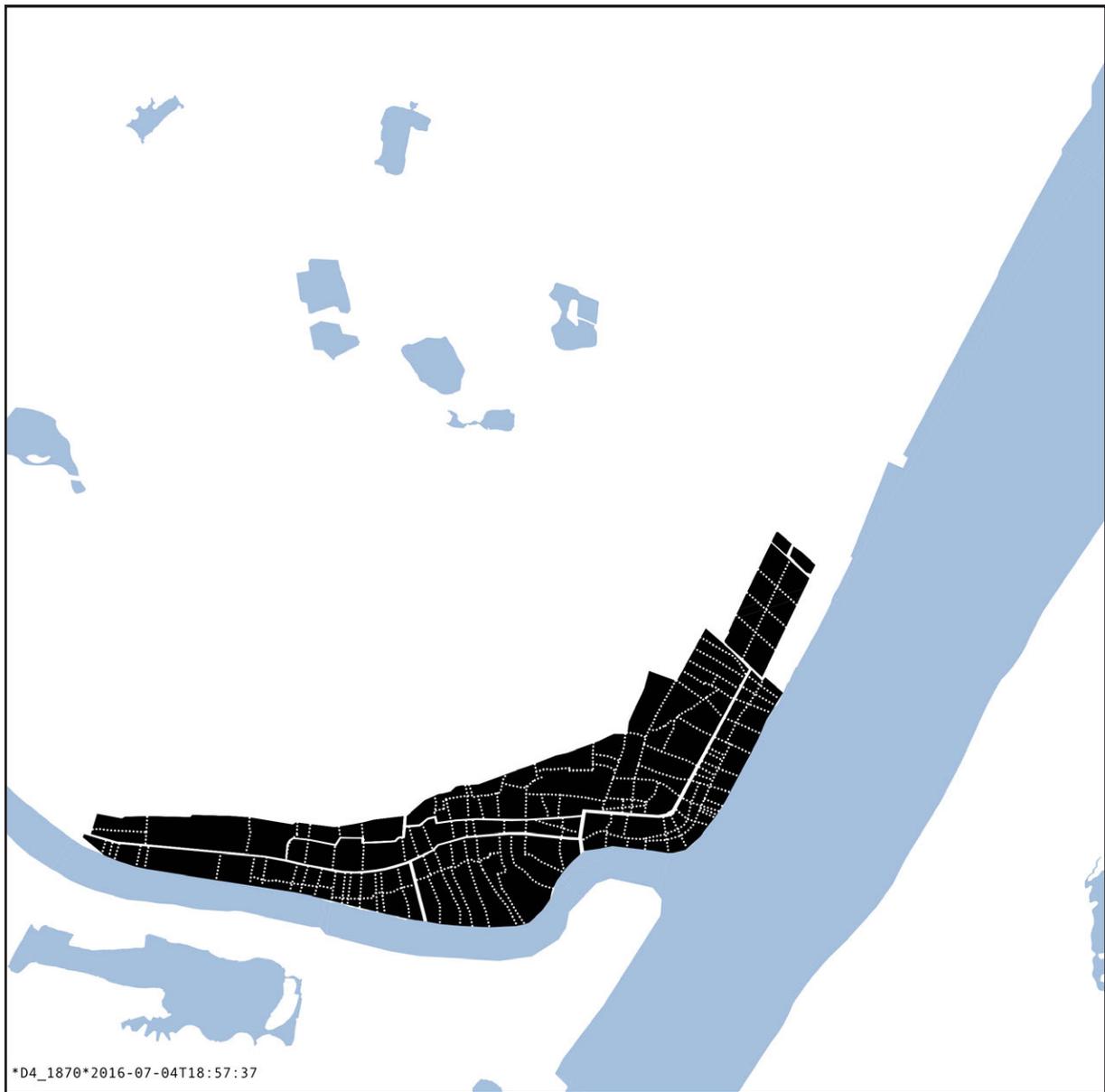
FIGURE 7.52 Hankou riverside homogeneous areas and secondary connections in 1870

1870 → 1910

The period from 1870 to 1910 for Hankou riverside can be characterized as the establishment period for a dual settlement that consists of a much older Chinese part and a new western part; the former Foreign Concessions.

The origin of Hankou was a village of fishermen and traders by boat that was situated not on the Yangtze River itself, but on its tributary, the Han River, similar to many other water towns in China and elsewhere around the world. Since the middle of the 16th century businessmen from the provinces of Shandong, Jiangsu, Anhui, and Sichuan have come to Hankou for trade, resulting in a culturally integrated port town.

*D4_1910*2016-07-04T18:57:37

FIGURE 7.53 Hankou riverside homogeneous areas and secondary connections in 1910

In 1870 the Chinese settlement was contained within its town wall. It had, what is called, a fish-bone structure with long streets that are more or less parallel to the riverbanks and short alleys that are perpendicular to the streets that connect to the rivers. The lengths of the alleys varied between 130 to 150m, the distances between each alleyway varied between 15 to 20m; this allowed for two plots back to back.

The British were the first to obtain a concession in 1861 that was situated adjacent to the Chinese town on the Yangtze River. The streets were laid out in a regular grid.

By 1910 the model of growth for the Chinese town is densification rather than extension, because of the clear confining boundaries of the wall and the rivers. A large number of new alleys were developed based on the existing alley structure. In 1910 the alley system was at its most complex and complete.

TOC

At that time an extensive growth happened next to the Chinese town. From 1861 the official British, Russian, French, German, and Japanese Concessions (from south to north) gradually developed, with a small, not officially approved, Belgium settlement at the northeastern end. This is different from other concession areas in China, such as in Tianjin and Shanghai, where the concessions were built outside the city wall. In Hankou the British, Russian and French Concessions were built inside the wall. The land-leasing model was also different from that in Shanghai. Each concession in Hankou was leased to the respective country all at once. This resulted in top-down planning and a rather clear and tidy urban structure that was well preserved. In general the concession areas are planned with a grid system that consists of streets parallel and perpendicular to the Yangtze River. The direction of a part of the town wall in the French Concession generated some radial roads and triangular plots. Each concession shows a distinctive urban form as well as architectural typology:

— British Concession: strict grid system
— Russian Concession: grid system with some triangular plots
— French Concession: grid system with radial roads
— German Concession: strict grid system with larger plots
— Japanese Concession: strict grid system with smaller plots.

FIGURE 7.54 Hankou riverside homogeneous areas and secondary connections in 1910

1910 → 1950

The period from 1910 to 1950 can be characterized as the development period in which the available area was gradually filled in.

The Jinghan Railway, that forms the northwestern boundary, made space for the city's development from the riverside inland. The Chinese town extended somewhat outside the town wall. Some hospitals, schools, factories, and other public services were built as well as sophisticatedly planned residential areas with a clear grid system. This development evidences the influence of the western way of planning of the Foreign Concessions. In the western part, the British concession expanded up to the railway. On the edge of the Japanese concession, the establishments of a match factory, a petrol station, and their related facilities changed the original urban structure.

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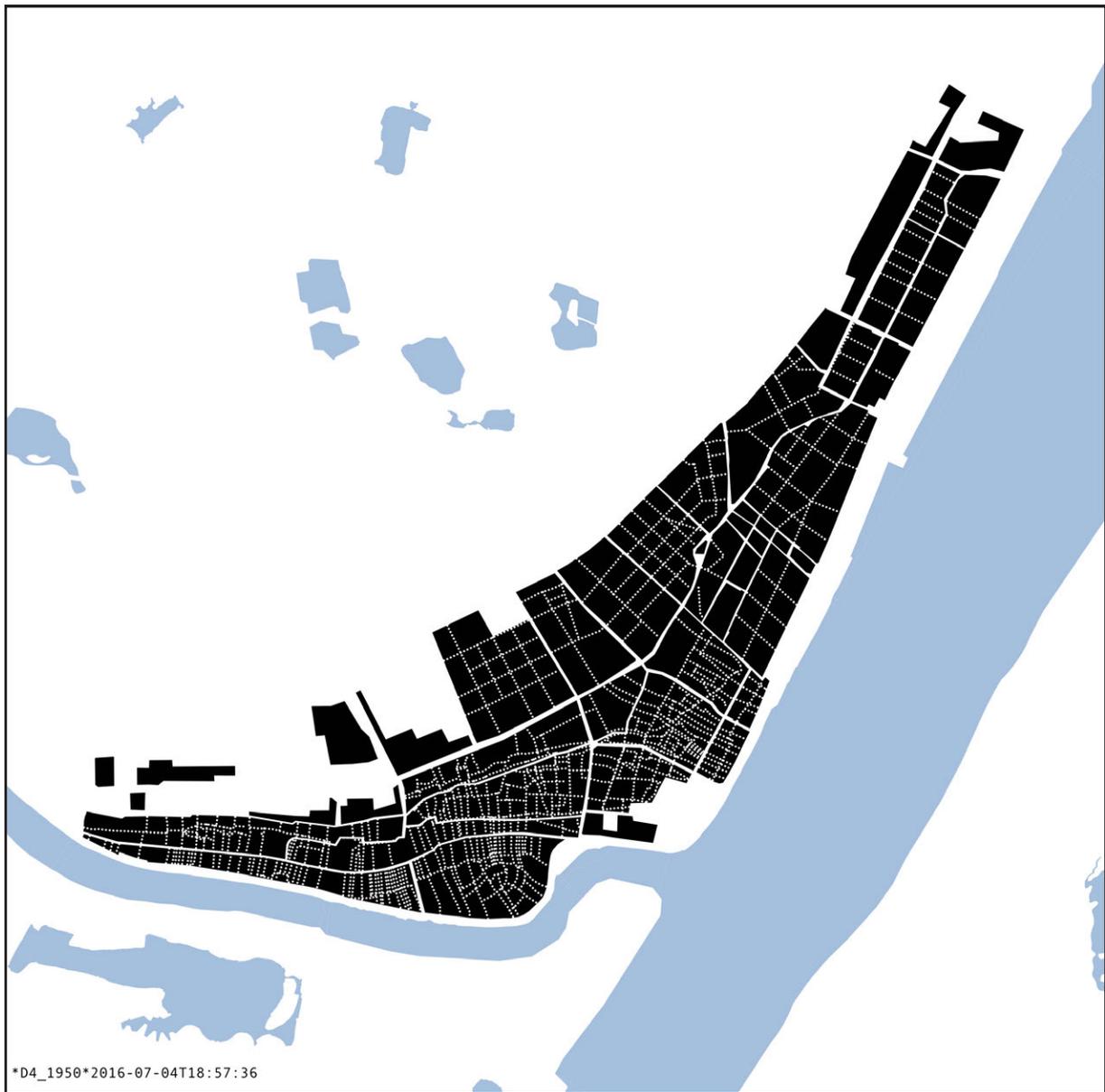
FIGURE 7.55 Hankou riverside homogeneous areas and secondary connections in 1950

The operation of the railway and the increasing volumes of trade on the Yangtze and Han Rivers created a demand for connections between inland and the rivers, as well as between the Chinese town and the Foreign Concessions. In response, new roads and open spaces were inserted in the original tissue. The new roads perpendicular to the Yangtze River are: Minzu Road (Ethnic Road), Minsheng Road (Civic Life Road), Minquan Road (Civic Rights Road), and Sanmin Road (Three People Road). These roads broke up the original homogenous areas in smaller pieces. The River Street (Yanjiang Road), in contrast, was built immediately along the riverbanks and cut the original alley system loose from the rivers. In addition, the Dragon Temple Park was constructed as an open space on a hill at the confluence of the two rivers. The spatial structure of the concession areas stayed mainly the same.
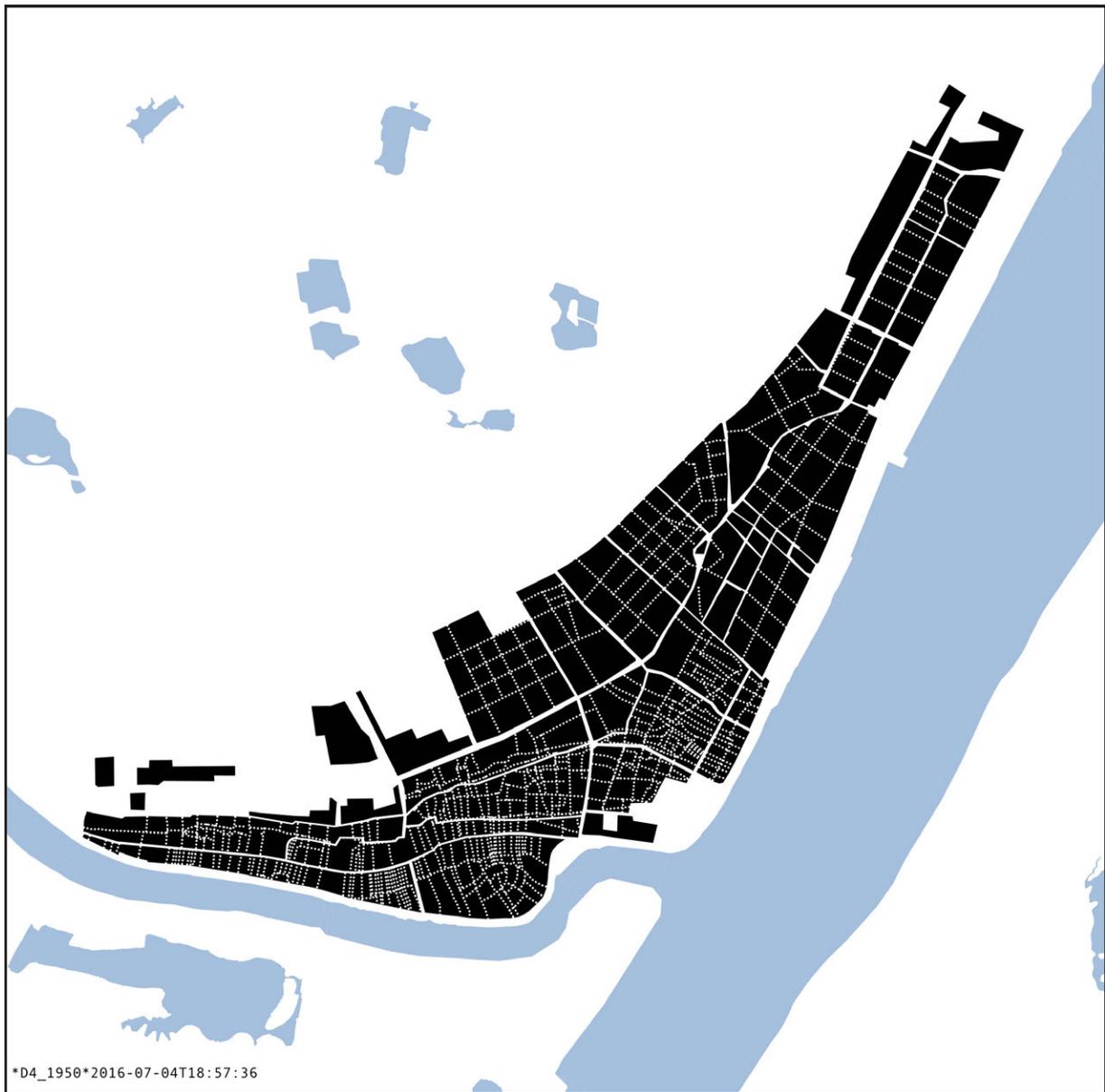
FIGURE 7.56 Hankou riverside homogeneous areas and secondary connections in 1950

1950 → 1970

Between 1950 and 1970, the area of Hankou riverside filled in completely. Most new development belonging to the new industries, based on the national First and Second Five Years Plans, took place in other parts of Wuhan. The leftover space on the western end of Hankou riverside was developed with some small factories and their corresponding residential areas, danwei, and the Qiaokou Park. The concession areas mainly stayed the same.

The opening of the Jianghan Bridge in 1956 and its connecting road, Wusheng Road, and the other two perpendicular roads to the river, Liji Road and Chongren Road, broke up the large homogenous areas. The 1970s map shows the most complete built-up situation of Hankou riverside. Along the original town wall (nowadays Zhongshan Road) and at the turn of Jianghan Road to the Yangtze River, the urban fabric of the fish bone street-and-alley system and the grid system are distinctively present.

*D4_1970*2016-07-04T18:57:36

FIGURE 7.57 Hankou riverside homogeneous areas and secondary connections in 1970

Some newly introduced roads broke down the originally larger homogenous areas. The area as a whole, however, kept its main characteristics of long streets following the course of the rivers and streets perpendicular to the rivers, but on a larger scale. The opening of the Yangtze River Bridge in 1957 provided a much more efficient and effective alternative transportation option in contrast to the river ferry. This diminished the role of Hankou as a port city. In addition, traditional commerce and manufacturing gradually disappeared due to the newly introduced economic plan since the establishment of the Peoples' Republic of China in 1949. Also, under the strict household registration system (hukou), only the officially registered local residents could live there, which put an end to the cultural integration that used to characterize the city (LONG, 2006).

In conclusion, although the physical urban form mainly stayed the same, the traditional socially, economically and culturally diverse city disappeared.

TOC

`*D4_1970*2016-07-04T18:57:36`

FIGURE 7.58 Hankou riverside homogeneous areas and secondary connections in 1970

*D4_1990*2016-07-04T18:57:35

FIGURE 7.59 Hankou riverside homogeneous areas and secondary connections in 1990

1970 → 1990

Between 1970 and 1990, the area did not change much. Only small cracks, undefined open areas, appeared along the Zhongshan Road on the edges of large homogeneous areas. The Cultural Revolution from 1966 to 1976 suspended development. However, since the end of the 1970s, local policy encouraged self-employed and private businesses, and stimulated market oriented development. This break from the economic plan initiated the Chinese settlement of Hanzheng street area (in the bend along the Han and Yangtze rivers) to become a nationally well-known small business and wholesale market area. Over time this led to its transformation with a huge increase in scale of new commercial and residential building complexes.

`*D4_1990*2016-07-04T18:57:35`

FIGURE 7.60 Hankou riverside homogeneous areas and secondary connections in 1990

1990 → 2000

The period after 1990 is characterized by intensive transformation and regeneration. This was at first government initiated and later market oriented. The old urban tissue with its large homogenous areas began to fall apart.

Many transformations were initiated by the construction of new large-scale infrastructures. Big changes between 1990 and 2000 were caused by three new bridges, two over the Han River and one over the Yangtze River: Moon Lake Bridge in 1998, Qingchuan Bridge in 2000, Second Yangtze River Bridge in 1991, and two newly built roads: Duofu Road and South Youyi Road. In addition, the construction of overpasses, as part of the Yangtze River Road upgrading project, led to changes around

FIGURE 7.61 Hankou riverside homogeneous areas and secondary connections in 2000

the intersection of Zhongshan Road and Wusheng Road.

The awareness of the high efficiency of modern architecture, the application of new building construction methods and materials, such as steel reinforced concrete, and the transformation of the business model from trade on the streets to shopping in department stores, led to the construction of a large number of very big complexes in the original Chinese settlement.

In the former German, Japanese and French Concessions, some danwei that belonged to government offices with their related residential high-rise buildings were under reconstruction.

In 2000, some complete urban blocks were demolished and transformed into a new spatial pattern, but these transformations remained more or less within the existing urban structure.

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FIGURE 7.62 Hankou riverside homogeneous areas and secondary connections in 2000

2000 → 2006

2006 is the year with the most intensive transformation. Duofu Road (Lucky Road) continued to be developed inland from the Yangtze River with a number of big commercial building complexes on both sides and the underground civil air raid shelter.

*D4_2006*2016-07-04T18:57:34

FIGURE 7.63 Hankou riverside homogeneous areas and secondary connections in 2006

The South Youyi Road (South Friendship Road) was completed to connect the Youyi Road and the Qingchuan Bridge; this made a connection from the inland areas to the river. These transformations destructed considerable parts of the urban tissue, altering its structure. Empty plots appeared everywhere in the area and were often combined for large-scale new developments, most of which are high-rise buildings with more than 30 floors. As many secondary connections were eliminated, the urban system lost its coherence and recognizability of the whole area.

*D4_2006*2016-07-04T18:57:34

FIGURE 7.64 Hankou riverside homogeneous areas and secondary connections in 2006

*D4_2013*2016-07-04T18:57:34

FIGURE 7.65 Hankou riverside homogeneous areas and secondary connections in 2013

2006 → 2013

From 2006 to 2013, more and larger scale transformations took place, filling much of the empty plots and further destructing original urban tissue. A large part of the former British Concessions were taken out for the construction of the Yangzi River Tunnel.

TOC

1-1870

2-1910
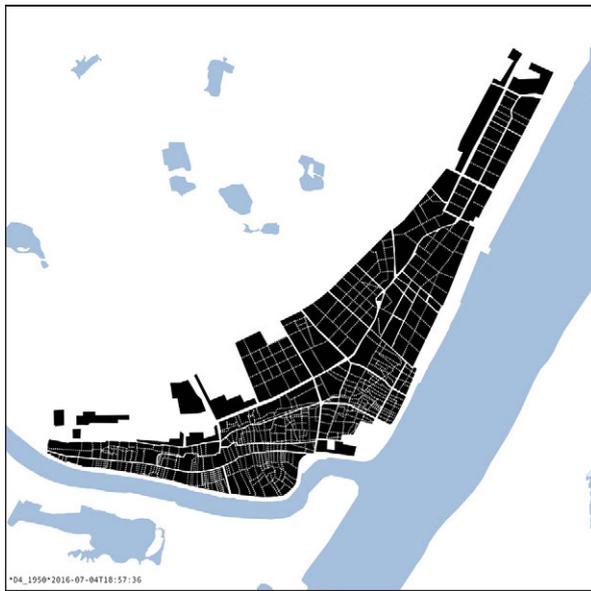
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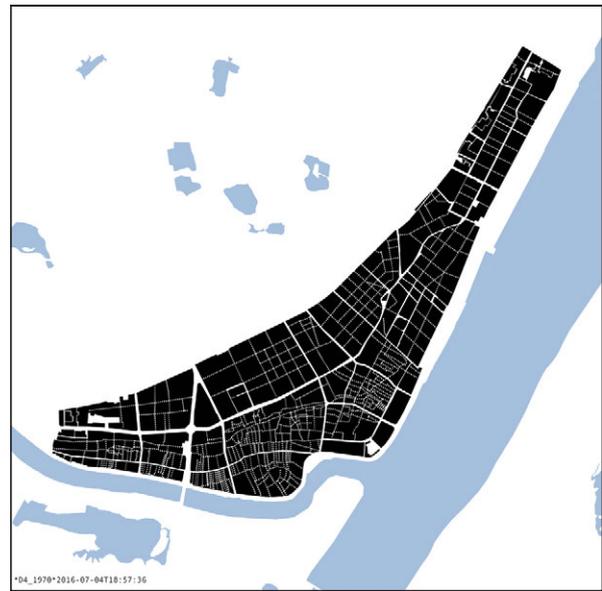
4-1970

Hankou riverside homogenerous areas and secondary connections transformation 1870 to 2013

Figure 7.66 gives an overview of Hankour riverside transformation from 1870 to 2013.
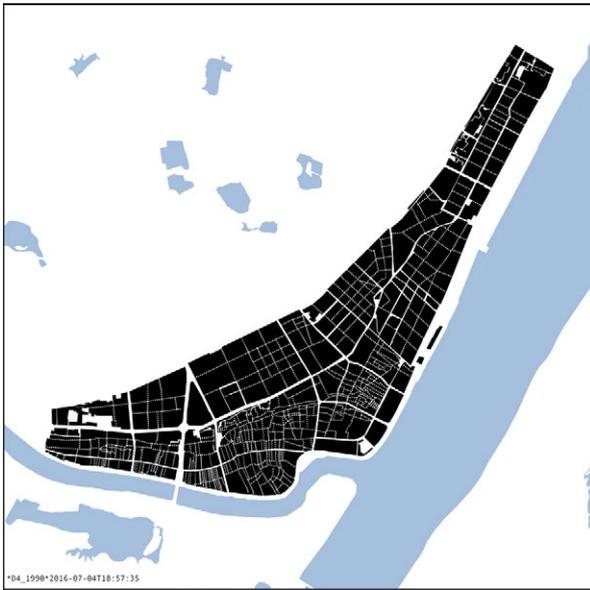
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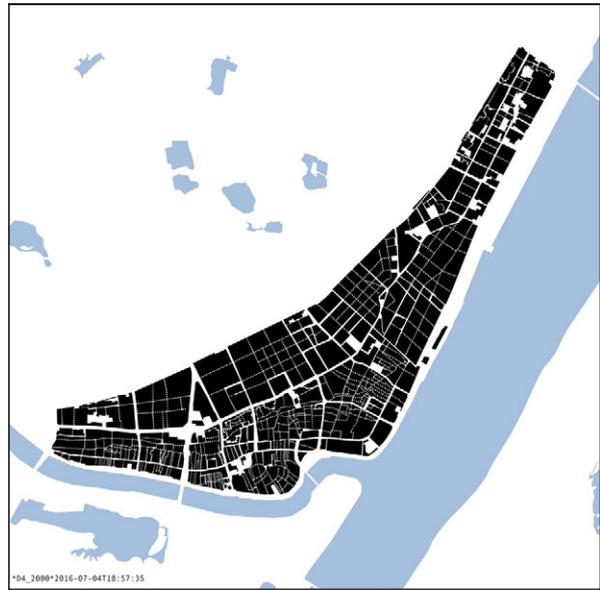
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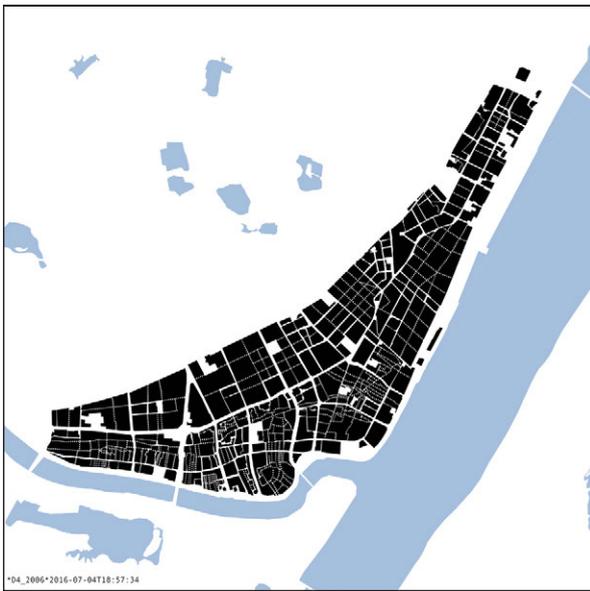
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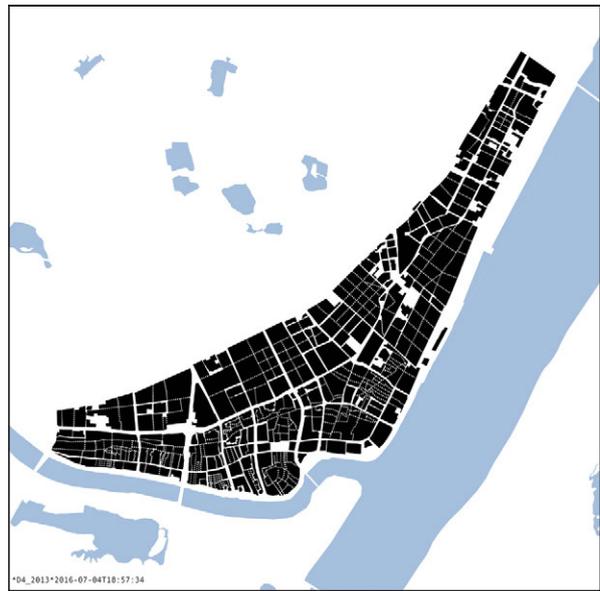
8-2013

§ 7.4 Spatial structural elements on three scales

§ 7.4.1 Macro scale structural elements

1. Landscape (Figure 7.67)

The fundamental structural element of the city is the landscape, particularly the abundantly present rivers, lakes, mountains, and hills. Although these natural elements are sometimes slightly changed by men, they are relatively stable and constant. The landscape elements on the macro scale form the basis of the urban morphology. The series of sketches shows clearly the urban spatial structure through time (see Section 5.2.3). Though the natural green elements form a system, they are hardly integrated with the urban green areas on all scales. The city has the tendency to turn its back to its landscape.

2. Infrastructure (Figure 7.68)

The ring roads, highways, (above ground) railroads, and metro lines as currently constructed constitute the main infrastructure in the city. On the one hand they allow the necessary urban flows and connect the different parts of the city. On the other hand, they are strong breaks in the urban fabric on the lower levels of scale. They are the second type of determining spatial elements of the city on the macro scale.
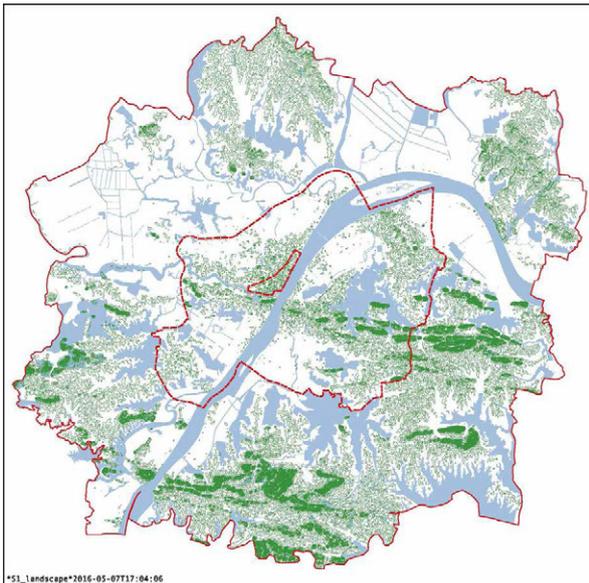
FIGURE 7.67 Landscape
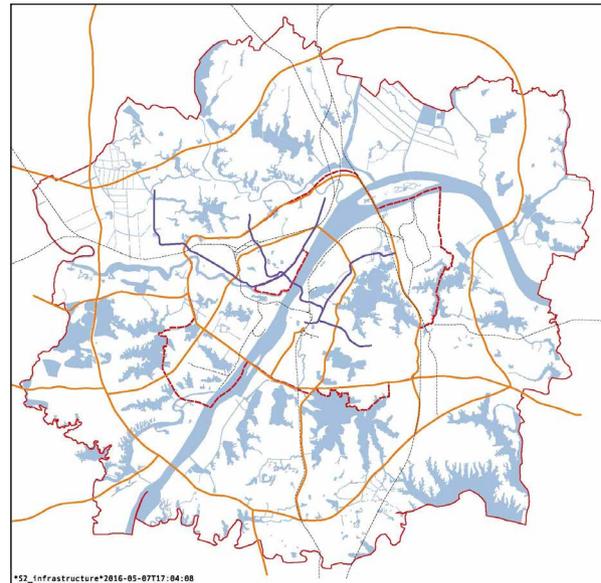
FIGURE 7.68 Infrastructure : highways, railroads and metrolines

3. Homogenous areas (Figure 7.69)

The homogeneous areas together visualize the spatial structure of the city: the morphology on the macro level of scale. They display the 'skeleton' of the city and its deep structure in the relationships between the different homogeneous areas. In the map series, the homogeneous areas are black, and the elements separating them from each other are left white (the third color, blue, indicates water). When black and white is reversed, this shows the equal importance of both legend units, and their interdependency: the one is meaningless without the other. The spatial structure of the city is represented in the black AND the white together.
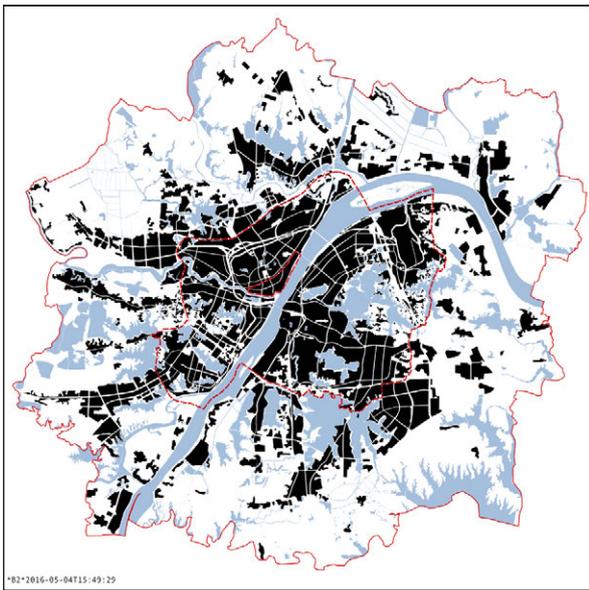
1   Metropolitan areas Homogeneous areas 2013

2   Different homogeneous areas

3   Spatial structure

4   "Skeleton" of the city

FIGURE 7.69 Homogeneous areas

Three types of homogeneous areas on the macro scale:

When studying analytical maps on the macro level of scale, Wuhan appears to consist of three basic types of homogeneous areas:

1   Areas with a compact urban tissue without a dominant internal formal structure; often historical environments established before 1950 (Figure 7.70-1)
2   Areas with a strong internal spatial consistency; often following an overall design, as is the case in most newly developed areas after 1950 (Figure 7.70-2)
3   Areas intersected completely by one or two roads that are more or less straight (Figure 7.70-3)

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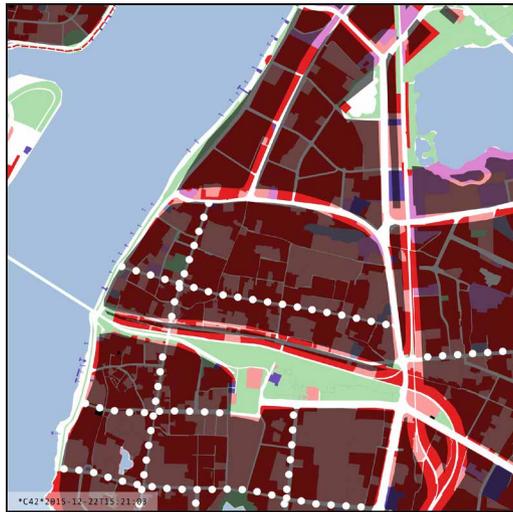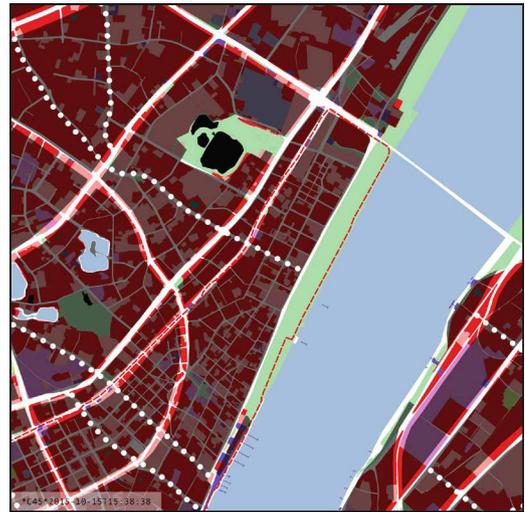
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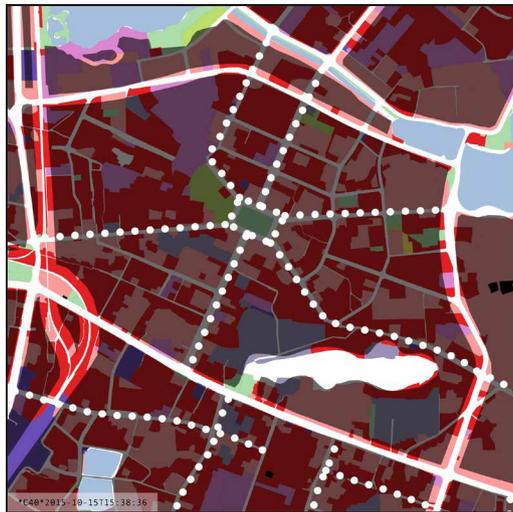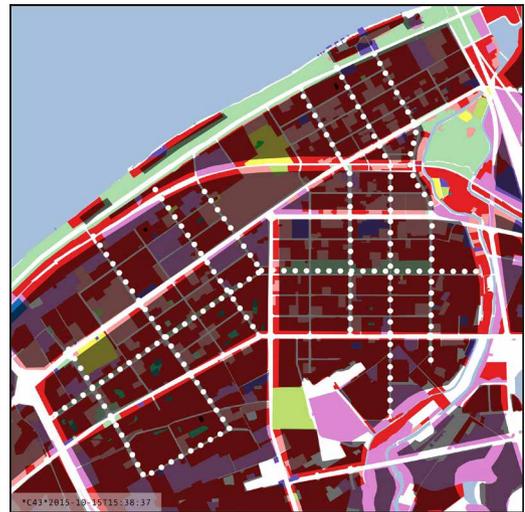
2-Strong internal consistency (a)   *(b)*
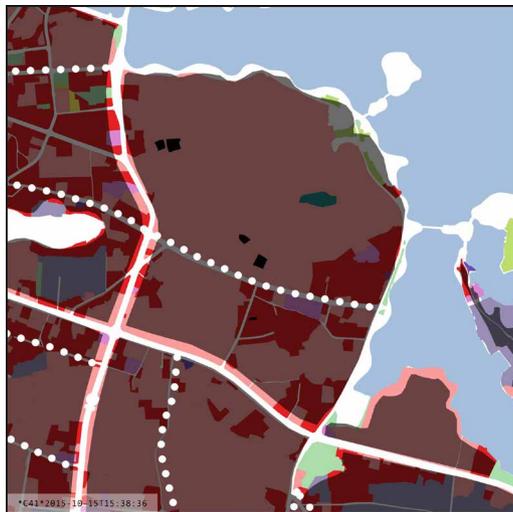
3-Cross road (a)   *(b)*

FIGURE 7.70 Three types of homogeneous areas

Categorization of the homogeneous areas for all of Wuhan on the macro scale, including both the Inner city and the Metropolitan area, shows how different types of homogenous areas are spread over the city (Figure 7.71).

The first type, 'compact tissue' occurs in old parts of the city where their spatial characteristics remained the same as they were at the beginning of the twentieth century. This is the case in Hanyang, Wuchang, some adjacent areas, and in towns, villages and some industrial projects that were once situated at a distance from the city. At a later time these industrial projects became incorporated into the city. The compact tissue areas are important elements in the identity of the city.

The second type, 'strong internal consistency', is a neighborhood that has been built according to a clearly recognizable design and has retained this characteristic. The earliest ones stem from the 1950s when the first of the Wuhan Master Plans regulated the urban development. They also include areas that have been largely or completely transformed and areas that have been incrementally transformed according to new designs in the processes of modernization and regeneration of the city. Also in this category are areas that are relatively new and have not been transformed in the processes of modernization. These areas are also important for the identity of the city, whether they are old or new.

The third type are mixed areas. These consist of different types of environments that have one overriding characteristic: one or two more or less straight roads (that may be avenues or boulevards) cross the area. This type covers by far the largest portion of the urban area. These areas can, but not always, have relatively strong identities. They do however, create connections to adjacent elements, either built-up areas or nature areas.

In processes of regeneration, it will occasionally be possible to change the type of a homogeneous area. This should be judged against the pattern of surrounding homogeneous areas, their relative sizes, and coherence.

§ 7.4.2 Middle scale structural elements

1. Individual homogenous areas

Each homogenous area can be considered as a basic morphological unit. All the homogenous areas together make up the spatial structure of the city on the macro scale and at the same time, each homogeneous area consists of streets and block systems on the micro scale, indicated by the secondary connections (see below under 2). In this way they form a link between the macro and micro scales (Figure 7.70 and Figure 7.71).

For the homogeneous areas, size and the differences in size do not have a normative meaning. Very small is not necessarily a problem, *if* there are secondary connections to the surrounding areas. Nor is very big a problem, *if* there is a clear internal structure. What really matters are the secondary connections of the middle scale that is so often missing and undervalued in Chinese cities. These secondary connections were part of the traditional Chinese city and it even had a clear meaning in organizing the city in areas for different social groups.
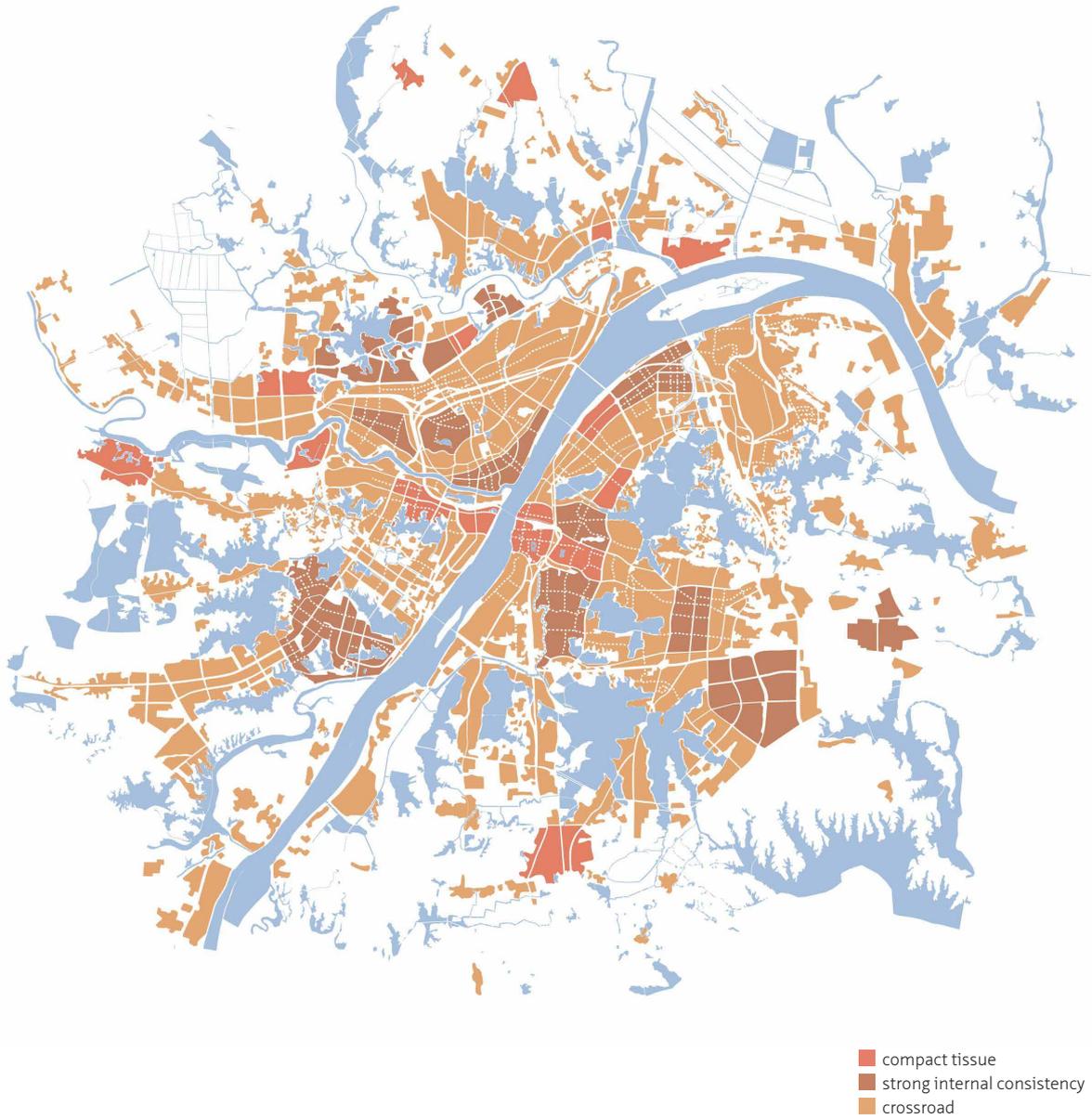
FIGURE 7.71 Metropolitan area and intercity: three types of homogeneous areas distribution in 2013

2. Secondary connections

When the secondary connections are interpreted and added to the maps, the distinctions and connections between homogeneous areas and the overall structure of the city appears (Figure 7.70). As mentioned before, these can be seen as a representation of the middle scale that is lacking in many Chinese cities. They are important for local orientation and identity.

In case of urban regeneration, there are reasons to add secondary connections. First when the internal structure of a homogeneous area is hard to recognize, and second when there are no or only a few connections to neighboring areas.

Often open spaces that separate homogeneous areas from each other can simultaneously form meaningful connections on a higher level of scale; for instance the case between the Yangtze River and the East Lake (Figure 7.71-2b). Keeping these spaces open allows for these large-scale elements to be part of the identity of the adjacent areas as well.

When isolated, the systems of secondary connections seem disconnected (Figure 7.72). Even though in reality they work together with the open spaces between homogeneous areas. In many cases the urban structure can be improved by adding more of these secondary connections, strengthening the spatial structure of the city and making it less vulnerable for local transformations. On this level of scale, in some areas the secondary connections form networks in themselves, while in other areas individual secondary connections seem to be floating in space. This is an indication for conducting more detailed research on a lower level of scale to discover where new connections could be made (Section 7.4.4).

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FIGURE 7.72 Isolated secondary connections 2013

§ 7.4.3 Micro scale (Hankou riverside) structural elements

1. Rivers (Figure 7.73-1)

Similar to most port cities in the world, Hankou riverside owes its present urban structure largely to the courses and banks of the Yangtze and the Han River. The rivers were, and are, important not only technically as infrastructure for fishing, shipping, and trade, but also in a socially as an open and free territory and the most recognizable feature in the identity of the city.

2. Flooding wall (Figure7.73-2)

The flooding wall, constructed after a serious flood in 1954, forms a strong boundary between the waterfront and the hinterland. The lack of physical and visual accessibility to the rivers leaves a great potential for the orientation of the people and a meaningful public domain.

3. City wall (Figure 7.73-3)

Using historical maps and interpretation from literature, the city wall is traced on our maps. Though it was taken down in 1907 and transformed into Han Malou (Road behind the city), now Zhongshan Road, it is one of the most important modern roads in Wuhan both in the technical and the social sense. The trail of the wall is still present in the contemporary urban fabric and the urban form on the two sides of the wall/road is clearly different.

4. Railway (Figure 7.73-4)

The historical Jinghan Railway that was incrementally built in 1889 in the late Qing Dynasty had the first trains running in 1905 and ceased function in 1991. It still forms a clear boundary on the north-west. This is the main reason why we chose Jinghan Road as the boundary for the research on the Hankou riverside scale.

5. Modern roads (Figure 7.73-5)

The many newly built roads broke up the old urban fabric and now form the new structure of the site on an increased scale.

6. Green structure (Figure 7.73-6)

The map shows the surprising amount of urban green areas in Hankou riverside. In the concession grid, the green is corresponding mainly to the pattern of streets. In contrast, in the traditional Chinese settlements the green pattern has the character of inserted and dispersed open spaces. Interconnecting the green elements, inside and outside Hankou riverside, can attain a higher quality of use and a greater ecological value.

1-River
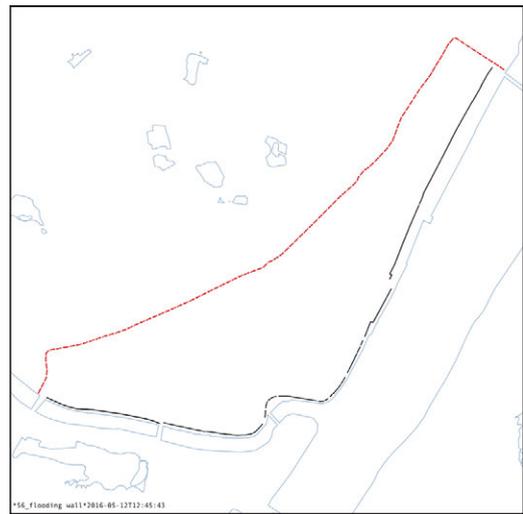
2-Flooding wall

3-City wall
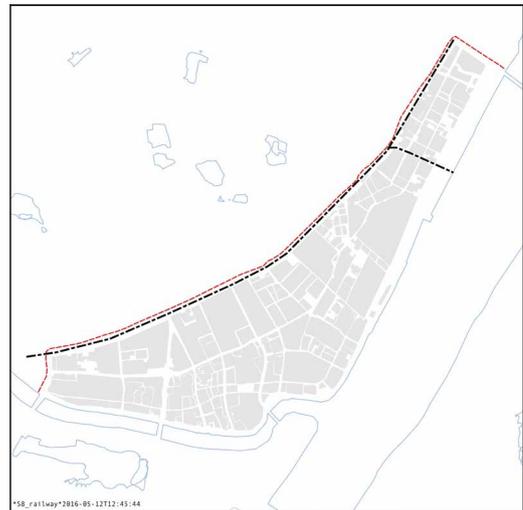
4-Railway
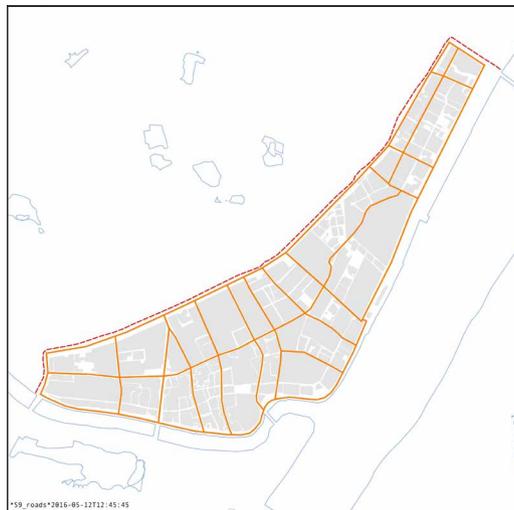
5-Roads in 2013
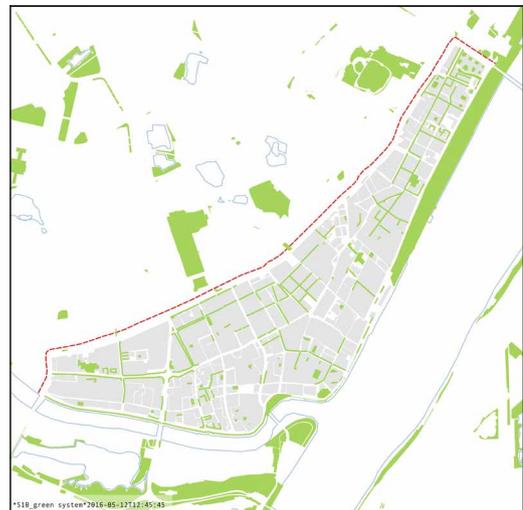
6-Green structure in 2013

FIGURE 7.73 Spatial structure elements 1-6 in Hankou riverside

FIGURE 7.74 Fishbone structure in 1910 and 2013

The fishbone structure in the Chinese settlement depicts the basic characteristic of that area. Overlapping the map of 1910, which had the most complete structure, and the contemporary situation shows how much of the old tissue had disappeared by 2013.

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*S12_grid system_1970+2013*2016-05-12T12:45:46
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FIGURE 7.75 Concession grid and later grid structure in 1970 and 2013

The Concession grid together with the Later grid system formed the second prominent urban structure in the area. Overlapping the grid system in 1970, the period when the grid system was fully developed, and the contemporary situation shows that the grid system is more resilient and can absorb changes in the buildings and building types over a long time.

9. Eight types of homogenous areas in Hankou riverside[28]

Earliest tissue
Concession grid
Later grid
Lifen
Danwei
Compound
Big building
Mixed area
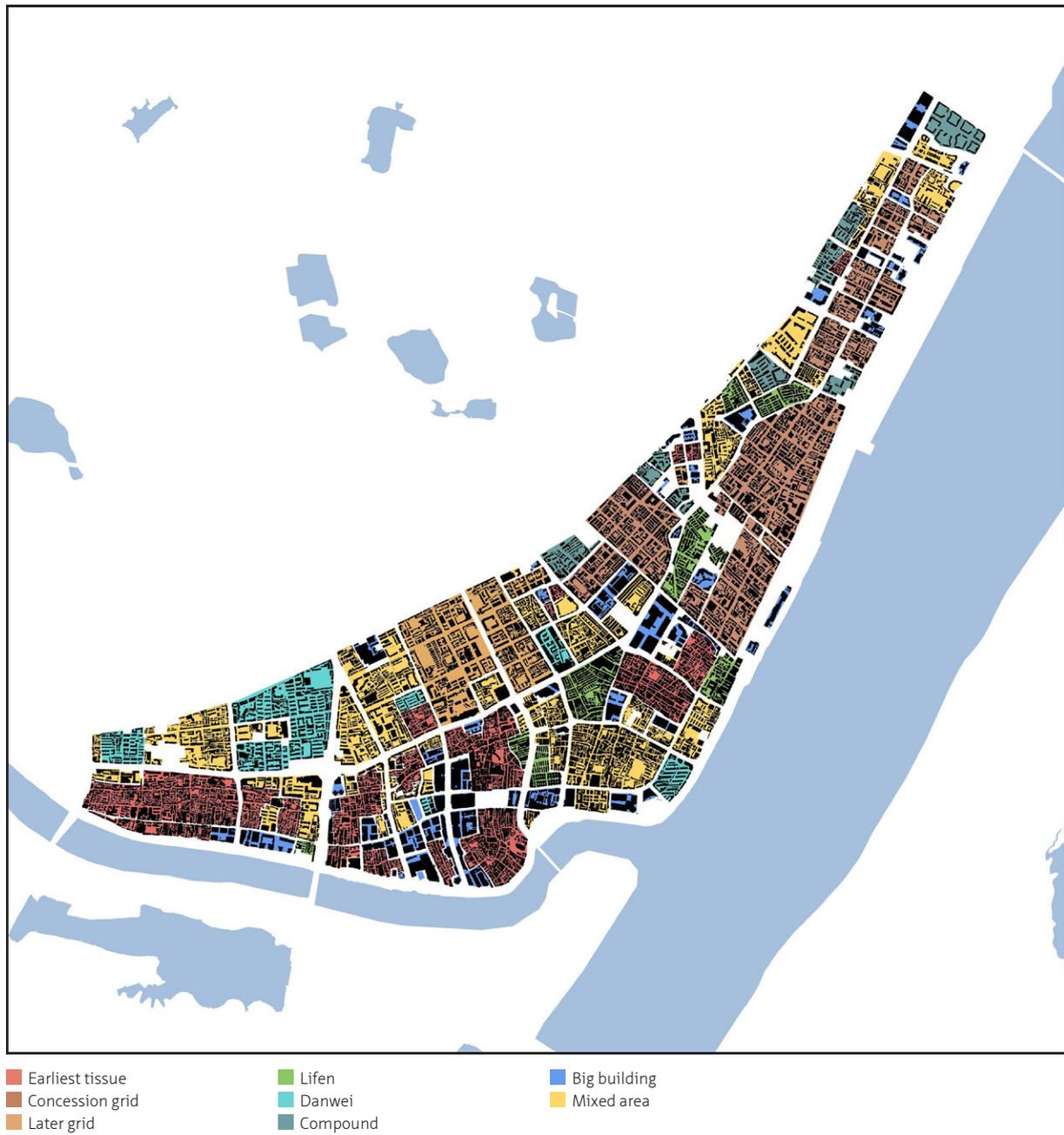
FIGURE 7.76 Hankou riverside 8 types of homogeneous areas in 2013

[28] A first version of this categorization of the homogeneous areas in Hankou riverside was developed in a workshop Mapping Hankou Riverside—Analysis and Design of the Urban Form in the School of Architecture and Urban Planning of the Huazong University of Science and Technology/HUST in Wuhan, with 21 Master students of architecture, urban planning and landscape architecture, in cooperation between Professor Henco Bekkering, CAI Jiaxiu and Joran Kuijper of TU Delft and Professor WANG Yuan, LI Shasha and CHEN Lijing of HUST.

The homogeneous areas together visualize the spatial structure of Hankou riverside. While looking in closer detail, eight different types of homogeneous areas are recognized. (Figure 7.77)

1. Earliest tissue
....

The Earliest tissue is what is left of the historical urban pattern. (In most cases the buildings are not of the same age.) This type of environment with dwellings in high density and small-scale urban facilities and services has been disappearing fast as a result of urban regeneration, mainly in the 21st century. The city has largely lost a type of urban environment that is unique to Hankou. Based on the fishbone structure of long and big streets that follow the course of the rivers from a distance, and narrow alleys that are spaced close together leading to and from the rivers. The further away from the rivers, the bigger the blocks are; the closer to the rivers, the smaller the alleys are.

2. Concession grid
....

As explained, the area of the former Foreign Concessions is largely characterized by its grid pattern laid out since the 1860s, which has withstood changes very well. Here, many monumental historic buildings are still standing.

The Concession grid is generally composed of individual, relatively small-scale, square, or skewed urban blocks, sometimes with a slight deviation in direction. Each block has a different configuration. There are blocks with buildings that form continuous boundaries along the streets and Lifen (see type 4 below) inside; blocks with Lifen breaking through the block and various other types of buildings; blocks with neat linear edges and a variety of building types inside; and blocks fully filled with a variety of freestanding building types.

3. Later grid
....

The later extensions of the original concessions also have a grid pattern, but with more variation in the scale of the urban blocks. The grid consists of a variety of block sizes that range from four times the size, half the size, or one and a half times the size of the original blocks. The largest blocks in the grid always have Lifen and Danwei (see type 4 and 5 below) inside. Some intruding and morphologically unrelated elements, such as individual huge building complexes or linear buildings, have begun to destruct the blocks from the edges. In the middle of several blocks empty spaces occur, indicating ongoing transformation.

4. Lifen
....

The Lifen is the locally specific high-density low-rize housing type from the first half of the 20th century. It is comparable to the lilong in Shanghai. It is a typological mix of Chinese and western housing units that are located on alleys in the small-scale fishbone structure, with a main alley and smaller secondary alleys that branch off. The main alley is the widest and connects the Lifen with the surrounding streets. The secondary alleys can be called front alleys and connect the front courtyards and main entrances of the housing units. These front alleys are narrower, but where public life mainly takes place, such as eating, chatting with friends, playing Majiang or cards, etc. The third level of alleys

is the narrowest. These are the back alleys that connect the back courtyards and back doors. Most family life or private life takes place here, such as washing clothes, cooking, etc.

The Lifen forms clearly recognizable homogeneous areas with strong overall forms. Fortunately, some of the Lifen are still there and being renovated.

5. Danwei

The danwei are areas where working, living, and services (ideally also small-scale horticulture) are combined, based on a factory or institution, and meant to house its workers and accommodate their daily lives. This system was taken from the Russian example in the 1950s and became a strong element in Chinese cities. The first really rapid expansion was based on the establishment of new industries and new government institutions by the early communist regime. The physical construction of a danwei consists mainly of rows of dwellings of mid-size height and orientation according to Feng Shui. The distance between the rows is much larger than in the Lifen and is calculated according to the minimum required hours of direct sunlight per day. Some of the buildings turn a corner at the end to form a more introverted courtyard that supports a sense of community. Today, the link between the factory or institution and the people living in the danwei has become weaker or is absent, but many of these environments for living have a relatively high quality of public space and are generally highly appreciated even though the size of the housing units is limited.

6. Compound

Very different in organizational background, but similar in its urban spatial characteristics, are the housing compounds with modern housing, apartments or houses with gardens, that are widespread in contemporary Chinese cities. Elsewhere in the world they exist as well, often called gated communities. Contrary to the danwei, these compounds provide only housing. The physical structure is similar to that of the danwei, but the scale is bigger and the number of dwellings and the number of floors of the buildings are normally much higher. A shared characteristic is that they have clear boundaries on the outside, and are oriented inwards. Though in China the housing compounds are guarded, but normally open for visitors, they have two main disadvantages for the urban environment. First, they are turned inwards and thus contribute nothing to the public space outside their fences or walls. Second, because of the relatively large scale of the developments they do not connect well to the surrounding urban fabric. In terms of this research: they offer no secondary connections to adjacent homogeneous areas.

7. Big building

The latest urban regeneration has brought in many very big buildings and building complexes that often replace an existing complete urban block or even two or more. They are disruptive of the continuity in the urban environment both in the scale of their footprint and their architectural scale, as they are often high-rises. These big buildings have hardly any spatial relationships to their surroundings, nor to each other. In most cases, the lower part has a larger footprint with a tower on top. Even when accommodating different functions, they have generally only a few entrances and contribute little to the adjacent public space. The map shows that this type of homogeneous area is spreading now.

8. Mixed area
....

Many areas have been or are in transition, resulting in a mix of different types next to each other. When these show reference to each other, they can result in good urban environments. Often though, the contrast in scale of the buildings is such that there is no connection between them and the area's internal coherence is lost. Even when this is a temporary phase in the transformation, it can be very disrupting.

The overview of the individual homogeneous areas grouped by type shows the dominance of Big buildings and Mixed areas, even though their scale often seems relatively small (Figure 7.78). In reality, as the term says, the big buildings of course are not small at all. Their impact on the surroundings is strong and often overpowering.

In the northern part the areas with the Concession grid are truly dominant. This is a valuable asset of Hankou. Of the other historical types, the Earliest tissue, the Lifen, and the danwei, there are still a relatively large number of areas that exist, but in many cases these areas are small, sometimes too small to retain the full qualities of the type (and they are broken down and disappearing fast).

TOC
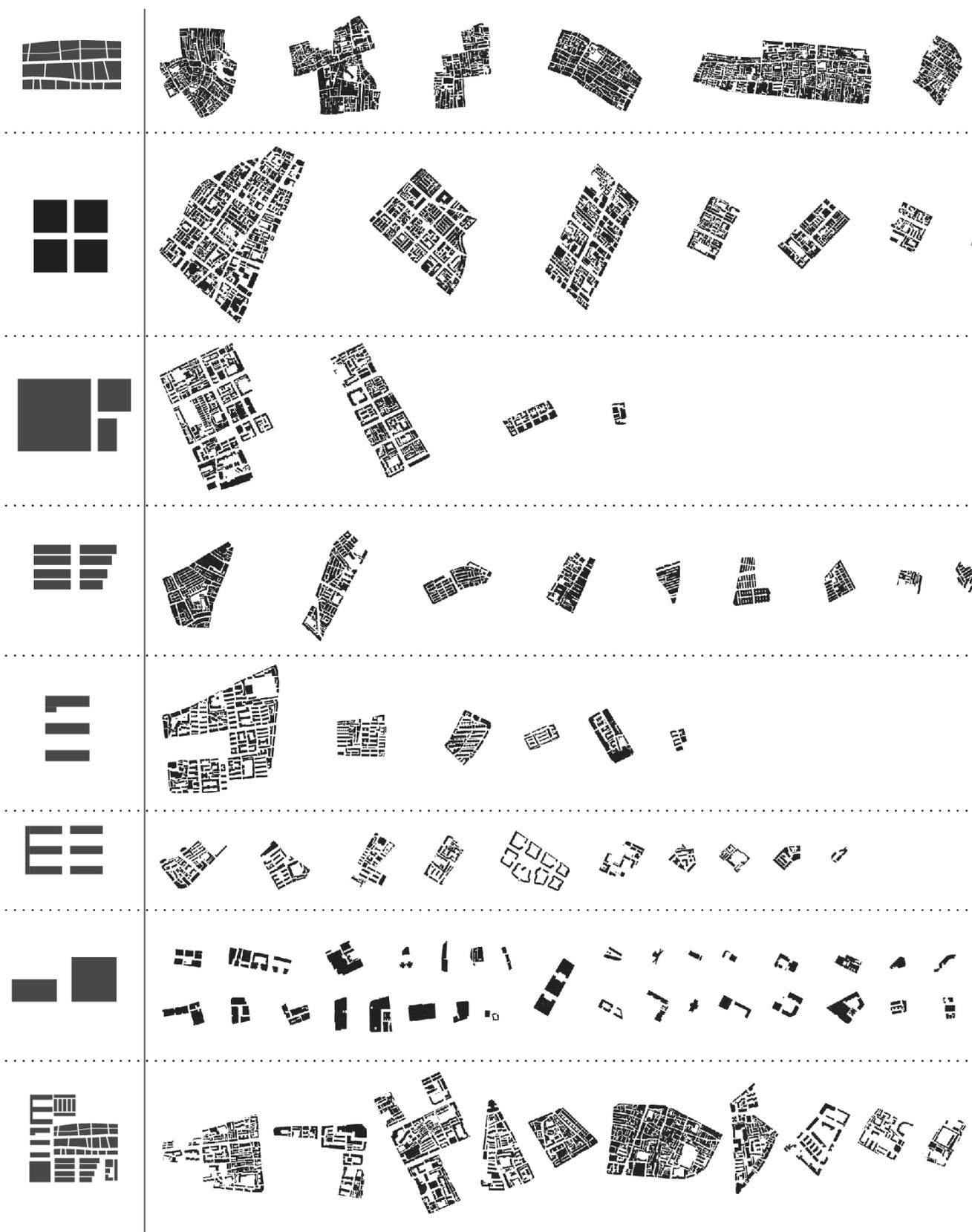
FIGURE 7.77 Typology
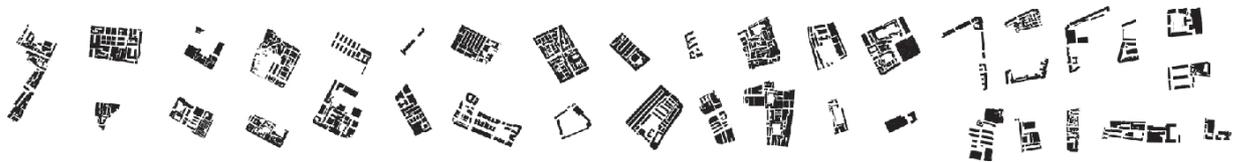
§ 7.4.4 Conclusive spatial characteristic: fragmentation and its practical implication

The three spatial structural elements on the macro scale (see Section 7.4.1) and the nine spatial structural elements on micro scale (see Section 7.4.3) together show that Wuhan and Hankou riverside are fragmented. However, the middle scale structural elements: the homogeneous areas and secondary connections can be seen as opportunities to react to this fragmentation.

Fragmentation of Wuhan

The three elements mentioned above, landscape, infrastructure and homogenous areas together (see Section 7.4.1) show that Wuhan is fragmented, as both the natural and artificial lines are hard to cross forming strong borders that result in separation between urban areas. This does not necessarily have to be interpreted as entirely bad; in fact, it is a characteristic and part of the identity of the city of Wuhan. At the same time, while in many parts of the city these elements help orientation, in other parts they hinder orientation and movement from one area to another. Where wanted it is possible to integrate large-scale infrastructure in the city and eliminate the barriers it causes. In such places designing and adding connected (public) spaces can enhance the coherence in the city. For instance wide underpasses under elevated railroads and highways that also relate areas on both sides visually, pedestrian bridges over water that can be effective on lower levels of scale, or building spanning infrastructure, preferably with a public program, that would attract people from both sides. Such new elements should always be connected to existing spatial structures and relate to and be integrated in the existing urban pattern. In an existing built-up environment it will generally not be possible for urban regeneration to completely change the urban structure. In newly designed areas it is more easily possible and generally necessary for urban extensions to create a new coherent spatial structure, that on the next larger level of scale will also have to be related and connected to existing urban structures.

Fragmentation of Hankou Riverside

The fragmentation in Hankou riverside is mainly manifested in the following aspects:

— The segregation of the waterfront and the hinterland that result from the flooding wall and the heavy traffic along the rivers.

— The modern road system perpendicular to the rivers.

— The big buildings and out of scale regeneration projects.

The desired goal is to create more integration between inland and the river as well as between the Chinese settlement and the former Foreign Concessions.

The practical applications of homogenous areas and secondary connections in urban design practice is listed below.

The analysis in this research is on the scale of the city as a whole. (Potential) qualities and problems within the homogeneous areas are not as visible as the level of the secondary connections: the middle scale. Only in the analyses of Hankou riverside this researched touched on the level of scale of buildings and public or open space. Even this micro level of scale may be too high as a basis for decisions on local (re)building. The following is an indication of the way *the morphological approach* using homogeneous areas can be applied in the practice of urban planning and design:

1   For any project, consider the homogeneous area it is situated in as a whole, in relation to its surrounding homogeneous areas and secondary connections. Within a homogeneous area spatial changes should not work against the existing urban structure (unless this structure can be completely changed). The reasonable expectation is that the surrounding spatial structure stays unchanged. So it is necessary to understand this structure and to continue, support or strengthen it. This does not exclude change, but asks for a sensibility to enrich the structure and not only distract from it.

2   Emphasize secondary connections, existing or newly added, to strengthen the urban structure and introduce a stronger middle scale. What we have defined as secondary connections do two succinct things: they form a coherent spatial structure within a homogeneous area and/or they form connections between adjacent homogeneous areas. Both are categorized as middle scale elements and both require different arguments for their design decision. The first is about strengthening the existing pattern, or fitting the design to the existing pattern. The second is about improving existing connections and/or adding new connections.

3   Research and analyze the morphological structure on a lower level of scale (the example in this research is Hankou riverside). Urban renewal does not only affect the spatial coherence on a larger scale than that of the project, up to the homogeneous area it is part of, it also affects the lower scale of its immediate surroundings.

4   Replacing a building block within a homogeneous area generally will not change the urban spatial structure of the city as a whole—depending on (changes in) density and scale. It may however, change the inner consistency of the homogeneous area itself and should be considered on the lower level of scale.

This is not to say that change is not wanted or not acceptable. Of course, new urban designs should take care of programmatic aspects of a contemporary nature and modern conditions for living. This should include the environmental effects, while at the same time incorporating basic human needs and accommodating daily life in the city—in the great diversity that is asked for by a living and changing society. This should include attention for public space and the pedestrian scale. For instance: in certain locations the small scale of existing building blocks may have to be enlarged to allow for air, privacy, etc., but this does not mean that overall density should be lowered as it could endanger the level of facilities and the urban mix of functions that sustain daily life in the city.

The above can be seen as an elementary procedure for the preparation of an urban design using this research.

§ 7.5.1   **Methodology and drawing techniques**

1. Urban mass and street pattern

The resulting maps represent urban mass rather than infrastructure to detect the structural spatial elements that determine the city as it is. Even though maps either based on urban mass or on infrastructure may superficially look quite similar, they are not the same. The mapping of urban mass allows for creating what in the Delft method is called homogeneous areas. Leaving out detailed information that is not structural within these areas shows the hierarchy in urban form. The mapping of street networks does not allow for that as easily. The street network merely focuses on the integration and connectivity of linear elements and leaves the urban mass (built up areas) with the same value. This is makes it nearly impossible to read the actual urban forms and scales and depict the formal structure. It is important to notice that in the maps some of the more recent parts of Wuhan—that have the modernistic characteristics of large secluded compounds (gated communities) with free standing buildings in flowing space—look the same as the traditional areas in the city—that can be considered as a continuous mass of buildings with a coherent network of public/open space cut out from it (See Figure 3.1 in which the two figure-ground drawings show this difference). The difference will only show in spatial analysis on a (much) lower level of scale.

2. Building footprint and street pattern

On the micro scale of Hankou riverside, the base material for the maps is the building footprint. This is much more detailed than the urban land use data that is used for the analysis of the meso and macro scale: Inner city and Metropolitan area. Both offer spatial information, but on different scales. The figure-ground is on the scale of the individual building in its relation to open space; the land use data does not indicate open space, even though it does show patterns of spatial distribution. Rather these show publicly administered space, the space outside the lots with urban land use. This difference is very clearly visible when the homogeneous areas on the two scales are compared (See Figure 7.1 and see Section 7.2.2-1).

Regrettably, the building footprint data of Hankou riverside is only available for the years 2013, 2006, 2000, 1990 and 1970 in the timeline. From 1970 and earlier these maps either do not exist or are not available. The maps from these earlier periods are of street patterns and building blocks, rather than building footprint. Working backwards in time, this information too can be reduced to homogeneous areas in a way that is comparable to the building footprint.

3. Different levels of abstraction

The series of maps for Hankou riverside are based on different map formats. The homogeneous areas on most maps are based on maps of the building footprint at the time and reduced to 'true'

figure ground maps: building footprint in black, and open space in white. The 1950, 1910, and 1870 homogeneous areas maps are based on historical maps that show street patterns and building blocks.

Figure ground maps and street pattern maps offer different types of information. Figure ground maps show the footprints of the individual buildings and the related open spaces. Street pattern maps depict the composition and hierarchy of the streets. The information provided by figure ground maps is more detailed and concrete than that offered by street pattern maps. The information of both types of maps, however, is abstracted into homogeneous areas.

§ 7.5.2 **Working process while making Hankou riverside series**

While working backwards in time, the big individual buildings disappear gradually, which results in a somewhat different understanding and classification of the homogeneous areas. It becomes clear that these are remaining parts of what were originally larger areas.

The maps series of Hankou riverside does not only show the growth of the built-up areas, but also the internal changes and the transformations. For this result a working process is required that combines working in historical order and working backwards in time.

Consistent with the technique used for the macro scale analytical maps, the Hankou riverside maps also start from the contemporary map: the 2013 base map in AutoCAD format with the building footprint in black (See Figure 7.77).

For the map of 2006, a year with enormous transformations going on, some areas that were under construction in 2006 while they were built in 2013 are subtracted from the 2013 map; some other areas that were still part of the older tissue in 2006 while in 2013 they were under construction or rebuilt with a completely new urban pattern are reconstructed in the 2006 map. Correspondingly, the relevant homogeneous areas are adjusted and mostly enlarged. The same working process is employed for the maps of 2000 and 1990. While working backwards in time, the homogeneous areas become bigger as compared to their later state.

The maps of 1990, 2000, 2006, and 2013 mainly show internal transformations within the boundaries, not growth, as the area was already well developed. This means that simply eliminating parts from maps of a later period cannot create maps earlier in the timeline. Each map is drawn individually, based on the corresponding historical map, while at the same time comparing it to the earlier and later maps in the timeline. This is even more so when working backwards in time for the analytical maps on the macro scales of the Inner city and the Metropolitan area because of the—relative—size and intensity of the transformations that have taken place in Hankou riverside.

The 1870, 1910, 1950, and 1970 maps mainly show the growth within the boundaries. Some changes happened in the urban fabric from opening up roads perpendicular to the Yangtze River. This series of maps was drawn checking both forwards and backwards in time. It is started from the map of 1910, because that offered the most complete and reliable representation of the old urban tissue and the alley system. The second map drawn was that of 1870. The as yet unbuilt areas and alleys were eliminated from the 1910 map. The third one was the 1950 map. The growth was mainly outside the built-up areas, thus these are added as individual homogeneous areas. Some open spaces are subtracted.

The changes in the alley system, depicted as secondary connections, were drawn working forwards and backwards in time. This too started from the map of 1910, based on which the other maps' secondary connections are eliminated.

Recommendations for future research

The insights developed in this research, a historical-morphological analysis, are intended to better understand the urban form of contemporary Wuhan, and to identify the spatial structure and structuring elements of the city in relation to the urban history. It is about the urban form as it changes through time. These insights are important for the myriad of decisions that have to be taken every day on the planning and design of the future changes in and around the city. This is especially the case at this moment of preparation of the amendment of the Wuhan Master Plan 2030 and Grand Wuhan ambition. Within these proposals key projects such as the Yangzi River New Town, Yangzi River Axis and East Lake Green Heart developments are undertaken. The relevance of the presented research is for the urban transformations within the existing city as well as for the further extensions into the metropolitan area. As described in the previous paragraph, in the practice of planning and design, it will be necessary to conduct additional morphological analyses on the relevant level(s) of scale for the location.

This research is on three levels of scale: Metropolitan area, Inner city, and Hankou riverside. There is however, a higher level of scale of the metropolitan region with its satellite cities and the important aspects of agricultural production and nature conservation, connected by ecology. This level of scale too, should be researched regarding its spatial characteristics.

Also on the scale of the existing city it seems important to research its green structure, for its ecological and recreational aspects, water, and water management, which constitutes one of the major problems the city has also been facing.

The same is true for the relation between the city form and its transportation systems. This is a field in which traditionally planning and engineering are the strong forces, but the large infrastructures in the city also have important visual and spatial effects that should be studied and designed.

Another aspect of the form and organization of the city is the development of so-called new centralities. Wuhan is a poly-centric city, and the planning of the relationships between the existing centralities and possibly new ones needs to be undertaken. For that, understanding their development is indispensable.

Really any aspect of the city should be seen as related to its morphology, and be researched as such.

§ 7.7 Conclusions

This chapter presents the *Mapping Wuhan* research and the author has critically reflected the application of the Delft morphological approach along the research process to answer the sub research question 4 and its background questions:

Sub research question 4:

How can *the morphological approach* assist urban designers in the urban design processes to achieve historical continuity?

Background questions:
1 How to use the morphological approach to analyze the physical urban form in Wuhan? (Section 7.2)
2 What are the urban form transformations of Wuhan on different scales (Metropolitan area scale, Inner city scale, Hankou riverside scale)? (Section 7.3)
3 What are the spatial structural elements of Wuhan on these three scales? What are the practical implications of the spatial structural elements? What are the spatial characteristics of Wuhan? (Section 7.4)

The *Mapping Wuhan* research is the first time a multi-scalar morphological analysis according to the Dutch method applied in a Chinese city. The Delft reduction technique, defining homogeneous areas and additionally looking for secondary connections, and Geo-referencing and working backwards in time are the three main working methods. The research presents a timeline of 8 periods (starting in 1870) that condense towards the present (2013), as the city develops ever faster. (Section 7.2)

Section 7.3 presents the main results of the research: an Atlas consisting of four series of analytical maps. The transformations of the Inner city and the Metropolitan area are presented in historical order from 1870 to 2013. (see Section 7.3.1 and 7.3.2) By comparing the maps to one another, they show not only the growth of the city in time, but also the existence, importance, and sometimes the emergence or disappearance of spatial structural elements in the urban form. The next series shows the development of the urban spatial structure in sketches on a higher level of abstraction. (see Section 7.3.3) The analysis of Hankou riverside zooms in to the level of scale of a constituting part of the city that holds one of its important centers, including one of the three original Chinese towns out of which Wuhan developed, and the former Foreign Concessions. (see Section.7.3.4)

The research detects 13 spatial structural elements over three scales and concludes *fragmentation* as the city's main physical characteristic. (see Section 7.4) A short description of each spatial structural element with its meanings for the structure of the city as a whole, and their practical implication to the future city transformation and extension are enclosed. The research proposes that the homogeneous areas and secondary connections can possibly be used as handles for any urban design using this research.

Section 7.6 suggests that additional morphological analyses are needed on other levels of scale: the scale of the metropolitan region with its satellites cities as well as the relevant level(s) of scale for the location. In addition, a few aspects of the city ask for detailed attention, such as agricultural production and nature conservation, connected by ecology, water and water management, and green structure, both for its ecological and recreational aspects; the relation between urban forms and transportation systems and the reorganization of urban form through emergence of new centralities, etc.

In the end, a critical reflection on the working process and working method indicates that:

1. When designers work with the morphological approach they work on all scales and across scales, but they have a tendency to work from larger to smaller scale.
2. Mapping is a tool to conduct the morphological approach as well as produce a representation (product) of the research.
3. Maps are interpretations. There is no single truth.
4. Maps are reductions. They are heavily deducted from the real world. (It is up to the designer to decide what to show and not to show.)
5. Maps are abstractions. They are external representations of designers' thinking.
6. Maps provide a means for intra personal and interpersonal communication.
7. A homogenous area can be seen as a basic entity for form reduction, a structural element and a connecting element.
8. A secondary connection is a connecting element and as such a structural element.

Though Chapter 7 systemically represents the urban form transformation, detects the determined spatial structural elements, and shows the city's physical characteristics, other aspects are missing in the research, such as, how people actually use the physical space and how the life style transforms overtime. Chapter 8 is presented symmetrically to Chapter 7 to investigate how *the pattern language approach* can assist urban designers in the urban design process to achieve historical continuity.

8 Conceive the lived space: A pattern language of life style transformation— reveal the structure of public spaces

Introduction

In line with Chapter 4, where a *pattern language approach* is reviewed worldwide and a specific emphasis is placed on the Dutch context, this chapter chooses the Hanzheng street area or Wuhan in general as context to investigate the sub research question 5 and its background questions:

Sub research question 5:

How can *the pattern language approach* assist urban designers in the urban design processes to achieve historical continuity?

Background questions:
1 How to use the pattern language approach to represent the everyday life style in the Hanzheng street area in Wuhan? (Section 8.2)
2 What are the representative individual patterns regarding the everyday life transformation? (Section 8.3)
3 What are the pattern languages of everyday life in the Hanzheng street area? What are the practical implications of the languages' properties? What are the everyday life characteristics of the Hanzheng street area? (Section 8.4)

The Hanzheng Street area (HZJ) is located where the Han River flows into the Yangzi River in Wuhan and has a history dating back more than five hundreds years. It used to be a prosperous domestic and international trade center. Yet due to the decline of shipping and the changes in business models in recent decades, HZJ lost its attractiveness and has become an area with enormous problems. The city image is shabby. Monuments and historical buildings are poorly protected, resulting in a broken chain of historical continuity. Outdated business models and an intensive and diverse market agglomeration imply a large amount of business runners and low-level employees. Discontinued external transportation, low internal road density for transport, and insufficient transportation facilities have led to a failing logistic efficiency and a messy transport situation. This low logistic efficiency further leads to enormous goods left behind in the streets, which also blocks the pedestrian traffic. In response to this, the Wuhan municipal government has expressed a strong ambition to solve these problems radically by transforming the whole area into a new Central Business District (CBD) and relocating its business and residents outside the city. This highly top-down imposed-development model creates conditions for the transformation of HZJ, and even that of all of Wuhan, into an unjust, socially, spatially and economically fragmented city.

How was Hanzheng street area transformed socially? How did social events and activities form Wuhan's local lifestyle? What is the underlying logic of the complex authentic local life and what are the desires and needs of the local people? How can these insights instruct todays urban planning, design, and construction? The Urban Environment Research Centre (UERC) led by Professor WANG Yuan, in the School of Architecture and Urban Planning of Huazhong University of Science and Technology/HUST in Wuhan, has continuously observed and conducted research on the area since 2005. The author has had the privilege to be involved in the research group since her bachelor study and completed her master thesis under the supervision of professor WANG Yuan. The continuous observation and reflection of the area, the preliminary research of the area completed together with the professors and students from UERC, and the author's personal living experiences in Wuhan forms the foundation of this research.

Section 8.2 introduces the research context. It first clarifies research objectives and content. Then, it introduces the research method concerning the role of individual patterns in urban studies by linking social groups and operating urban spaces. The constitution and representation form individual patterns and the intention will be to attempt to partially structure social spaces with a pattern language. Finally, seven research steps are articulated.

Section 8.3 presents a pattern book consisting of twenty individual patterns. These patterns are shown in the format of a series of postcards. They are used as a way to think and structure information. Representative pictures, explanatory diagrams and texts together reveal different aspects of social life and spaces, and their practical implication for future design.

After developing the above twenty individual patterns, Section 8.4 organizes them into pattern languages to partly reveal the social structure of the city and discuss practical implications for city transformation. It concludes that the main social characteristic of the Hanzheng street area is *inclusiveness* and gives a further explanation of its practical implications. The application in practice of the pattern clusters, linkages, and anchoring points works towards *inclusiveness*.

In addition, section 8.5, reflects on thinking processes of making individual patterns and relating and clustering the patterns when creating the pattern languages.

Section 8.6 acknowledges the limitation of the research and suggests possible developments for the future research.

Finally, section 8.7 concludes this chapter.

§ 8.2   **Setting the scene:**

§ 8.2.1   **Research aim and content**

The aim of the research is:

1   To critically reflect on how a pattern language approach assists urban designers along the process.
2   To understand the local lifestyles in the Hanzheng street areas and in Wuhan in general through its history up to the contemporary situation.
3   To (partly) reveal the social structure and pinpoint 20 aspects of everyday life in Wuhan.
4   To convey information from literatures, field work, personal living experiences in Wuhan, and cultural background as a Chinese into individual patterns and generate a pattern language as a design tool.

The content of the research:

This research uses the pattern language approach, the Delft application in particular, to approach complex everyday life from 20 aspects. 20 individual patterns are developed and presented explaining how each individual pattern operates urban spaces and links social groups. A pattern language is built with these 20 individual patterns to reveal the social structure of Wuhan.

§ 8.2.2   **Research method: Pattern language**

This research is developed based mainly on the following four resources: 1, The ongoing 13 years observation and some preliminary research conducted with students, Professor WANG Yuan and Professor LONG Yuan from the Urban Environment Research Centre in the School of Architecture and Urban Planning of Huazhong University of Science and Technology/HUST in Wuhan; 2, the author's nine years personal living experiences in Wuhan; 3, the general cultural background and understanding of Chinese life styles that come from the author being Chinese, born and grown up in China; 4, a literature review. The above information not only secures a solid foundation for understanding, but also is the main material to support the individual patterns.

The Delft interpretation of a pattern language approach is applied in this research. Individual patterns are used as a tool to understand and structure the complex lived space (Section 8.4) and the each pattern is seen as a vehicle to convey information from lived space to representational space (Section 8.3). Building up pattern languages reveals the importance and relevance of individual patterns and working together with other people in workshops provides a shared platform for people with different backgrounds to communicate.

1. Individual patterns, sub patterns and their role

Each individual pattern can be seen as an aspect of urban issues. Each of which provides a way or angle to approach urban space and social groups. They are researched and presented to explain how each individual pattern can, on the one hand, operate urban spaces, and, on the other hand, link social groups. A pattern can be a person, a social entity, an event, a certain type of physical space, or an activity. For instance, a 'hair dresser' is a social figure. This pattern shows how this profession uses urban space to reform urban systems, and how the hair dresser can bridge the distance between a person's private domain and the public domain by bringing people together. Another example, a 'clinic', is a social entity, looking at an urban issue from the public welfare point of view. The pattern, 'stairs', is an object or a physical space, it does not explain the morphology of different types of stairs but focuses on how people use the stairs as a tool or a means to arrange or rearrange their living environment, and what the meaning of the stairs is in people's everyday life.

Of course, the 20 individual patterns do not cover all the aspects of society. They each represent a part of it. For instance, the pattern 'hairdresser' explains a certain type of use, but it does not necessarily have to be a hairdresser, it can be other trades or professions which have the same type of function, such as a food vendor. In addition, the 20 individual patterns presented in this research are mainly the traditional patterns that are threatened to disappear in China. This is partly because the current exclusive urban transformation model leads to different kinds of public space and physical form, which does not accommodate these patterns anymore. This is also because the Chinese society itself is changing deeply and turning away from certain patterns, for instance, No. 7 Clinic, No.12 Parasitism, No. 14 Ritual, etc. They are less relevant in the modern life. If so, then why are they important now and why should we be aware of them and be careful with them when elaborate urban design? It is about the meaning of these patterns and their connections with each other. For instance, what is the meaning of No.7 Clinic to the modern life? Due to the medical system reform in China, Chinese people today go to big hospitals and community hospitals. The self running clinic is disappearing. It is a consequence of social reform. However, the traditional clinic, which also serves as a public space for low class people who are from villages that come to big cities to work, show a certain need in society and therefore gives inspiration for future hospital design. Furthermore, losing some of these patterns gradually is not a problem, as the society moves forward new patterns emerge and the old ones transform into new forms. The problem is that all of these patterns are disappearing all together at once in the radical urban transformation in China. They hardly come back in the Chinese generic city and the whole social structure, which has been developed over centuries, dissolves. It will need a lot of effort and a few generations to build up again. To study these traditional patterns and present them here is to: A, document them as an archive; and B, provide basic vocabulary for future design.

Each of these individual patterns also has a few sub patterns, which are shown as diagrams (see Section 8.2.3-4). They connect and are complementary to each other. They as sub patterns together show the transformation and form the individual pattern which is a high level pattern. Just as Salingaros explained in his paper:

— One pattern contains or generalizes another smaller-scale pattern.
— Two patterns are complementary, as one needs the other for completeness.
— Two patterns solve different problems that overlap and coexist on the same level.
— Two patterns solve the same problem in alternative, equally valid ways.
— Distinct patterns share a similar structure, thus implying a higher-level connection.

With connective rules, two different aspects of a pattern come into play. On one hand, a pattern's internal components will determine its inclusion into a larger patter. On the other hand, it is the interface that determines overlap, or connection on the same level. Two patterns on the same level may either compete, loosely coexist, or necessarily complement each other.

(Salingaros, 2000, p. 151) (Figure 8.1)
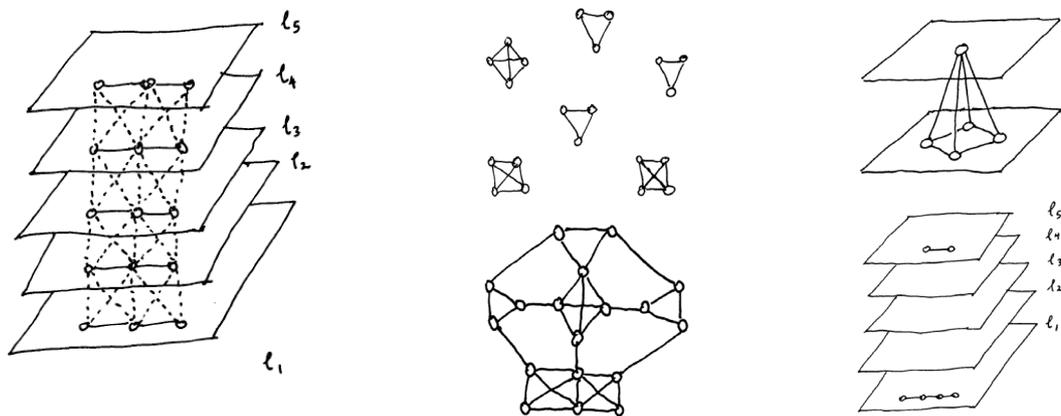
FIGURE 8.1 Clarifications on the couplings between patterns as suggested by Salingaros (2000)

2. Cards setup and explanatory texts

The 20 individual patterns are presented in a format that consists of a series of postcards with some explanatory text. On the front page is presented: a number; the name of the pattern, indicating its meaning; a statement, which can be seen as a strong and condensed explanation of the pattern; one icon-like illustration abstracting the pattern; one picture depicting the pattern; and its relation with other patterns. On the rear is the practical implications explained with conceptual diagrams.

In the explanatory texts is the following:

— Diagrams with their explanatory texts further explain the meaning and the forms of the pattern mainly originating from field work, author observations, and on-site interviews.
— Practical implications explain the possible interpretation in practice and its application.

TOC

3. Building up a language

The author started to make a pattern list from her own understanding and from what she was interested in. However, the list is plain and the order random. The patterns numbered first are not more important than later ones. While building up a pattern language, the importance and relevance of individual patterns and the structure of them can be revealed.

The city is more complex than we initially grasped. The relative simplicity of conveying information of 20 individual patterns helps, but still we recognize complexity while organizing and structuring the patterns. Complexity can be conceived in two layers: the first interpretation by the author, who made the patterns and decided on what to show and what not; the second layer results from people who worked with them. To facilitate this, a workshop was organized in TU Delft, where people were invited to make their own pattern languages using the 20 chosen patterns (Section 8.4). A comparison revealed the diversity as well as the common understanding between different people.

§ 8.2.3   Research steps

The pattern language research here was built up in seven steps:

1   Making a list and naming
2   Individual research on each pattern
3   Selecting representative pictures
4   Drawing diagrams
5   Writing statements
6   Writing practical implications
7   Clustering and building a pattern language

1. Making a list and naming

In order to grasp complex urban life, a first selection of relevant themes was made. These themes can be deeply embedded in the mind from earlier experiences or research, through fieldwork and/or literature review, or they can come from something you are simply interested in. There are always more patterns than those listed, but to be selective in making a first selection is important. Because usually the first selection is more intuitive, it shows somewhat the unconscious focus, interest of designers, and what they actually care about in a certain project. To list them and make them explicit at an early phase is beneficial for designers to realize and develop concepts for a project. By playing around with these first selective patterns, it helps to explore design ideas. In this case, making a first selection helps the author maintain a starting point and have opportunities to develop the research further. We can always change the order or replace some of the patterns with other more relevant ones as the overall research develops. This research develops 20 individual patterns, which is not too little to build up the pattern languages and reveals the complexity of public life later on, nor too much to overload the starting point to move forward the research.

Names indicate meaning and are the most effective way of helping understand the actual pattern and to communicate it to other people. So it is important to find an effective, precise and condense term for what you want to emphasize.

2. Individual research on each pattern: fieldwork, sketching, reading, writing, etc

Though we tried to be precise in the first step, still the chosen patterns are vague and what we wanted to tell was broad. In this phase, a more in-depth research is needed to understand the patterns. There are various ways of doing this, for example, reading literature about the cultural and social background of each aspect provides a general context; going on location to talk to relevant people and observe behavior allows the gathering of first-hand data and gives direct personal experience; writing about what you want to tell will narrow down the abundance of information and help to bring focus; sketching will turn running texts into spaces with consideration of scales and grouping information into scenery. These approaches are all complementary.

3. Selecting representative pictures

Selecting the right picture was a crucial step in this research. Not only because it was placed next to the name on the front page of the postcard, which delivers the first impression and most direct information; but also because showing pictures is the first attempt to visualize patterns and link them with space. The pictures with a clear focus in relation on the actual pattern were chosen.

4. Drawing diagrams

Drawing is the designers' tool for understanding and thinking, it can externalize thoughts and ideas (Goldschmidt, 1991). Though sketching went along with the research, conclusive drawings are needed to explain each pattern. Cross-scale drawings, combinations of plans, sections and maps can effectively illustrate different scenarios under each individual pattern. They can illustrate different types and depict examples of how a certain pattern operates in urban space and links social groups.

5. Writing statements (claiming)

A statement is a piece of condense information that explains each pattern. It is like a hypothesis; it describes what a certain pattern means in the city in relation to urban spaces and social groups.

6. Writing practical implications

A further explanation of how the pattern can be used in urban design practice was made.

7. Clustering and building a pattern language

This step tested the clarity of individual patterns and sought the relations between them. A pattern language helps to visualize the complex relationships and structures of social space. Building up a pattern language together with other people will raise discussion and can establish a common understanding.

These steps are not intended as rigid step-by-step linear processes. One can always reverse the processes or have different starting points according to different goals (see Section 8.5.1).

§ 8.3   A pattern book

The life style transformation research results are presented as a pattern book consisting of 20 individual patterns.

01
Street in street

enriches the complexity of urban hierarchies. It is a physical representation of people's desire to have interactive urban boundaries.

Relations

Practical implication

Make sure to design more space for the sidewalks, which will facilitate the formation of street in street.

A. Break through urban blocks and invite people to come in
B. Define a second layer on the street, extrude inside out
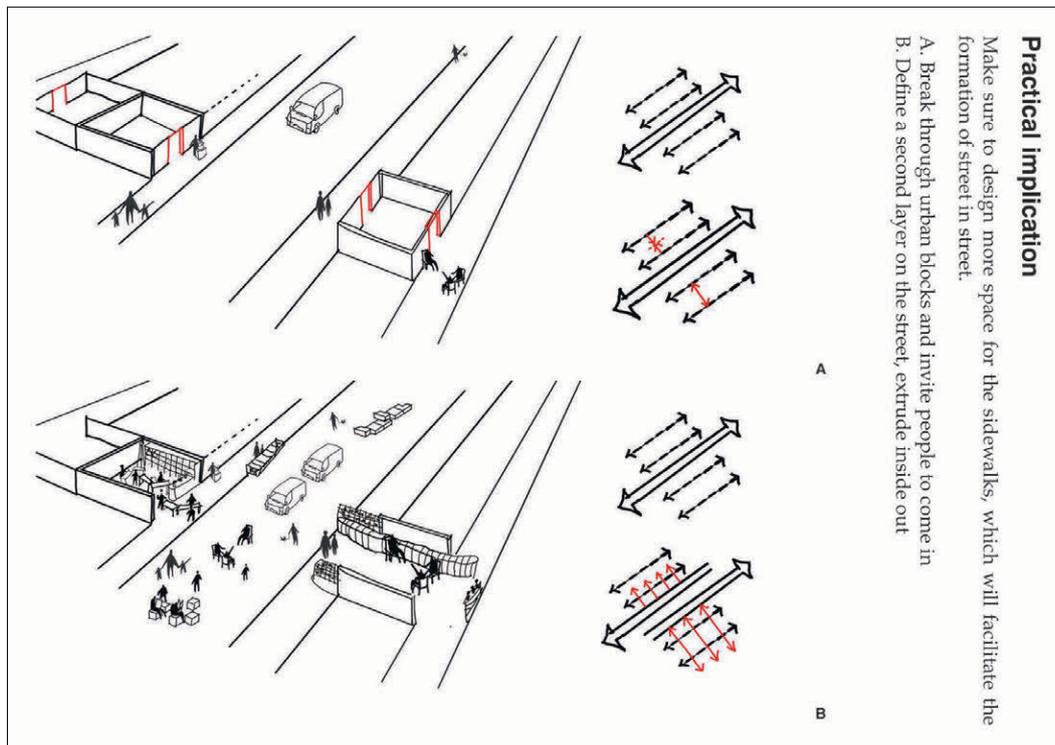
1. Street in street（街中街）

Diagrams:

A. Break through urban blocks and invite people to come in

The small business and retail by the sidewalks are open to the city. By doing so, it invites passers by to come inside. These breaks in the urban blocks add an extra lower scale of connections in the urban hierarchy.

B. Define a second layer on the street, extrude inside out (externalize the indoor business)

The shop owners often put their commodities out on the sidewalks perpendicular to the shop facade, which forms many sub streets. Occupying the sidewalks intensively not only invites passers by to come in the shops, but also pushes out the pedestrians, who are supposed to walk on the sidewalks to the street. Sometimes the shop owners even put their goods in the middle of the street. By doing so, it divides the original street into to two and weakens or excludes the transport function of a street. The above not only introduces another lower level of scale in the urban hierarchy, but also transforms a transport oriented street into a public space where pedestrians walk around and where the shop owners have lunch and even take a nap.

Practical implications:

The above phenomenon often appears in dense cities. It reveals how people smartly use space under extreme conditions. This pattern also brings the question: what should the relation be between pedestrians and transport and how to balance them on different scales?

When designing a shopping street, leave more room on the sidewalks to allow cooperation between shoppers and owner's appropriation. Also try to make sure the street that the shopping street is connected to is at a relatively lower level of scale in the city. This will allow negotiation between transport and public space.

02
Space appropriation

activates urban spaces, allows for people to meet, secures social control and creates community.

Relations

Practical implication

In order to accommodate appropriation in the design of public space, try to balance place neutrality and identity.

A. Replenish the spare parts in the city
B. Attachment and extension
C. Redefine urban boundaries
D. Claim the leftover space in the city
E. Invade formal space/informal use of formal public space
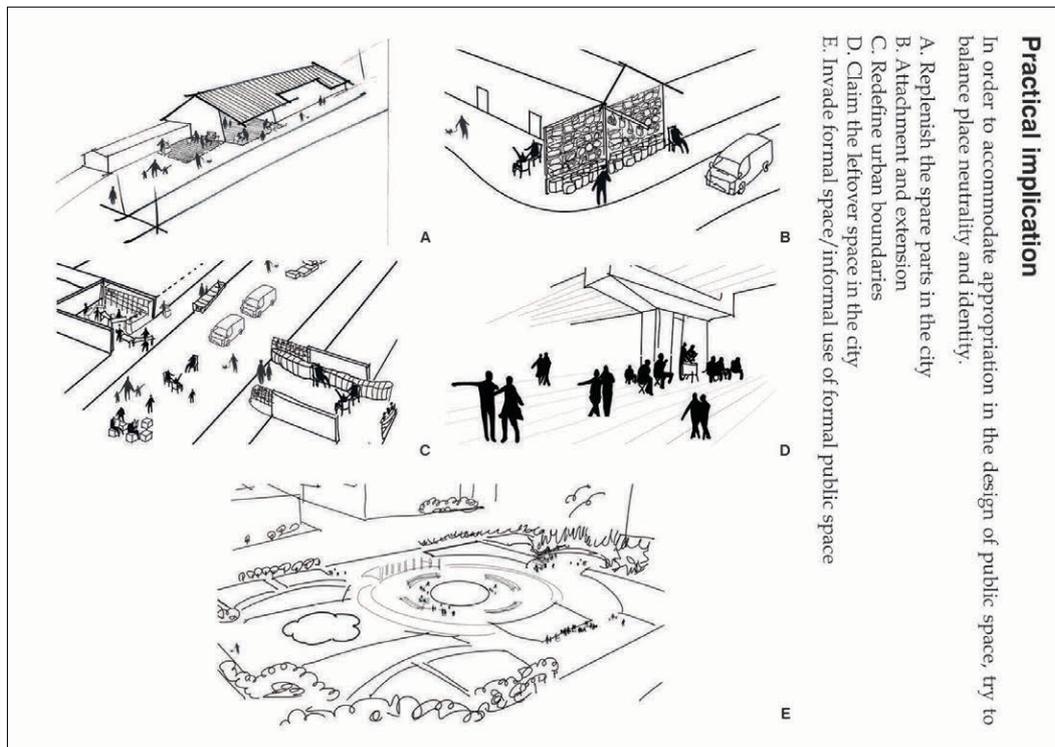
FIGURE 8.3 2. Space appropriation (Picture: LI Li (2014) [photograph] (Wuhan))

2. Space appropriation （空间挪用）

Diagrams:

A. Replenish the spare parts in the city
Food vendor, hairdresser, and shoe repairer, etc. tend to appropriate spare urban space, such as street corners, concave and nooks of the street (see Section 6.2-4 Hairdresser B).

B. Attachment and extension
Some low-income inhabitants who cannot afford a stable retail shop attach their goods to the wall and clearly extend the wall with shelfs. This appropriates very limited space in the public domain.

C. Redefine urban boundaries
Appropriation can result in a secondary layer on the street (see Section 6.2-1 Street in Street B).

D. Claim the leftover space in the city
Due to the city expansion and necessity of big infrastructure, enormous ring roads and high ways were built. The spaces underneath these infrastructures are often abandoned and dangerous. Sometimes, citizens cleverly reclaim these spaces and transform them into a dance floor and performance stage. It offers "the eyes on the street" and the citizens become the city safeguard (see Section 6.2-13 From spectator to actor B).

E. Invade formal space/informal use of formal public space
Citizens recreate and claim temporary space in streets and parks for specific ceremonies, dancing or exercise. These formal public spaces often have political and historical meanings. People often appropriate the edges and corners of these formal spaces, but not the core or the center.

Practical implications:

Citizens initiate their own public spaces through appropriation. It manifests the social significance of the physical space. The collective transforms urban space into a real-time, interactive, flexible, temporary, inclusive, diverse environment and therefore accomplish publicness.

In order to accommodate appropriation in the design of public space, try to balance place neutrality and identity. A certain degree of neutrality will facilitate unforeseen use. If a place is closely designed for a specific use, other ways of using are often hampered (Meyer, de Josselin de Jong, & Hoekstra, 2009). Therefore, a place should be at the same time neutral toward different kinds of use and have a recognizable identity.

03
Eating in the street

creates community and claims social identity on all urban scales.

Relations

Practical implication

Incorporate in the design of public space linear spatial elements that facilitate outdoor eating and other activities.

A. Claim individual identity
B. Bond community
C. Link different neighborhoods and social classes
D. Promote city branding
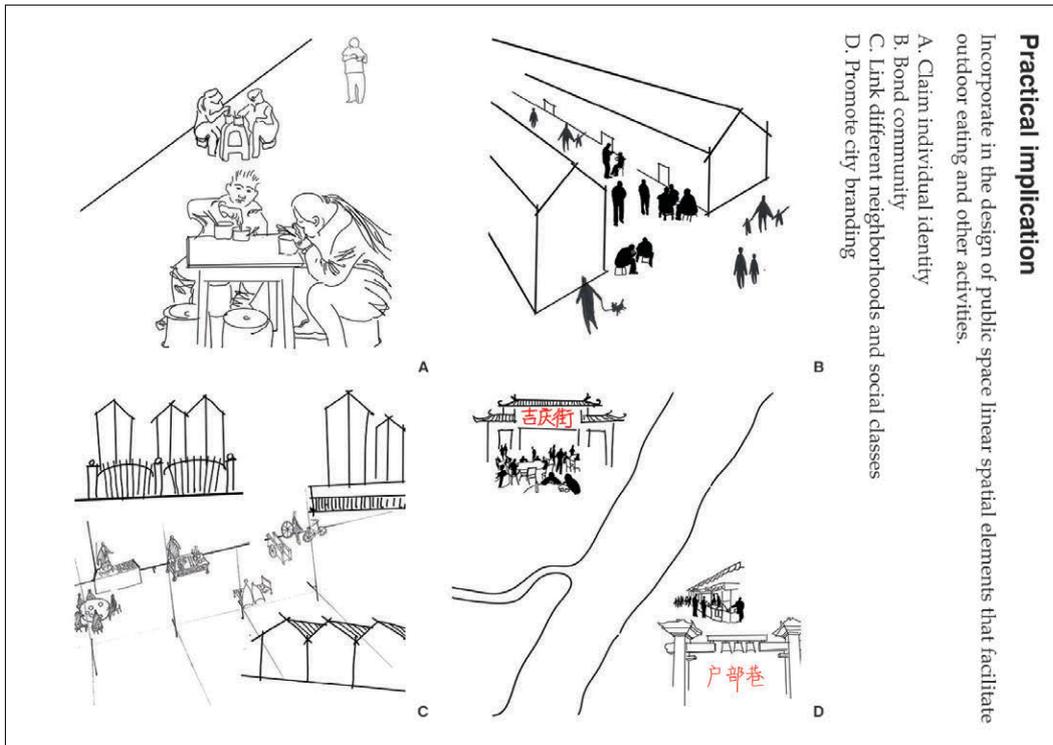
FIGURE 8.4 3. Eating in the street

3. Eating in the street （街中食）

Diagrams:

A. Claim individual identity

Individuals that eat noodles in a bowl and stand in the street claim individual identity and private territory in the public domain.

B. Bond community

On the neighborhood level, people eat at their front door and interact with neighbors. This not only tightens the community, but also forms a communal atmosphere and identity.

C. Link different neighborhoods and social classes

This is on the intra-neighborhood level. In the current diverse urban environment, high profile gated communities, villa neighborhoods, middle-class high-rise buildings and urban villages are separated. This segregates citizens according to their social status. However, there is always a backstreet around the corner where food vendors gather together and where all the street food can be found. This street is outside these communities, but shared by all of them. The inhabitants from different neighborhoods despite their different social status gather together and eat on the street. People who drive flashy cars and wear suits have breakfast together with people who are on allowance. In such a manner, different communal identities are connected.

D. Promote city branding

This is on the city scale. For instance, Jiqing Street (吉庆街) and Hubu Alley (户部巷) are the two most famous eating streets in Wuhan. They connect communities throughout Wuhan. The local inhabitants gather together there to eat in the street, meet friends and watch street performances, etc. Furthermore, they are not only well known in the city but also on a national level. The local government uses them to promote the city branding and attract tourists. They form the city identity.

Practical implications:

Whyte (1980) states that "*Food attracts people, which attract more people*" (p. 52). However, the pattern *eating in the street* can be about food, eating and street, but can also be other private behaviors appearing in the public territory. For instance, in the historical areas in China, it is often seen that many middle age people walk around in their pajamas. By doing so, they are claiming their own territory in the public place. This also implies they feel safe in their city. Activities like *dancing in the street* also have a similar role and meaning to public space. Therefore, try to incorporate in the design of public space linear spatial elements that facilitate outdoor eating and other activities.

04
Hairdresser

is a social figure bridging the private and the public domain.

Relations

Practical implication

This can be any trade which uses urban space in a similar way. Make sure to allow their existence and promote the diverse use of urban space.

A. Flowing hairdresser + loose customer
B. Flowing and relatively stable hairdresser + loose customer
C. Concentrated hairdresser + moving customer
D. Fixed hairdresser + moving customer
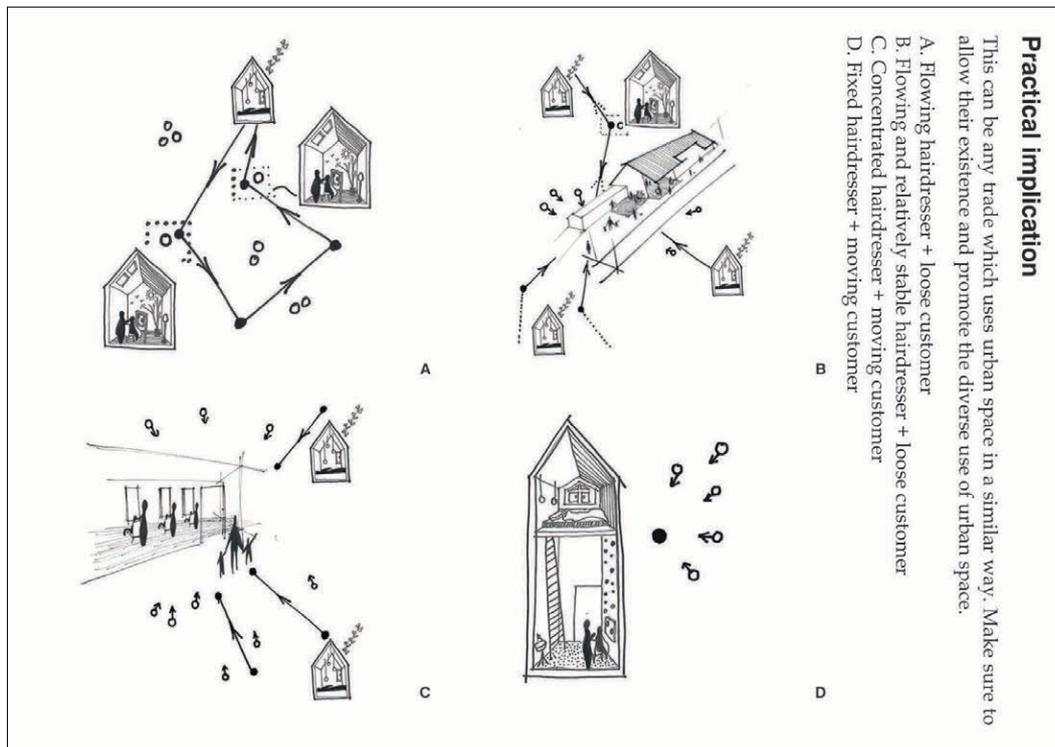
FIGURE 8.5 4. Hair dresser (Picture: HUANG, 2008)

4. Hairdresser （理发师）

Diagrams:

A. Flowing hairdresser + loose customer
A hairdresser walks around the city shouting with his or her toolbox. Whenever he or she encounters a customer, they go to the customer's home to cut their hair. The hairdresser enters the client's private territory and interacts with them.

B. Flowing and relatively stable hairdresser + loose customer
A hairdresser walks everyday to a relatively stable urban space with their toolbox. The working place can be at a street corner or under a canopy. It can also be a one-square-meter space in front of a restaurant or any other shop. The hairdresser shares urban space with other hairdressers or used other shopowners' space. If a hairdresser meets a customer on the way to work or going back home they would go to the customer's home to cut their hair. Next to interacting with the client in a private domain, a hairdresser also interacts with other professionals in urban public space.

C. Concentrated hairdresser + moving customer
This is the modern type of a hairdresser's shop. The hairdressers form a company and gather together to work. Customers go to the stable space to have their hair cut. The hairdresser interacts with other hairdressers and clients in an interior public space.

D. Fixed hairdresser + moving customer
A hairdresser transforms part of their home into a hairdressing studio. Normally they sleep upstairs and cut the clients' hair downstairs. Or they can live at the back of the house and work in the front. The customers enter the hairdresser's private domain. The hairdresser overlaps private life and public business.

Practical implications:

Next to the rich meaning attached to hair in the Confucian tradition[29], the pattern *hairdresser* represents certain types of functions. It can be any other profession that uses the urban spaces in similar ways, for instance a food vendor, a cobbler, a knife grinder, a dough figurine sculptor, etc.

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[29] Hairdressing as an occupation did not exist in China until the Han Dynasty (206 BCE – 220 CE), and even then it only served feudal nobles. Under the Qing Dynasty (1644 – 1912) hairdressing was forced on ordinary people due to the political control of the foreign Manchu regime (known as the Qing). Men all had to have the same haircut: bald at the forehead with a long braid at the back (the queue). That was the beginning of the necessity and popularity of hairdressing as an occupation in China.
The beginning of the Confucian master piece, *Xiaojing*, states: "Your physical person with its hair and skin are received from your parents. Vigilance in not allowing anything to do injury to your person is where family reverence begins" (Rosemont at al., 2009: p. 105). Family reverence (孝 *xiao*) is considered as a necessary condition for developing any of the other human qualities of excellence (Rosemont at al., 2009). Protecting the hair and body is the entry point of cultivating *xiao*. Hair, as part of the private domain, gives hairdressing an ethical meaning. "A hairdresser shop is the first place for a society to accept hair. It is a place where the human body and society connects. It is a place where aesthetics and politics intertwines." (WANG, 2006). As such, hairdressing is initially the first attempt to connect the private and public domain.

The trades listed above require relatively low investment and skills and are mainly for the marginalized urban population. Due to the exclusive urban-transformation model in China in recent decades, these people are either relocated outside the city, or the new urban fabric does not facilitate these needs. As a consequence, these trades are slowly disappearing. Instead, the pattern tends to become rather homogenous, either become C— work in a concentrated shophouse or together with other shops in a shopping mall.

The new urban transformation projects should make sure to allow for the existence of these trades and promote a diverse use of urban space.

05
Chinese drying

adds another layer that defines urban spaces. It creates individual identity as well as a residential community atmosphere.

Relations

Practical implication

Design communal laundry and drying space in emerging building typology.

A. Communal drying
B. Flags on building facade
C. City level public space
D. High-rise building
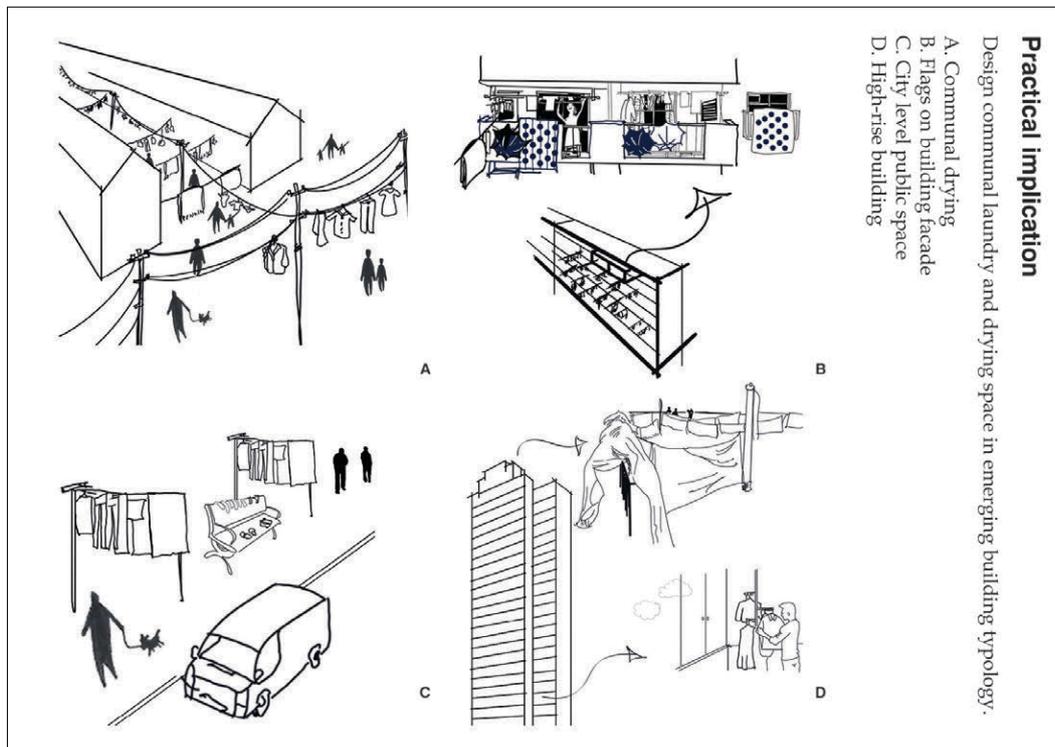
FIGURE 8.6 5. Chinese drying

5. Chinese drying (中国式晾晒)

Diagrams:

A. Communal drying
The origin of the pattern appears often in the Chinese traditional neighborhoods. People create and share drying spaces; for instance, they put a cable from one household balcony to another across the alley. Neighbors hang clothes together and help each other out. Laundries everywhere in the neighborhood create a vivid residential atmosphere and communal identity.

B. Flags on building facade
The inhabitants hang their laundry and blankets on open balconies and on the building facade. This is often seen in the Southern part of China where the weather is humid and the rain season is often 1 to 2 months long. Whenever there is the sun the residential buildings become colorful. In Hongkong, these buildings are called "United Nations" because the laundries and blankets somehow resemble the flags from different nations. Extending inhabitants' personal life out on the building facade they are displaying their individual identity.

C. City level public space
Sometimes, this pattern not only stays in the communal and private domain, but also extends to city level public space. For instance, people hang their socks on a public bench in the park or on the sidewalks next to a very busy road, or sometimes even make cables and hang their blankets in the city square. Therefore, the private and the public are completely overlapped.

D. High-rise building
High-rise building is the main residential building typology in big cities nowadays and there are hardly any communal spaces for inhabitants to dry their clothes. Therefore, they either dry them on their closed balcony at home or on the roof of the building. This deprives intensely the chance for people to regularly interact with their neighbors. In addition, it is not always safe to go to the roof because there are hardly people around and sometimes elderly people fall without anyone noticing.

Practical implications:

Today, it is nearly impossible not to build high-rise buildings in dense cities. However, trying to intentionally design some laundry space for the inhabitants is beneficial, not only because it facilitates social interaction but also because it secures vulnerable groups such as elderly people and kids. For example design a communal space with high ceilings, or open air every 5 to 10 floors in the high-rise for neighbors to gather together. Otherwise in time, when the high-rise buildings slowly replace most of the other building typologies in the big cities, this pattern will tend to become homogeneous and will be only manifested as D.

06
Up sleep + down business
Back home + front shop

take spaces from the private domain and give it to public domain. This adds to the complexity in public to private transition zones and increases the possibilities of social interaction.

Relations
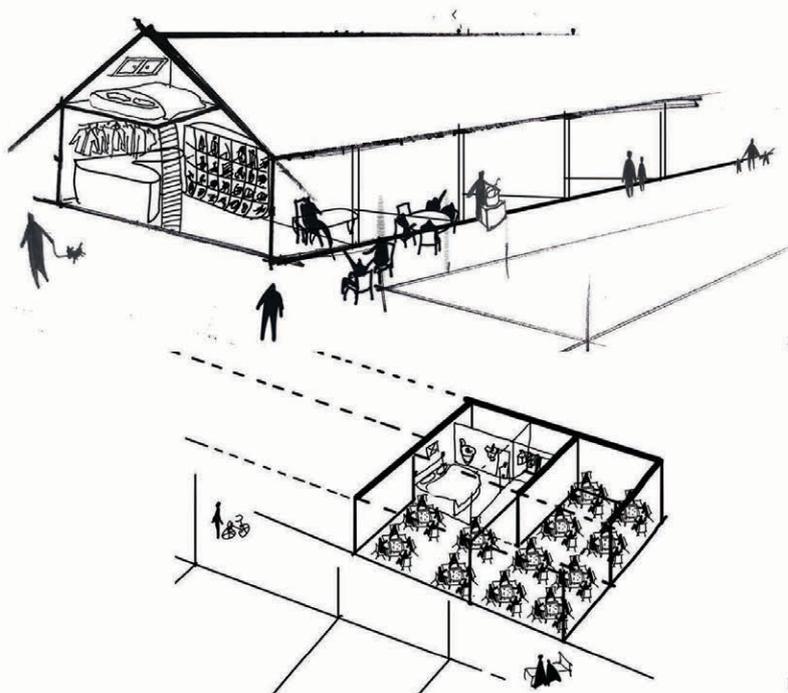
Practical implication

Promote household and shop owner initiative that draws space back to the city, which will eventually result in a rich public space system.

A. Up sleep + down business
B. Back home + front shop

A

B

FIGURE 8.7 6. Up sleep + down business; Back home + front shop (Picture: LI Li (2015) [photograph] (Wuhan))

6. Up sleep + down business（上住下铺）; Back home + front shop（后房前店）.

Diagrams:

This is a Chinese way to reorganize housing typologies. The facade can be seen as a boundary between public and private space. When people run their business, they share space within their private domain to the public domain and invite people to come inside. Many small businesses are run in this way, such as Majiang entertaining shop, fruit shops, hairdresser shops, clinics, etc. This pattern is mainly manifested in 2 ways.

A. Up sleep + down business

Sleep upstairs and run business downstairs. This can be accomplished by adding another floor inside their one story house (such as hairdresser CR6.2-4D) or the house owners can live on the first floor and run their business on the ground floor.

B. Back home + front shop

When the ceiling is not high enough to add another floor in the house, people divide their home into front and back parts. They run business at the front and have their private life at the back.

Practical implications:

This pattern gives insight to designers about the possible ways inhabitants can transform their home and contribute to the city's public domain. Therefore, in the design, try to facilitate and active people's initiative. For instance, design a relatively longer portioned shopping stand in the shopping mall that allows the shop owners to divide it into two parts. They can sell goods at the front and possibly have a nap or lunch at the back. The "sleep" and "home" in this pattern does not mean the shop owners have to stay in their shop overnight, but indicates their private activity. In addition, in the design of office building, especially for the young starting entrepreneurs, try to promote different use, such as designing considerately high ceilings and building structure. Then it is possible for them to build another layer in one unit or integrate different units. One of the good examples is the SoHo in Manhattan.

07
Clinic

next to providing medical assistance, provides a social place where individuals look not only for health, but also for a social identity that contributes to community bonding.

Relations

Practical implication

Any necessary functional entities in the city that can be integrated in the urban spaces on all scales and designed as a social space.

A. Chinese traditional medical care system
B. Grid system
C. Anonymous home
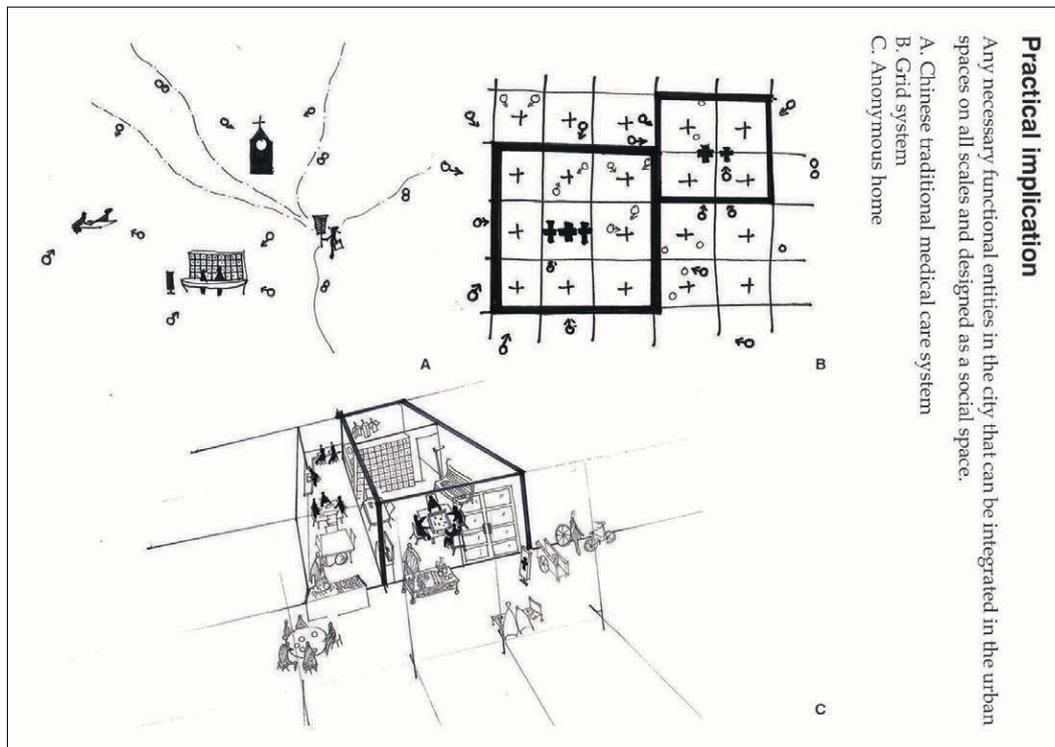
FIGURE 8.8 7. Clinic (Pictures: HUO, 2006)

7. Clinic （诊所）

Diagrams:

A. Chinese traditional medical care system

In old days, the medical care system in China was mainly manifested in 3 different forms: 1, Western surgery and medicine was brought in by missionaries and patients go to churches to see a doctor. 2, Chinese traditional medicine has mainly two parts: Individual clinic and pharmacy. Patients go to a doctor's clinic and the doctor diagnoses by feeling the patient's pulse. This is a very intimate moment as body connection is involved. Then the patients go to a pharmacy to get the medicine. Most of the pharmacies have a doctor who is in charge of medicine but can also works as a doctor. 3, moving doctors carry their tools, walk around the city, and check out random patients (Just as a hairdresser, Section8.3-4). In the old system, all the clinics and pharmacies were embedded in the alleys and street network. The moving doctors cover every corner of the city.

B. Grid system

At the beginning of 20th century, China started to incorporate the western values of medical care and therefore tried to reform the medical care system accordingly. Each small clinic covers a certain amount of square meters in the city. Citizens who live in the range are appointed to go to that clinic. Every larger district has a higher level clinic or medical care station. On the city level, there are a few high level hospitals. Interestingly, understanding the medical care system is now a way to interpret the city and another way to reform the administration of the city. The administrative boundaries neighborhoods and their management can be organized according to the hierarchy of the medical system. The other way around, different levels of medical care also indicate different levels of urban scales.

C. Anonymous home

In the system mentioned above, the small individual clinics also play a role as an anonymous home for city immigrants. These clinics often embed with the urban fabric and social life. They often locate at a small street or a deep alley, next to a local restaurant, or hairdresser shop, etc. The city immigrants often go to the doctor who is from the same home region as them and therefore whom they can trust. They go there to share their social identity, look for warmness and social interaction. This community bond is important to the city immigrant, especially when they are ill and homesick.

Practical implications:

This pattern firstly is an inspiration to the urban researchers. It provides a special angle to understand city, a social welfare point of view. Secondly, it explains to the current medical care reform that it is not necessary to eliminate all the individual clinics because they do have a very important social meaning, especially for the vulnerable groups. Thirdly, the pattern can be a clinic and medical care system, but can also be any other necessary functional entities in the city, such as an education system and corresponding communal book store, library and training schools, transportation system and corresponding stations, and bus stops. They too, can be integrated in the urban spaces on different scales and designed as a social place for citizens.

08
Flowing

is a way of linking every conner in the city, bridging urban life and revealing invisible stories

Relations

Practical implication

Optimize mobile efficiency and instruct a healthy life style.

A. Walkers
B. Other mobile tools
C. Automated post
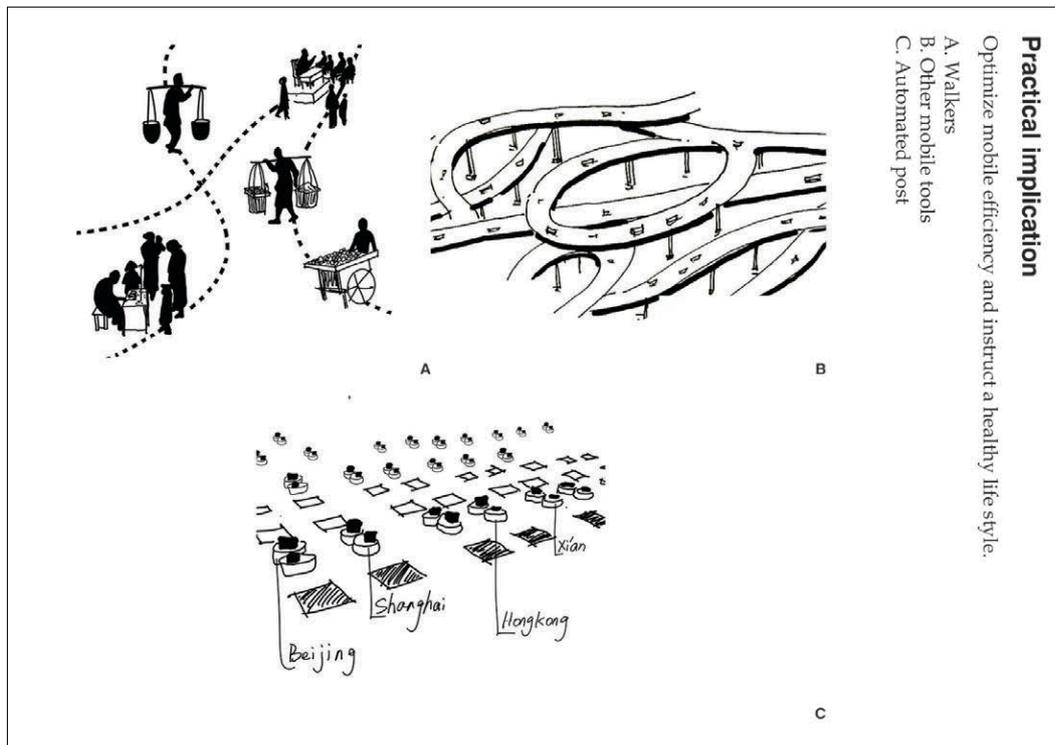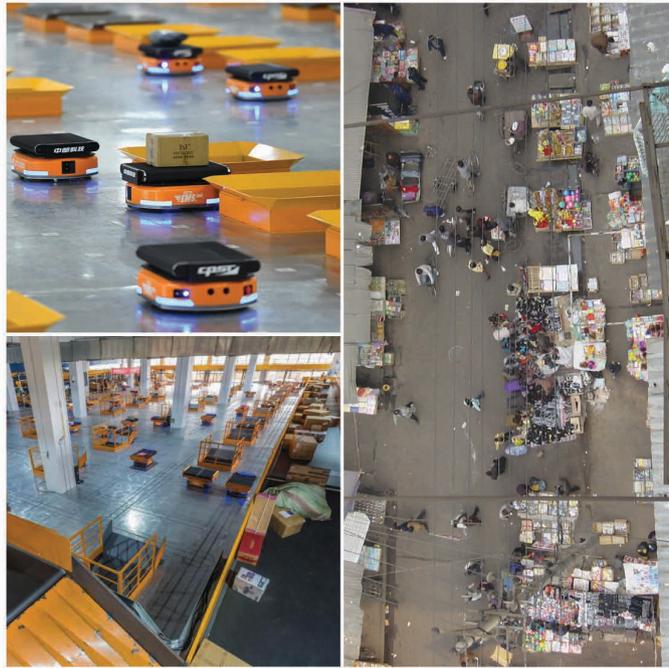
FIGURE 8.9 8. Flowing (Pictures: (left) LI Jinfeng (2018) [photograph] (Wuhan); (right) YE, 2005)

8. Flowing （流动）

A. Walkers

Walkers consist of professions, such as food vendor, trash collector, shoe repairer, kitchen knife grinder, dough figurine sculptor, storytellers, etc. who walk around and connect every corner of the city. They are the closest to the inhabitants' life and therefore know the narrative of a city. Because of them, the conventional physical spaces are no longer independent loose elements. They become dynamics and they are integrated as a network, a public space system. The walkers reveal the vitality of a city and people's everyday life (such as hairdresser Section 8.3-4).

B. Other mobile tools

Newly mobile tools gradually replace walking, such as motorbikes, cars, public transport, etc.

C. Automated post

Nowadays, internet shopping is gradually taking over conventional shops. As a consequence, an enormous amount of packages are on their way everyday. New technology has made it possible to distribute the goods automatically at the receiving station, then deliver them through flights, trains, trucks, and eventually mobile bikes to inhabitants front doors. Though most of the posting phases are not visible in the public space, they do reveal people's life style and connect every corner in the world.

Practical implications:

Due to the technology development, *flowing* constantly changes its form and its meaning to people's life. Analysis of these movements and data of posting could bring insights about citizens' life style, based on which optimization can be made. Consequentially, increase mobile efficiency and give instruction for a healthy life style. For instance, analysis of citizens' mobile habitats can bring insights of how many hours they spend in cars, transport and even in traffic jam everyday. Suggestions can be given on optimal commuting and the amount of necessary exercises. Analysis of post data can bring insights of people's shopping habit. Suggestions can be given on how to spend money wisely.

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09
Mixed use

accomodates diversity in urban life.

Relations

Practical implication

Try to create and accommodate differences on different scales, this will allow for users' different interpretations.

A. Different interpretations
B. Big buildings, a vertical city
C. Spreading out in the city
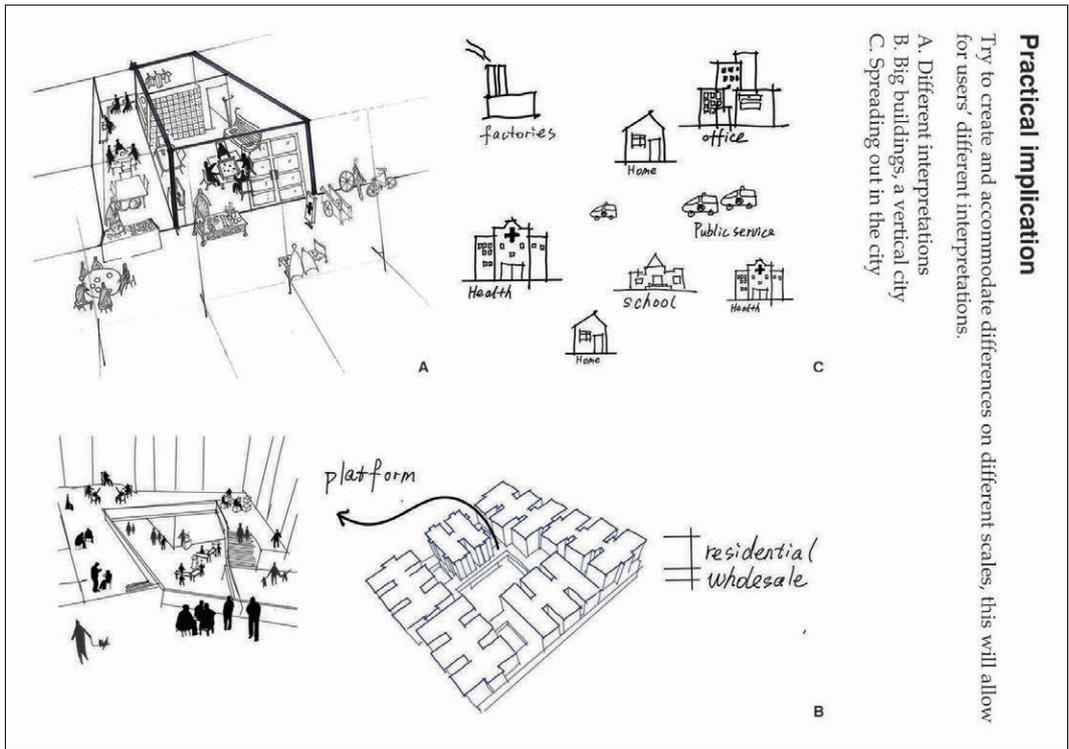
FIGURE 8.10 9. Mixed use (Pictures: MA Zhenhua (2006) [photograph] (Wuhan))

9. Mixed use（混合使用）

Diagrams:

A. Different interpretations

This pattern not only means the mixed use of different functions, but also new interpretations of space and new ways to use space. For instance, a dinner table can also be a ping-pong table. A local clinic can also be a communal space where inhabitants gather together, to for instance to play mahjong (Section 8.3-7C).

B. Big buildings, a vertical city

Dense cities have many big buildings and buildings complexes that have large footprints, (Section7.4.3-9-7). Sometimes these form a veritable vertical city composed of residential, wholesale, shopping (small retails), educational facilities (kinder garden and primary school), health facilities (local clinic), production space, and work space.

C. Spreading out in the city

On the city scale, it is difficult to mingle big functional districts with others. For instance, a factory district certainly demands more space due to its production chain. Furthermore, the fact that it might cause pollution also makes it impossible to be mixed with residential and shopping areas. In addition, a city level hospital needs a large urban plot and it is inefficient to insert other functions in, such as shopping and residential areas. In such cases, the idea of mixed use should be on a larger city scale, making sure that different functions, such as work space, health facilities, and educational institutions, are spread out in the city. For instance, the medical facilities can be set according to the city administrative boundaries, on every level, to make sure that the different levels of medical facilities are available and reachable (Section 8.3-7B).

Practical implications:

Mixed use represents a diverse life and accomplishes an accommodating system that can afford any combination and possibility at any time. "*Diversity is given, but difference is that by which the given is given.*" (Deleuze, 2004, p. 280) Try to create and accommodate differences on different scales, this will allow for users' different interpretations

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10
Life theatre

is where everyday life performs and is shown; where people can dance their dance and where they claim their social identity and human rights.

Relations

Practical implication

Set potential stages for the play of urban life and provide possibilities of seeing and being seen.

A. Display of people's intimate life
B. Floating platforms and corridors
C. Designed urban stage
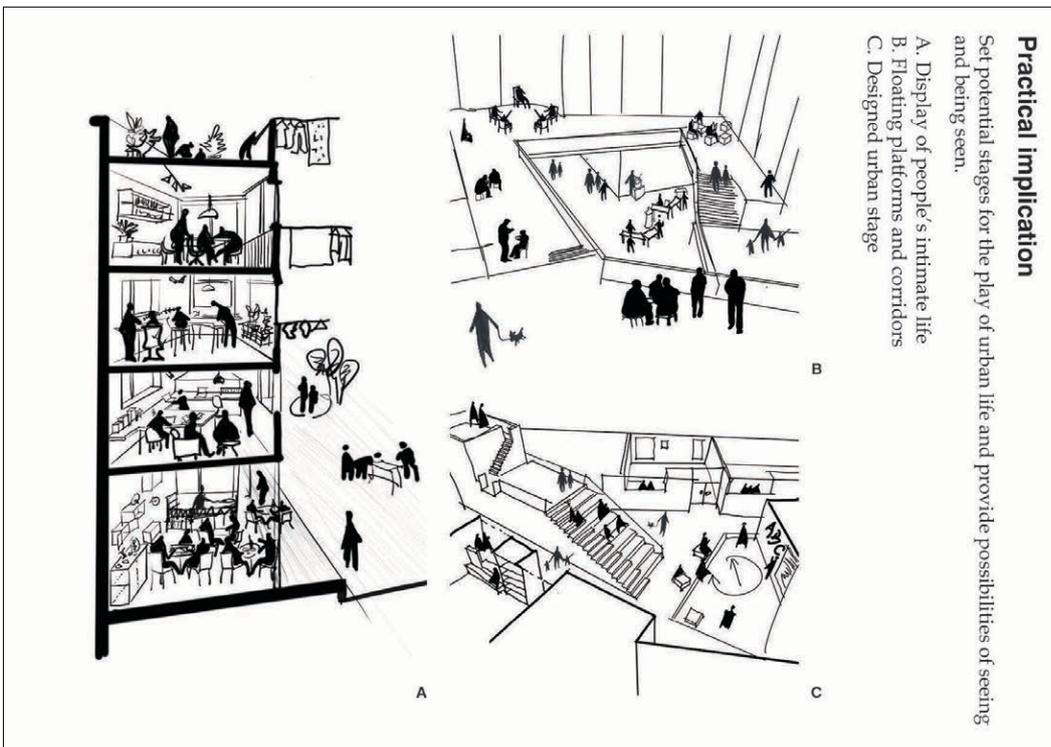
FIGURE 8.11 10. Life theatre (Picture: LI Li (2014) [photograph] (Wuhan))

10. Life theatre （生活的剧场）

Diagrams:

A. Display of people's intimate life
The urban life itself is a play and each household and individual has its own story. The collective contribute to the play of a city. The section depicting the display of peoples intimate life that contributes very much to feeling that the city is of its people. Leaving the ground floor open to the street breaks the boundary between private and public.

B. Floating platforms and corridors
Sequential platforms and corridors with different elevations provide opportunities for people to see each other. They are like an elevated Chinese traditional street.

C. Designed urban stage
Sometimes, in shopping malls and gated communities, some intentionally designed stages are placed in the center. This too, promotes communal and collective events, such as bands competition and kids drawing exhibitions, etc.

Practical implications:

Theater is not only an elite use of public space. It displays everywhere in the city. The essence of this pattern is the chance for people to see and be seen. Therefore, make sure to design potential stages for the play of urban life and provide possibilities of seeing and being seen.

11
Recognition system

is a dynamic process that layers everyday experiences and addresses. Both are tightly integrated in the urban fabric and reveal the logic of urban development.

Relations

Practical implication

Be aware of the above four ways in which people build up their recognition system.

A. House numbers
B. Symbols
C. Everyday space
D. Sense
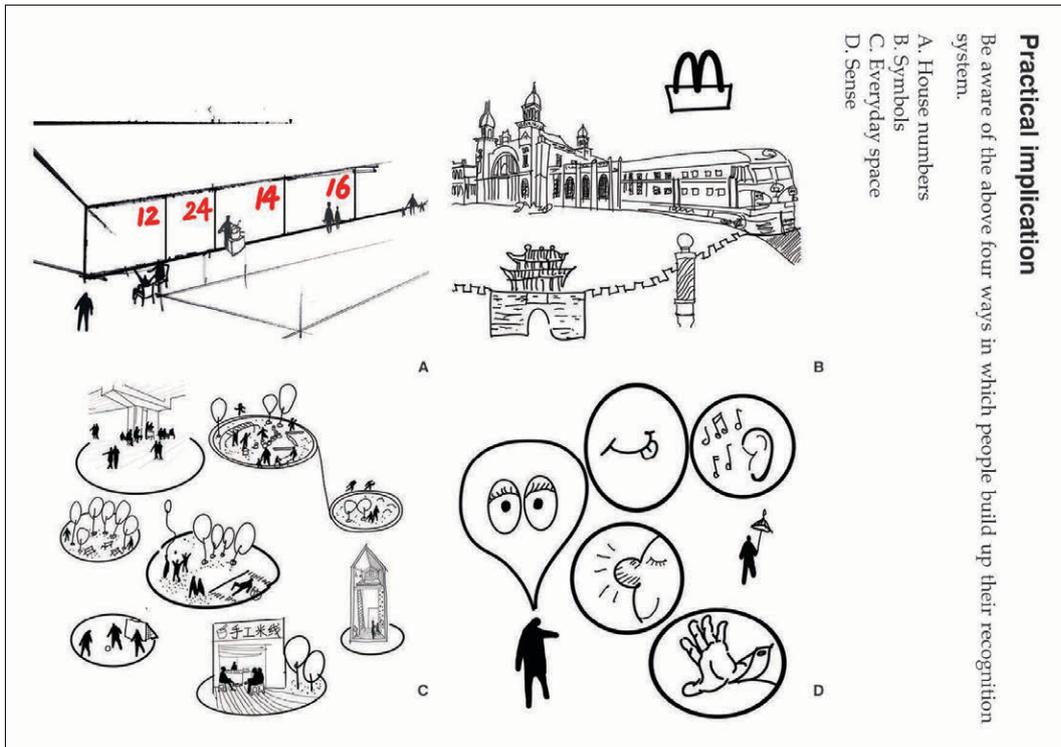
FIGURE 8.12 11. Recognition system (Pictures: (top) MA Zhenhua (2006) [photograph] (Wuhan); (bottom 2)LI Li (2015) [photograph] (Wuhan))

11. Recognition system (识别体系)

Diagrams:

A. House numbers

House numbers are formally used to identify a household. Usually, a logical order is being followed. However, in reality the order is not always logical. The special events in history and the rapid urbanization resulted in a shortage of accommodation in cities. As a result self construction was eventually recognized by the government and given a house number. The new inserted houses receive a number that follows the last number on the street. Therefore it is common to see a big number is in-between logical small numbers. For instance, we can find 24 in between 12 and 16. Thus, by reading the house numbers, we could gain understanding of the history and logic of urban development.

B. Symbols

A hairdresser shop or specific restaurants, such as KFC and McDonalds, are easily recognized by their universal symbols. In addition, public buildings and monuments are also kind of symbols on the city level. They help to recognize a city and unconsciously form a navigation system for people.

C. Everyday space

Citizens utilize everyday space and events as a landmark to orient themselves in the city. For instance, a street corner restaurant or a collective dancing place can be used as a landmark among neighbors who share a similar everyday experience. The everyday recognition system is dynamic. People layer it over time in their everyday life.

D. Sense

People's five traditional senses, taste, sight, touch, smell, and sound, assist their perception of a place. In time people associate their senses with certain locations. For instance, it is quite common that people always remember certain foods in their childhood, the smell and the taste of it. Ever since, when they smell something similar, they always relate it with their hometown. Then, their hometown is symbolized by a certain smell. These senses slowly build up our recognition system. They overlapped and interrelated. This is dynamic process as well, because it changes over time.

Practical implications:

Be aware of the above four ways in which people build up their recognition system. The first two might be relatively stable, whereas the latter two are quite dynamic. In urban design practice it is important to intentionally facilitate these on different scales.

12
Parasitism

is a physical coexistence as well as social and cultural co-reaction.

Relations

Practical implication

Set up a bigger structure in the built environment and give it time and space to let these happen.

A. Collective co-creation
B. Facade rhythm: attachment + extension
C. Transformation: inserting new functional space, therefore transforming the original form
D. Self construction
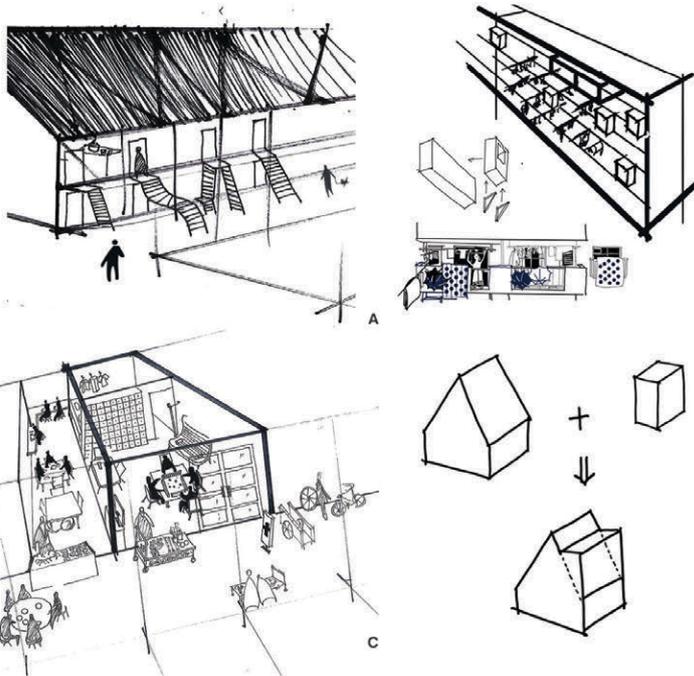
FIGURE 8.13 12. Parasitism (Pictures: MA, 2009)

12. Parasitism（寄生）

Diagrams:

A. Collective co-creation
This refers to the inhabitants' collective construction in the immediate environment. It comes from everyday experiences. Neighbors learn from each other. These constructions coexist and attach to each other. One does not happen not in relation to the other one. It reveals the logic of use.

B. Facade rhythm: attachment + extension
Due to the insufficient spaces inside the flat, the inhabitants tend to extend as much as possible. For instance, they build kitchens on the balconies with the stove section sticking out of the facade. Neighbors learn from each other. In time, these adding ups form alternated facade rhythm.

C. Transformation: inserting new functional space, therefore transforming the original form
When a new function is inserted in and parasitized on an original function, it not only changes the original physical spaces but also changes the public space around it. One of most illuminating examples is shown left bottom picture on the front page. It was a public toilet. In order to keep it clean and well organized, the municipality hired a cleaning lady to take care of the hygiene. The lady is often a city immigrant who is from the countryside, often has low income and has trouble finding affordable housing in the city. In time, her family moves to the city too. The need for more living space and a limited income results in a "house" on top of the public toilet. This not only inserted another function, living, to the public toilet, but also changed the original meaning of the toilet to the community and the street in front of it. The family uses the street as an open-air kitchen. When there is no rain, they cook outside and interact with neighbors. Other examples clinic (Section 8.3-7), hairdresser (Section 8.3-4), etc., are similar. They overlap their work and living. They often use the street and alley which the hairdresser shop and clinic is embodied in as their living room. There they cook and interact with neighbors.

D. Self construction (typology generator)
Inhabitants' self construction is born out of needs and everyday life wisdom. The outcome is often illuminating for designers. Based on the existing housing typology, in this way it often introduces a new typology in the city.

Practical implications:

Parasitism is a societal phenomenon that often appears in the areas where it has been used for a few generations. It often exists in the historical areas and urban villages in Chinese cities. Learn from the inhabitants' everyday wisdom. Set up a bigger structure in the built environment and give it time and space to let these happen.

13
From spectator to actor

To change from being passive to active and participative generates social experiences and links to lived stories. This adds meaning to spaces and creates orientation in the city.

Relations

Practical implication

Be aware of these places and design these to intentionally allow for such uses.

A. Linear connecting elements
B. Left over space
C. Marginal space
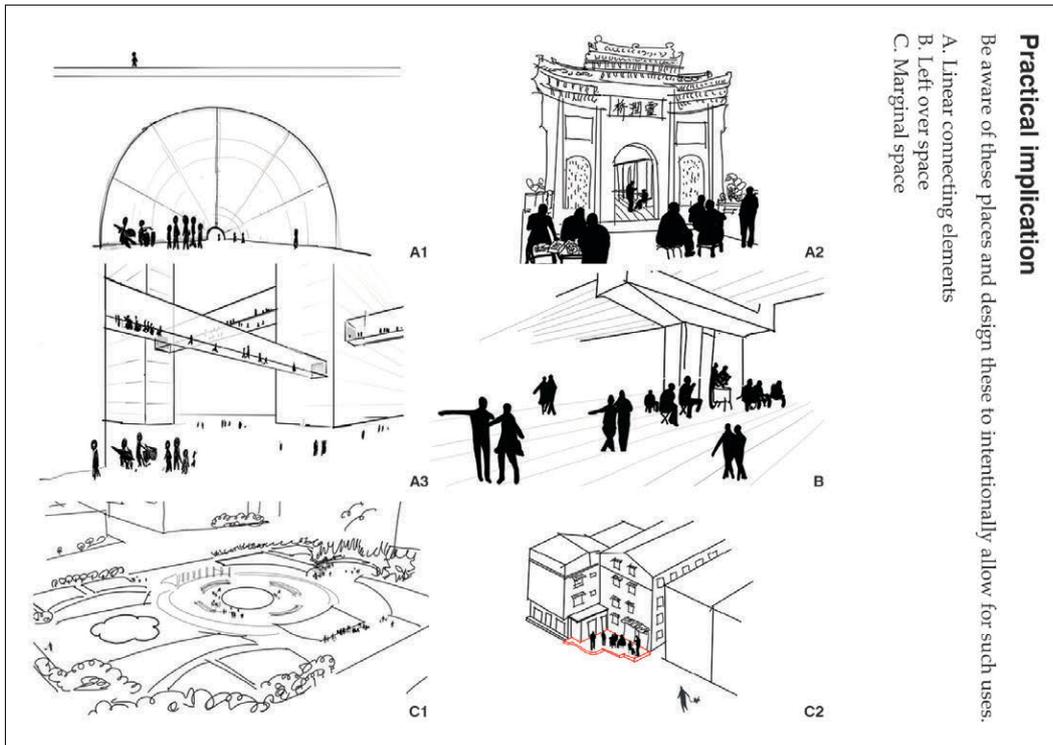
FIGURE 8.14 13. From spectator to actor (Pictures: LI Li (2015) [photograph] (Wuhan))

13. From spectator to actor （从观众到演员）

Diagrams:

A. Linear connecting elements

A1.Tunnel: actor + daily commuter
Tunnels in subways, under highways and ring roads, etc. facilitate lesser-known artist performances and interaction with daily commuters.

A2. Wind and rain bridge: local inhabitants + tourists
In the southern part of China, each traditional community had a wind and rain bridge. It functioned not only as a shelter when the rainstorm came but was also a public space in the community. Nowadays, the limited amount of preserved bridges has become a tourist attraction, while are still used as a communal place for the local inhabitants. The local inhabitants, usually elderly people, gather together during the day to exhibit and sell their traditional handcrafted goods or other items that represent the local culture to the tourists. In the evenings, when the tourists leave, they stay at the bridge, have dinner together and play cards with their neighbors. In this way, these inhabitants actively participate in and contribute to the promotion of their community. They become actors. A comparable example could be the street vendors that sit and sell on the busy pedestrian overpasses in the city.

A3. Corridor in between buildings
Dense office buildings are packed in metropolitan cities such as Hongkong, Beijing, and Shanghai. People run through corridors which connect different buildings. These corridors are like elevated streets. They not only facilitate the chance of working people actively participating in each other's structured everyday life, but also offer the possibility of seeing and being seen with people on the ground. This can also be done in residential buildings. The corridor that connects high-rise buildings can be designed as a communal space, bars, playground fields, etc. Steven Hall's Dangdai Moma in Beijing is a great example.

B. Left over space
Citizens claim left over spaces and transform them into their dance floors and performance stage. It offers 'the eyes on the street' and the citizens become the city safeguard (Section 8.3-2D).

C. Marginal space

C1. Margined space on city square and park
When local inhabitants appropriate the formal public space, such as a city square, they tend to occupy the corner or the edges. They usually dance, sing and do morning exercises there.

C2. Margined space on street
When individuals perform on the street, such as singing, dancing, yoga, skate boarding, etc. they tend to choose the street corner or the intersection of two sidewalks in front of shopping mall entrance.

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Practical implications:

Performance is not an elite action. Ordinary citizens are spectators and actors at the same time. The physical settings and the social atmosphere are important for the citizens improvisation, participation, and interaction. The characteristics of the spaces described above are not significant, important or inevitable space in cities. They are all margined spaces which are temporary, or being used differently from their original function temporarily. Maybe because they are less important and have been taken for granted enough that people feel easy going and no pressure to perform and show themselves. Citizens' performance is complementary to the formal performance in the theatre, concert hall, etc. The citizens are complementary to the professional actors.

14
Rituals

are self-organized social events that show the city as the life theater and demonstrate the essential meaning of everyday space.

Relations
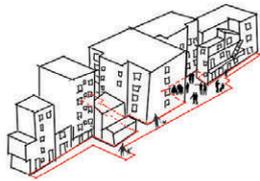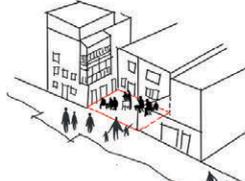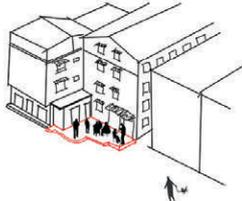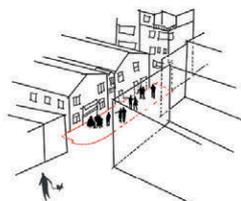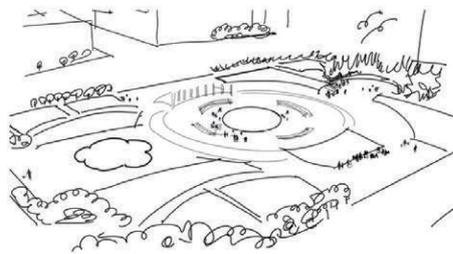
Practical implication

Make sure to design well-waved public space system to accommodate it.

A. Rituals in the interstitial space
B. Rituals in formal public space

FIGURE 8.15 14. Rituals (Pictures: (top) DENG, 2006; (bottom)LI Jingfeng (2018) [photograph] (Wuhan))

14. Rituals（民间习俗）

Diagrams:

A. Rituals in the interstitial space

Rituals are recurring social events organized by a specific group of people who are often from the same origin and share the same habits and culture. For instance, nowadays in big cities many city immigrants who are from the same region gather together every year on special days to conduct their religious and cultural events. These are often bottom-up events that often happen in the interstitial spaces that are spreading all over the city and link up streets and buildings (A1, A2, A3, A4).

B. Rituals in formal public space

In the contemporary city, square dancing, singing, taichi, etc. are very much present in parks and on squares. These events are often organized by a collective with people from diverse backgrounds and occupations who share a certain interest, and they have their own local organization. For instance, an everyday square dancing group may consist of government officials, university professors, small shop owners, and food vendors, etc. It is the dancing that brings these individuals together who rarely come across each other in their structured daily work. They often have a very clear task distribution, such as who is in charge of speakers, distributing news, etc. They gather together for the same benefit and goal on a regular basis. Actively participating in and appropriating the formal public space is a way to oppose the privatization of public space and reconstruct the meaning of public space through everyday practice.

Practical implications:

Rituals are like habits that people develop over time. These form community bonds and mingle different social groups. Make sure to design well-waved public space system to accommodate it.

15
Street and alley networks

create spatial hierarchies. They not only accommodate transport but also include a society composed of the families and businesses that exist along the sides of the network. Well-developed street and alley networks contain life styles and integrate with culture and customs.

Relations

Practical implication

Incorporating the local inhabitants in the design and implementation process and sharing the profit in the end.

A. Main alley network
B. Primary and subsidiary alley network
C. Fish bone parallel to the city river
D. 2T
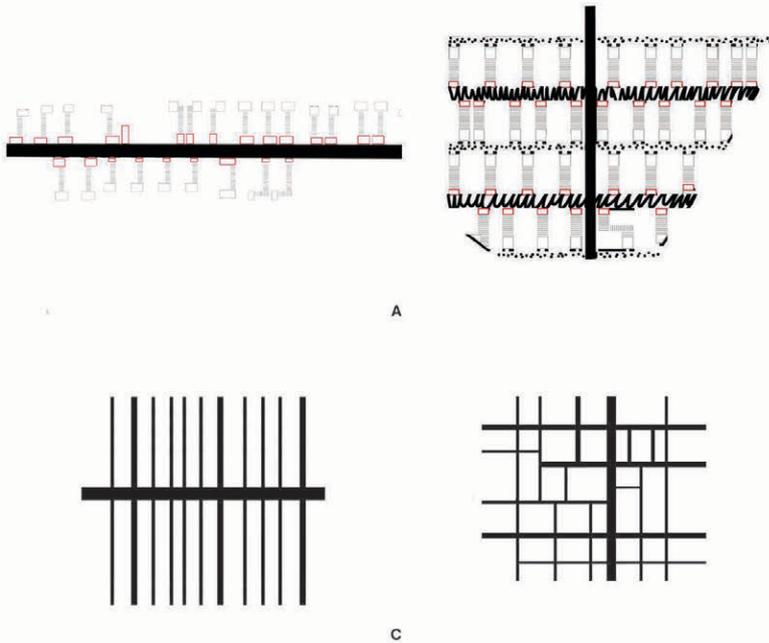
FIGURE 8.16 15. Street and alley networks (Picture: LI Li (2015) [photograph] (Wuhan))

15. Street and alley networks （街巷网络）

Diagrams:

A. Main alley network

The main alley network is a relatively simple network. The alley with two exits connects the two parallel city streets through the whole urban block. This network is usually applied when the plot is relatively small and contains only 20 to 30 housing units each. On either side of the main alley, the entrances and front patios of closely packed housing units are directly connected to the main alley.

B. Primary and subsidiary alley network (Fish-bone alley network)

The primary and subsidiary alley or fish-bone alley network is mainly used for row housing. The fish-bone alley network is the most popular network in Chinese traditional cities and usually adopted in the relatively big plots. The hierarchy of the alleys is distinctive. The primary alley usually cuts through the whole site. The subsidiary alleys are normally set perpendicular to the primary alley. There are two types: the front wide ones (usually 4.5 meters wide) connect the main entrances and front patios of each housing unit, while the narrow back ones (usually 3 meters wide) connect the back entrances and back patios of each housing unit. The layout of this network makes optimal use of the available land.

In the above two networks, along the alley, the front doors of houses are never directly opposite each other. Chinese FengShui believes that the front door is the access to the Qi in the family and if the two doors would be directly opposite each other that would affect the across street neighbors' health and disturb harmony. Aside from this, there are practical reasons of privacy. As such, this special arrangement of doors subtly mediates private and public space, as it preserves each family's privacy and enhances public activities in the alleys.

Most of the public life takes place in the main alley and the wide subsidiary alleys, around the intersection of the main alley and the subsidiary alleys, and at the intersection of the front patios and the wide subsidiary alleys. People gather together and play cards, mahjong and chat, etc. Most domestic activities take place in the narrow subsidiary alleys, such as washing, cooking, Chinese drying (Section 8.3-5A), etc. Even though the narrow subsidiary alleys are public space, they maintain a higher degree of privacy than the wide subsidiary alleys and main alley. The narrow subsidiary alleys connect to the back patios, where domestic activities normally take place. Because of limited living space, residents tend to gradually extend their domestic activities into the alleys.

C. Fish bone parallel to the city river

This fish-bone structure is different from B because it is mainly used in the inland and in the foreign concessions. The pattern C consists of long and big streets that follow the course of the rivers from a distance, and narrow alleys that are placed close together leading to and from the rivers. The further away from the rivers, the bigger the blocks are; the closer to the rivers the closer spaced are the alleys (Section 7.4.3-9). This is usually occurs along the main rivers in cities, which is quite usual in the southern Chinese cities like Wuhan and Guangzhou.

D. 2T (free growth urban structure)

The land along the course of the river often contained many ponds and flooded quite often. The direction of streets and alleys followed the natural condition of the river and ponds. The street and alley network seems messy and looks like free growth, but it has its intrinsic logic. It is often is a result of a few overlapping deformed fishbone structures.

The difference between C and D is that C's plot is long and narrow, whereas D's urban plot is more block-like. Furthermore, small businesses, such as selling cloth, tea, and other daily products, are placed in C in the long and narrow plot, in which the businessmen sell commodities in the shop in front and produce the commodities in the back. In contrast, D mainly accommodates storing and selling raw materials, such as coal and wood. The shops in D rarely produce.

Practical implications:

The street described above street and alley networks often developed over centuries. Most of the original inhabitants whose families had been living there for generations moved out and settled in the more modern neighborhoods in the city. Nowadays, these street and alleys mainly accommodate city immigrants and low-income citizens. How to improve the living condition and at the same time avoid gentrification is always a challenge. Incorporating the local inhabitants in the design and implementation process and sharing the profit in the end might be a good solution.

16
Public & Private

When public and private are superimposed and overlapped, the city accomplishes an extreme publicness.

Relations
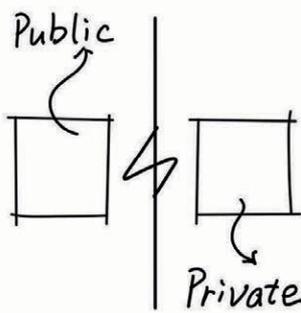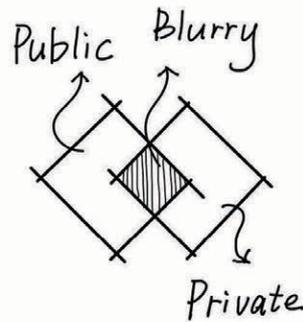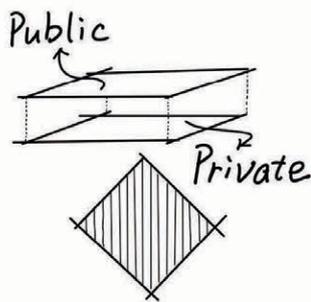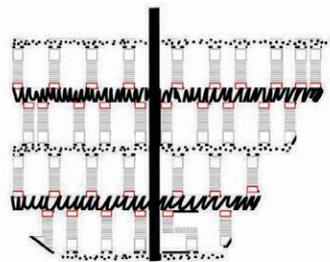
Practical implication

The relationship between public and private determines the urban form.

A. Absolute separation
B. Blurring boundaries
C. Super imposed
D. Gradual transition

FIGURE 8.17 16. Public and private (Pictures: MA, 2009)

16. Public and private（公共与私密）

Diagrams:

A. Absolute separation

In the modern cities, the public and private tend to be separated, especially in the case of gated communities and big shopping malls. This results in making the public even bigger and the private smaller.

B. Blurring boundaries

In some cases, the boundaries between public and private become blurred. They often tend to partly overlap: semi private activities happen in the public space. The second picture is a perfect example.

C. Super imposed

When the overlapping becomes extreme, the public and private are superimposed. Some extremely private activities happen in public space, such as people sleeping at the work place, people brushing their teeth and washing their face in the street, and people walking around in pajamas or even topless. Then there is no difference between public and private, and the city accomplishes an extreme publicness.

D. Gradual transition

In the traditional Chinese towns and the historical areas in the city, and in the mediaeval European cities, the relationship between public and private is gradual and transitional, from the higher levels of public to the private territory, from the main city square, to the public street, to the communal alley, eventually to private housing. The gradual transition from the public to the private facilitates control of social interaction and therefore of a sustainable livable environment (van Dorst, 2006).

Practical implications:

The relationship between public and private determines the urban form. Be aware of the above four types and design to accommodate B, C, and D.

17
Continuously varied borders

contribute to legibility, which supports the citizens' orientation in the city on a large scale, while it also facilitates space appropriation on a small scale.

Relations
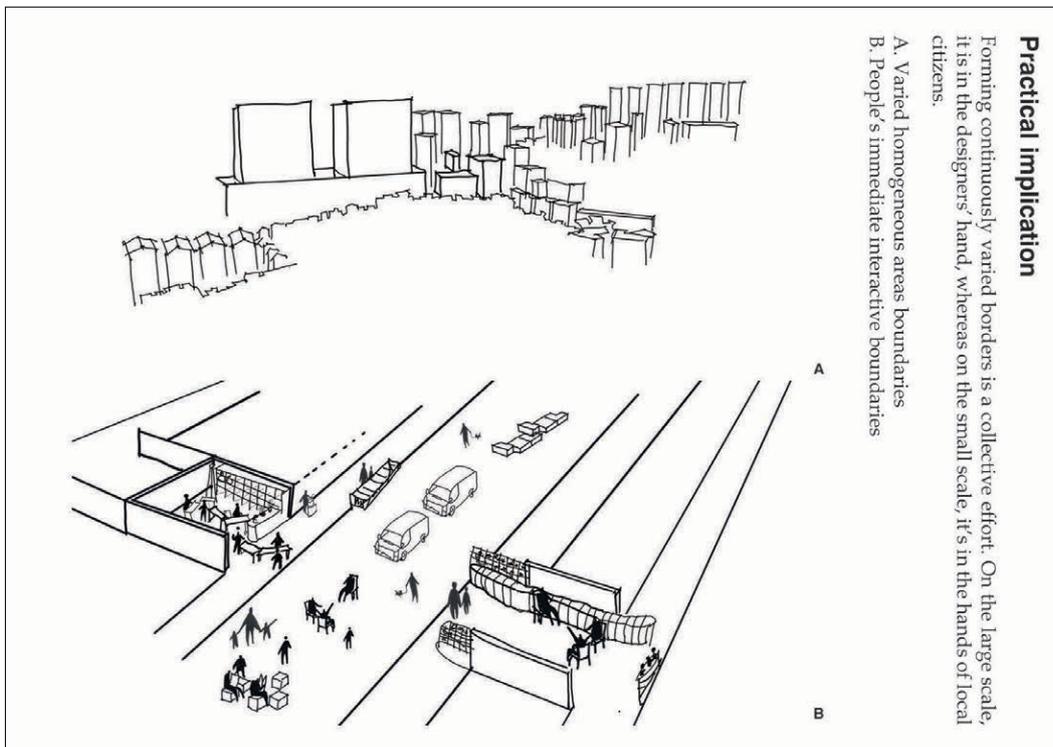
Practical implication

Forming continuously varied borders is a collective effort. On the large scale, it is in the designers' hand, whereas on the small scale, it's in the hands of local citizens.

A. Varied homogeneous areas boundaries
B. People's immediate interactive boundaries

17. Continuously varied borders （连续变化边界）

Diagrams:

A. Varied homogeneous areas boundaries

The homogeneous areas (CR5.3.1-3 and CR 5.3.2) boundaries, in each place they are different. Borders of big buildings, gated communities, danwei areas, and urban villages are different, not only in their physical form but also in the atmosphere they have. On the city scale, these borders are continuous and varied. The fact that they are varied is what makes the city legible and helps the citizens' orientation. Citizens explicitly experience these large-scale continuously varied borders, yet are not influenced too much by them. They are in line with the discus of designers.

B. People's immediate interactive boundaries

Objects and citizens often form small-scale continuous varied borders. They represent people's desire to have interactive urban boundaries and influence their living environment (Section 8.3-1B).

Practical implications:

Forming continuously varied borders is a collective effort. On the large scale, it is in the designers' hand, whereas on the small scale, it's in the hands of local citizens.

18
Inside out

The city is an inclusive living room where the inhabitants host guests and where passers by can interact.

Relations
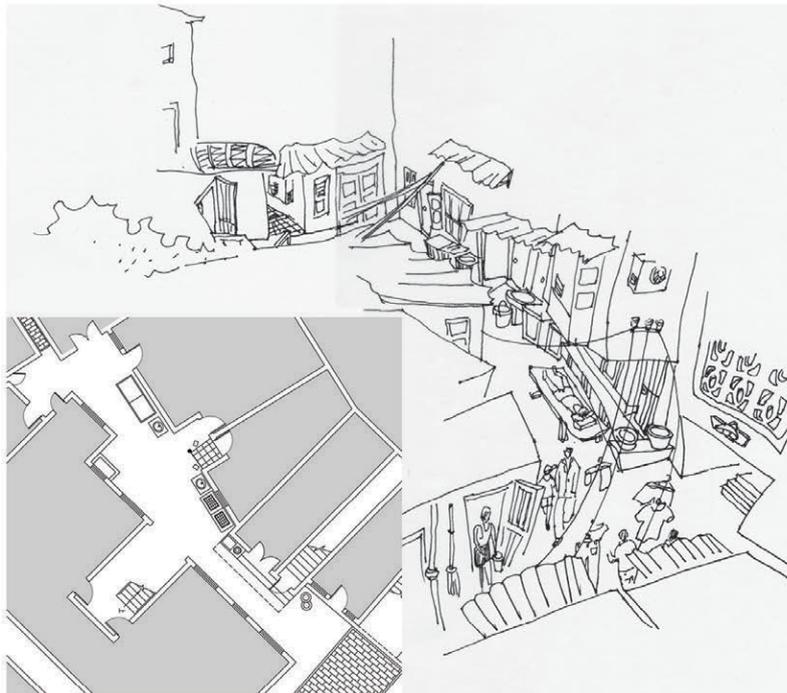
Practical implication

In the design of public space, allow for a recognizable hierarchy and in the design of the buildings for an open relation to the street.

FIGURE 8.19 18. Inside out (Pictures: MA, 2009)

18. Inside out（内翻外）

Diagram:

This often happens on the lowest level urban hierarchy, in the alleys and small streets that connect directly to the inhabitants' front door. In the historical area, often a few generations live together. The indoor living space is condensed and insufficient. Therefore many activities, which often happen on the living side of the facade, are externalized. The inhabitants cook, eat, take a nap, brush their teeth, play Majiang and cards with their neighbors, outside in the public space. The city becomes a collective living room.

Practical implications:

In the design of public space, allow for a recognizable hierarchy and in the design of the buildings for an open relation to the street.

TOC

19
Stairs

are cultural tectonics. They represent lifestyles often with non-intentional design.

Relations

Practical implication

Smartly used stairs in design allow for the rearrangement of spatial relations and possibilities of densification.

A. Overlapping + recreating function and space
B. Vertical rearrangement
C. Space generator
D. Ascending streets in between buildings
E. Communal alley scape
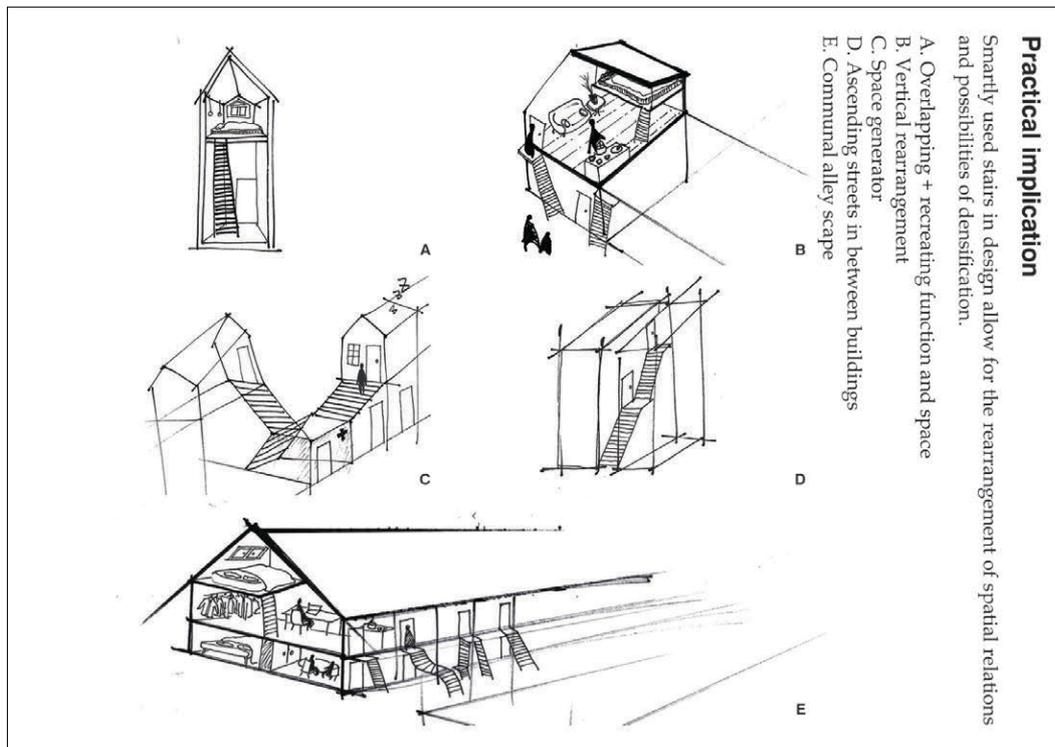
FIGURE 8.20 19. Stairs (Pictures: GONG, 2006)

19. Stairs （楼梯）

Diagrams:

A. Overlapping + recreating function and space
Existing spaces in a house of a building can be separated introducing stairs, that allows for the creation of a new layer with different functions. The amount of practical space and therefore the efficiency increases.

B. Vertical rearrangement
Stairs can provide the possibility to separate an individual house and offer space for a new household.

C. Space generator
New spaces and functions can be generated underneath the stairs, such as a communal clinic, or a small shop.

D. Ascending streets in between buildings
Different households can be connected using stairs. The stair is an ascending street.

E. Communal alley scape
Stairs can be designed in one row to occupy the entire alley. This is inhabitants' collective construction in the immediate living environment. These stairs coexist and are built in relation to each other. It eventually leads to a special communal icon and therefore a tightly bonded community (Section 8.3-12A).

Practical implications:

Smartly used stairs in design allow for the rearrangement of spatial relations and possibilities of densification.

20
Production space

is the result of social policies and economic needs. It is the driving force to reform residential and business spaces.

Relations

Practical implication

Consider keeping the spatial layout of factories and insert new functions, and consider keeping one or two production chains in the area.

A. Individual craftsmanship and family craft studio
B. A continuous production chain embodied in the streets and alleys
C. Concentrated factories
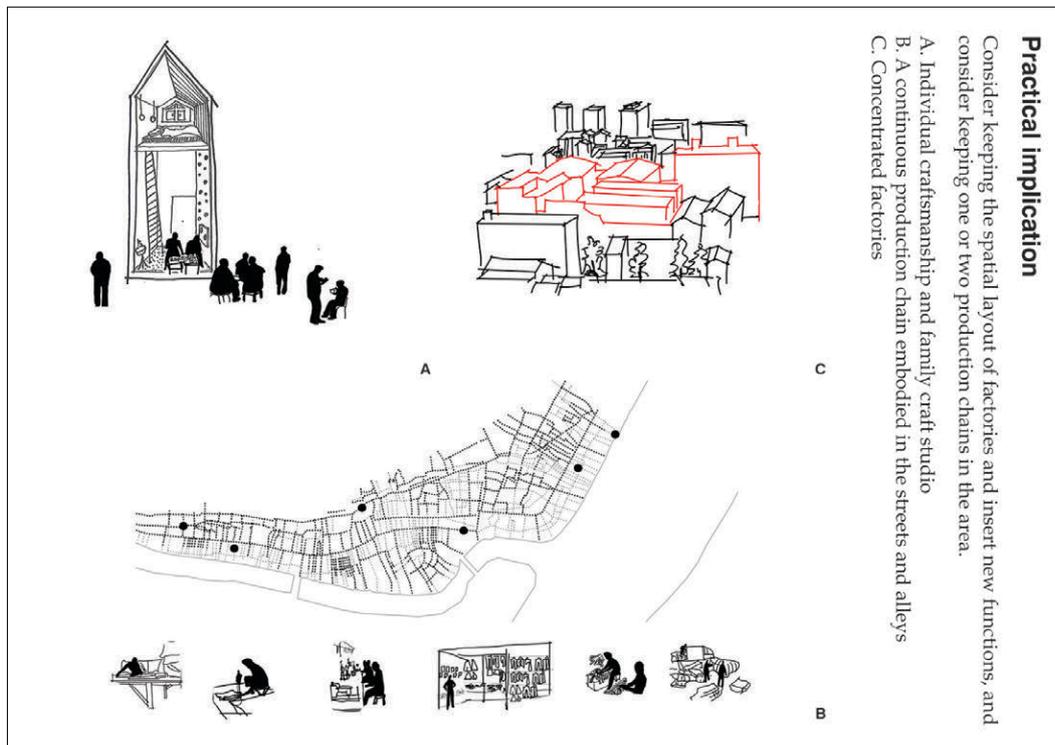
FIGURE 8.21 20. Production space (Pictures: QIAN, 2006)

20. Production space （生产空间）

A. Individual craftsmanship and family craft studio

Small craft studios, run by individuals and families, are usually integrated in the streets and alleys where private and public are superimposed. People do their crafts inside their own house or in front of their house on the streets. The crafting becomes part of the streetscape and the communal life. Customers come to check out the production of the goods, give input at any production phase, and they can directly buy whatever is finished. Producing, selling and living all happen in the same place.

B. A continuous production chain embodied in the streets and alleys

The above small craftsmanship businesses can run independently, but also run as part of a production chain, clothing is an excellent example. From pattern making to cutting, sewing, printing, ironing, trademarking, to finally selling in the local shop, or packing and shipping the clothes to other cities, it is a complete chain that is composed of different small craftsman studios run by different craftsmen and families. They develop trust and cooperation, and form a relatively stable production chain over time. These craftsmen studios are located in different streets and alleys in the area, but are not concentrated. Production and living are mixed, and there is a stable business interaction between different production studios.

C. Concentrated factories

Since the establishment of P.R. China in 1949, a few national policies, such as the Great Leap Forward, lead to enormous industries and factories. Many big communal and national factories are established in the Hanzheng Street area (HZJ). They are often located along the main street and occupy an entire plot or even more than one. Many of them broke the original urban tissue in HZJ. They have independent production spaces that are separate from their workers' life. Workers dorms or danwei areas often are not far away from those factories.

Practical implications:

Consider keeping the spatial layout of factories and insert new functions, such as culture and art studios. In the new development, consider keeping one or two production chains (explained in B) in the area and hire the original inhabitants to keep working there. It will keep authentic craftsmanship alive by acknowledging it as intangible cultural heritage, while at the same time attracting people from outside to the area.

§ 8.4   A pattern language (social structure)

§ 8.4.1   Setting up the workshop

FIGURE 8.22 Pattern language workshop with Dr. Van Dorst and Professor Bekkering. March 17th, 2017

Next to building up a pattern language by the author, a workshop was organized in TU Delft where Professor Bekkering and Dr. van Dorst[30] were invited to develop their own pattern languages based on the 20 chosen patterns (Figure 8.22). A further comparison on the working processes was also made. The goal of the workshop and the necessity of it in relation to the characteristics of pattern language as an approach, are explained as follows:

1   To test if all the individual patterns are clear, if some important aspects are overlooked, if any of them need to be split into two patterns, or if some of them can be combined into one. Because the individual patterns are developed from the author's interpretation of certain aspects of the built environment, a second and fresh check to see if they were well developed can be done effectively when other people are working with them.

2   Pattern languages that use the same individual patterns were used to make comparisons and invite discussion. Because individual patterns are interpretations, so are pattern languages. A comparison of different languages created a common ground while at the same time making different people's thoughts visible, complex and hidden relations explicit, and communication possible.

3   To reflect on different participants' working processes. Because a pattern language is also an interpretation, they are used differently in application. A comparison of different working processes can help to explore the possible contribution in urban design.

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[30]   Professor Henco Bekkering and Dr. Machiel van Dorst are the promotor and co-promotor of this Ph.D research. They contributed to the workshop by providing an angle from a professional urban designer and a sociologist point of view respectively.

The workshop lasted about two hours. The author explained the methodology and the 20 individual patterns in the first session. Then the participants worked individually to cluster patterns and build up their own pattern languages in the second session. The participants presented their interpretations in public and reflected on each other's work. The whole process was recorded by camera for discussion and script analysis later on.

The following questions are posted at the beginning of the workshop, asking the participants to pay attention to during the working process:

1. Do you understand all the patterns? Are any of them not clearly explained or not well presented? In other words, are the pictures and statements effective?
2. When you look at the patterns, have you tried to link the patterns with your own experiences elsewhere? Are these patterns generalizable? Can you find counterparts in your own culture?
3. When you work with these patterns, is there any moment when these patterns in one way or others stimulated your design ideas? When and how?

The results of the workshop are presented in section 8.4.2.

§ 8.4.2 Pattern languages

Figure 8.23 shows the pattern languages that result from the workshop and the author. This section describes each pattern language according to the working processes. Anchoring points, clusters, linkages and hierarchies of pattern languages are emphasized.
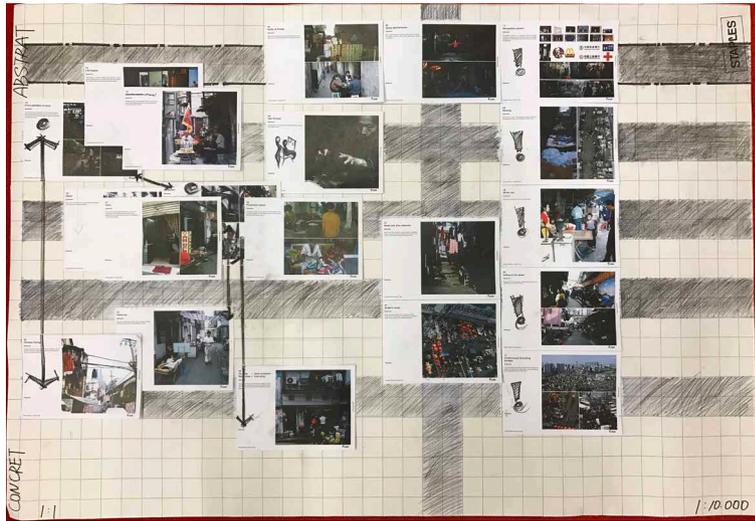
1-Pattern Language by author
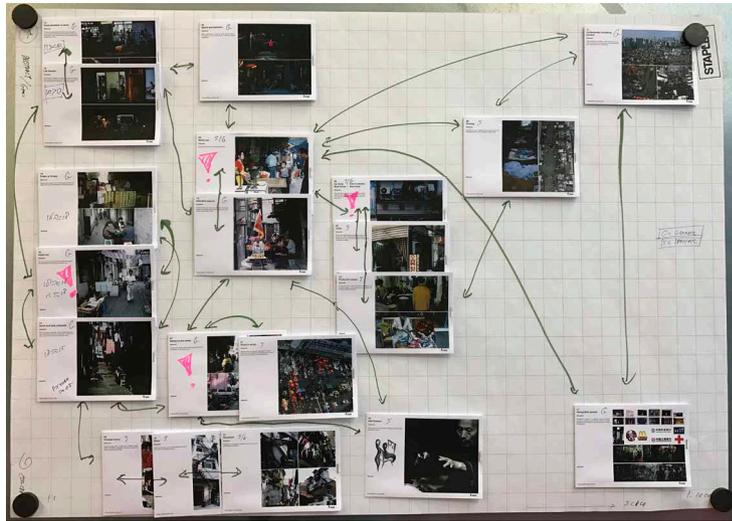
2-Pattern Language by Dr. van Dorst
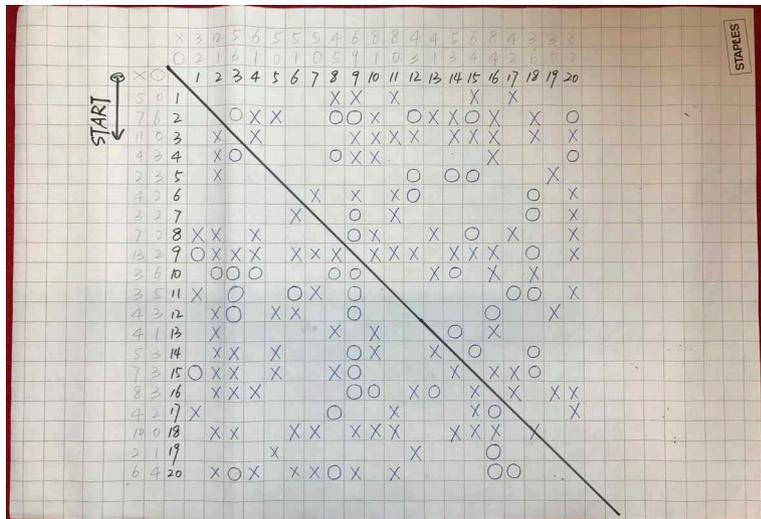
3-Pattern Language by Professor Bekkering

FIGURE 8.23 Three pattern fields

1. Pattern language developed by author. It uses the pattern field model from Delft school (Figure 8.23-1).

A first set of patterns[31] set the basis of the whole pattern field. Each of these patterns covered all scales but with different levels of abstraction. A comparison between them resulted in an abstraction order[32] (shown as a column in the pattern field). 'Abstract' and 'concrete' are always relative terms. The author primarily used two criteria: 1) the more abstract, the more interpretations are possible; 2) a social event or activity is more abstract than physical space. For example, *No. 11 Recognition System* is the core of urban design—people's orientation in the city and the legibility of the built environment, although different cities have different systems developed over different periods of time, and whatever is built and added to in the built environment influences people's recognition system, that is why it is put at the top. In addition, *No. 3 Eating on the Street* is an activity, an extra layer of interpretation is needed to figure out how it is related to space, whereas *No. 17 Continuous Varied Borders* is a pattern of concrete physical space which is more visible and understandable in relation to its meaning for the city. These first five individual patterns can be seen as anchoring points of this pattern language and they structure the whole field. They can be seen as the first level of hierarchy in the language. Here the author defines them as structuring patterns.

After setting up these five patterns, the other patterns were compared to them according to the level of abstraction, scale, and filed accordingly. While comparing and positioning, *No. 2 Space Appropriation* and *No. 16 Public vs Private* it turned out to be the umbrella patterns that covered all other patterns in this set. In working this way, the author became aware of the unconscious interests or implicit focuses applied when making the list. The patterns are chosen for their relevance to the relationships between the public and private, and all of them were about space appropriation. This demonstrated yet again that one of the advantages of pattern language as an approach is to make complex thoughts visible and explicit.

Once the positioning was more or less done, some clusters appeared. By making links and searching for relationships between individual patterns and among clusters, the hierarchy appears. In one cluster, one pattern (or a number of patterns) was crucial in linking to other patterns within the cluster, while at the same time linking to outside the cluster. For example, *No. 12 Parasitism* (on the left, smaller scale) links to *No. 19 Stairs*, and *No. 7 Clinic* (on the right, larger scale) links to *No. 20 Production Space* (more abstract) all the way to *No. 4 Hairdresser*. However, *No. 7 Clinic* is not necessarily related to *No. 20 Production Space* nor to *No. 4 Hairdresser*. They are positioned on three directions which come together as a cluster because of *No. 12 Parasitism*. Besides, *No. 12 Parasitism* also plays a role as a representative pattern of this cluster and links with other clusters. For example, by linking with *No. 18 Inside Out*, it bridges the relationships between its own cluster and the cluster consisting of *No. 18 Inside Out* and *No. 5 Chinese Drying*. As such, after the first five structuring patterns, together with *No. 18 Inside Out, No. 13 From a Spectator towards an Actor, No. 5 Chinese Drying, No. 6 Front Shop + Back Home; Up Sleep + Down Business, No. 12 Parasitism* forms the second level of hierarchy in the language. Here the author defined those patterns as joint patterns.

The two umbrella patterns mentioned above, *No. 2 Space Appropriation* and *No. 16 Public vs Private*, which represented this whole pattern field, can also be seen as joint patterns but on another level. They

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[31]   *11. Recognition system; 8. Flowing ; 9. Mix use; 3. Eating on the street; 17. Continuous varied borders*

[32]   One is more abstract than others.

link with other pattern fields, for instance dynamic transportation, e-commerce, etc., which together form city spaces on another level.

At the end, *No. 15 Street and Alley Networks*, and *No. 1 Street in Street* facilitate all the other patterns. They can be concrete as well as abstract. So they are positioned to form another axis in the language.

2. Pattern language developed by Dr. van Dorst with the same model (Figure 8.23- 2).

A first understanding and evaluation of individual patterns was done by making a matrix (Figure 8.24). It intended to evaluate each individual pattern on a rating scale, which contained 7 options. The right end is labelled the most general, whereas the left is the most specific.

Some of the patterns are more generic and some of them are more specific. The generalization or localization, the fact that if the pattern is context specific does not really help in the organizing process at the first place. Some things are applicable for other locations. Some are more context wise. Does not mean they are more or less interesting.

(Dr. van Dorst speaking at the workshop)

FIGURE 8.24 Working notes from Dr. van Dorst

FIGURE 8.25 Working notes from Professor Bekkering

After this first investigation some clusters appeared. The patterns that fall in a similar range on the scale bar tended to form a cluster. Then an attempt was made to set the clusters on an axis.

For instance, No. 5 Chinese drying, No. 19 Stairs, and No. 12 Parasitism all relate to density and adding to buildings, etc. There is a bit of scale difference but they are related. No. 20 Production space, No. 7 Clinic, No. 6 Front shop + back home; Up sleep + down business; one can facilitate the others.

(Dr. van Dorst speaking at the workshop)

While positioning the clusters in the pattern field, each individual pattern was put in relation with the others. There was constant questioning about if a certain pattern was relatively more abstract or more concrete than the other positioned patterns, or if one is larger or smaller in scale to the existing

ones. Dr. van Dorst defines abstract—concrete according to if a pattern has more abstract or concrete implications in the built environment; and defines scale as whether a pattern was more location specific or not.

After putting all these patterns in the right place, the linkages were made.

In the overview of this pattern field, some of the patterns could be seen as starting points or anchoring points in the total field. *"If we start from there, we can go everywhere."* (Dr. van Dorst speaking at the workshop) Anchoring points for Dr. van Dorst play a role as inspiration, from there he moved around and looked for relations with other ones.

There are mainly two reasons to choose them[33] as anchoring points: 1. They are fascinating in themselves. 2. They have relations with other ones. For example, Hairdresser itself is very interesting. However, there might be neighborhoods without a hairdresser but still functioning.

(Dr. van Dorst speaking at the workshop)

3. Pattern language developed by Professor Bekkering (Figure 8.23- 3).

Different from the above two pattern-field models, Professor Bekkering made his own matrix, starting from the list, looking at each pattern individually, and checking if it related to the others (Figure 8.25). Writing down the amount of links resulted in the pattern matrix (Figure 8.23-3).

Table 6.1 is the interpretation of the pattern matrix developed by Professor Bekkering. The first column states the relation between individual patterns and explains what kind of connections the formula is counting. A and B both stand for different individual patterns. The second column further explains the meaning of such connections regarding abstraction and importance of individual patterns, which indicates the hierarchy and the structure of the pattern language. The third column shows the rankings of the connections. The number between the brackets is the amount of connections that the formula is counting. It shows a few top rankings and last rankings with hidden lines in between to differentiate. Formulas 1 and 2 mainly address the importance and relevance of a pattern to the pattern field. In addition, formula 2 indicates the possibility of a pattern's abstraction level which needs to be double-tested in formula 3. Formulas 3 and 4 mainly reveal the hierarchy of the pattern language. This approach indicates that linkages have direction.

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[33]   The patterns with pink exclamatory marks on are the anchoring points. They are *9. Mixed use; 6. Front shop + back home; Up sleep + down business; 3. Eating on the street; 18. Inside out.*

FORMULA	EXPLANATION AND INTERPRETATION	RESULTING RANKINGS
1. A —> B A refers to B. The amount of connections A has	In general, the amount of connections a pattern has indicates its importance and relevance to the whole pattern field. If A refers to a lot of other patterns, it indicates that A is an anchoring point in the field which has a lot of relations with other patterns.	2. Space appropriation (12) 10.Life theatre (8) 11.Recognition system (8) 16.Public vs private (8) 20.Production space (8)
		1. Street in street (3) 18.Inside out (3) 19.Stairs (3)
2. A —> B A refers to B. The amount of connections B has	Next to the importance and relevance, the connections here might also indicate the abstraction levels of a pattern. If B refers to a lot of patterns, then B might be positioned at a relatively higher abstraction level. The opposite, if B refers to relatively fewer patterns, then B might be a relatively concrete and small scale pattern.	9. Mixed use (13) 3. Eating on the street (11) 18.Inside out (10) 16.Public vs private (8) 8. Flowing (7) 15.Streets and alley networks (7) 2. Space appropriation (7)
		5. Chinese drying (2) 19.Stairs (2)
3. A —> B, B -x-> A A refers to B, but B doest not refer to A. The amount of missing links (x).	If a lot of patterns refer to B, but B does not refer back, the amount of missing links indicates the abstraction levels B positioned. The more missing links, the more abstract B is. For instance, No.7 "Clinic" refers to No.9 "Mixed use", however No.9 does not refer back to No.7. No.9 "Mixed use" has the most missing links. It can be considered as the most abstract and umbrella pattern for this Pattern language.	9. Mixed use (9) 3. Eating on the street (6) 18.Inside out (7) 8. Flowing (5) 15.Streets and alley networks (4) 16.Public vs private (4)
		1. Street in street (0) 5. Chinese drying (0) 7. Clinic (0) 11.Recognition system (0) 19.Stairs (0)
4. A -x-> B, B —> A A does not refer to B, but B refers to A. The amount of missing links (x)	If a lot of patterns do not refer to B, but B refers back, the missing links might indicate the concrete levels B positioned. The more, the more concrete B is.	2. Space appropriation (6) 10.Life theatre (6) 11.Recognition system (5) 20.Production space (4)
		1. Street in street (0) 3. Eating on the street (0) 18.Inside out (0)

TABLE 8.1 Interpretation of pattern Matrix by Professor Bekkering

The above is an attempt to reveal the important individual patterns, the relations between patterns, and the hierarchy within the pattern language, but has not resulted in clusters yet. A further trial with program-processing by Gephi resulted in a database that visualizes the relations between patterns (Figure 8.26-1). The clusters of the pattern language appear when touching one of the nodes of the network. The other individual patterns which have connections with the chosen one are listed on the right side of the illustration (Figure 8.26-2).
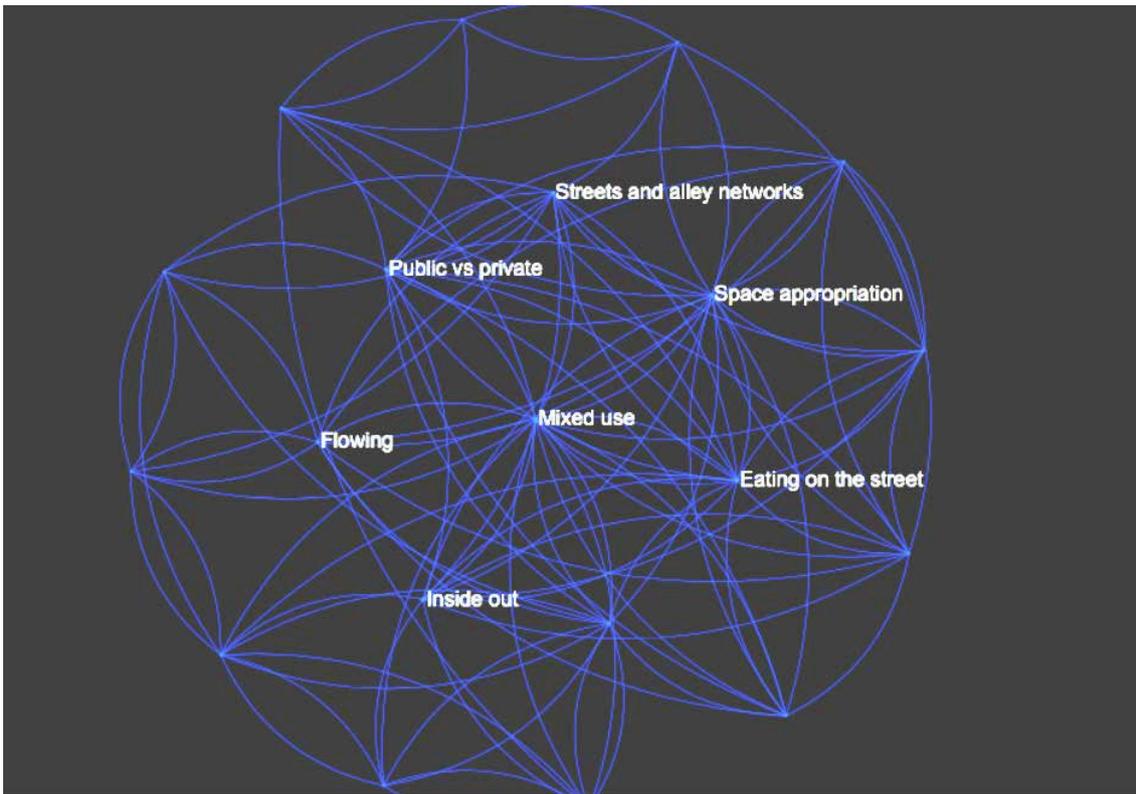
1-The pattern language visualization
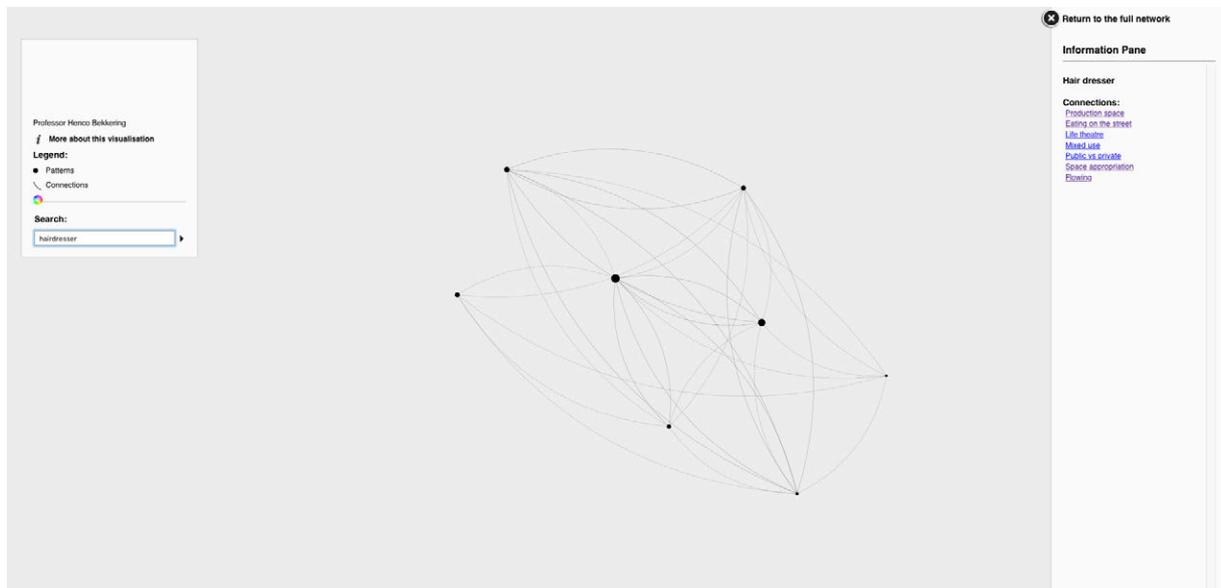
2-Individual pattern and its connection visualization (hairdresser)

FIGURE 8.26 Data base visualization from Professor Bekkering

267   Conceive the lived space: A pattern language of life style transformation—reveal the structure of public spaces

Comparison and discussion

This section reflects on the three languages. A comparison and discussion are made on the differences and similarities in the resulting anchoring points, clustering, and linkages of pattern languages. A further explanation on the roles of the above aspects is attempted.

1. The resulting anchoring points and their roles:

NAME OF PARTICIPANTS	AUTHOR	DR. VAN DORST	PROFESSOR BEKKERING
Resulting anchoring points	11. Recognition system; 8. Flowing ; 9. Mixed use; 3. Eating on the street; 17. Continuous varied borders 2. Space appropriation; 16. Public vs private 18. Inside out; 13. From a spectator towards an actor; 5. Chinese drying; 6. Front shop + back home; Up sleep + down business; 12. Parasitism	9. Mixed use; 6. Front shop + back home; Up sleep + down business; 3. Eating on the street; 18. Inside out.	9. Mixed use 3. Eating on the street 18. Inside out 16. Public vs private 8. Flowing 15. Streets and alley networks 2. Space appropriation
The role of anchoring points	1. Structuring elements—determine the logic and hierarchy of the pattern field. 2. Joint elements on different levels—intermediate elements to link up other pattern fields, link with other clusters, and link within its own cluster.	1. Inspiration 2. Joint elements — relate to other patterns.	1. Joint elements — the ones with the most connections with the other patterns. 2. Reveal the hierarchy of PL

TABLE 8.2 Resulting anchoring points and the role of them in the three languages

The resulting anchoring points by the author have three levels: the structuring patterns, umbrella patterns and joint patterns (see Section 8.4.2-1). They structure the pattern field as well as connect clusters. They can be considered patterns from HZJ. Though they are generated based on HZJ context, these patterns can be used and considered where else. Dr. van Dorst's anchoring points are the interesting and help raise the concept of where more patterns can be related, and from where he could find his path to approach the complex built environment (see Section 8.4.2-2). Professor Bekkering's anchoring points are the patterns that have the most connections. They can be used as a first set of design goals in the urban design process. Once the first design step is done, the other related patterns can be checked if the design accommodates them as well (see Section 8.1.3-2- Professor Bekkering's explanation).

2. The resulting clusters and their roles:

NAME OF PARTICIPANTS	AUTHOR	DR. VAN DORST	PROFESSOR BEKKERING
Resulting clusters	A: 10.Life theatre 13.From a spectator towards an actor 14.Ritual B: 19.Stairs 7. Clinic 12.Parasitism 4. Hair dresser 20.Production space C: 5. Chinese drying 18.Inside out	A: 13.From a spectator towards an actor 10.Life theatre B: 16.Public vs private 15.Streets and alley networks 18.Inside out C: 9. Mixed use 14.Ritual D: 3. Eating on the street 1. Street in street 20.Production space 7. Clinic 6. Front shop + back home; Up sleep + down business E: 5. Chinese drying 19.Stairs 12.Parasitism	No direct instant clusters, but could be revealed in the programming (Figure 26.6). It doesn't result in finite numbers of clusters. 20 clusters and either of them is part of other clusters, and none of them are completely isolated.
The role of clusters	Narrative	1. Scene 2. Test	Checklist

TABLE 8.3 Resulting clusters and the role of them in the three languages

The author sees clusters as a **narrative**. One cluster implies which way one pattern can generate another and in what way they are related. This is more from a design tool point of view. One individual pattern facilitates another. For instance, in the cluster A, *ritual* is a collective event which initiates the passive role of local inhabitants *from spectator to actor*, and further activates any place in the city as a *life theatre*. So if a design potentially facilitates *ritual*, then it is most likely it will also result in other patterns that are related to it. Another example, in cluster B, we can use *stairs* to generate spaces where a *clinic* or a *production space* could be located in (See individual pattern 19 – C). A *hairdresser* could also parasitizes on these spaces. This set of patterns together forms a cluster that can be named as *parasitism*. This cluster demonstrates exactly what Salingaros explains as coupling patterns (see Section 8.2.2-1) (Salingaros, 2000).

Dr. van Dorst interprets clusters as a **scene** which he perceives on the street. For instance, the cluster E shows how behavior influences what we perceive in the direct living environment.

By walking around, I see laundry hanging, I see stairs, parasitism. Then I understand that it is all about perceiving this densifying city and about how people shape the city towards their own behavior. Some of it is more durable and could stand for a longer time, such as some self-built houses on top of the roof. But others are more temporary, such as hanging up laundries. But these set of patterns are something when I walk around and when I see them, I feel this neighborhood is alive. There are people there.

Dr. van Dorst said in the workshop

Besides, he also sees cluttering as a process to **test** if individual patterns are appropriate for a certain task. Clustering means combining things. While working on that designers might interpret a pattern as too complex and it has to be spilt up. It happens especially when designers imagine how the pattern works in design practice. For instance,

Flowing is rather vague. It happens on all scales. So when I apply it I feel the need to split it up into two patterns, at the street corner level as well as on the city level.

Dr. van Dorst explained.

Different from Dr. van Dorst and the author, whose pattern languages have finite numbers of clusters and are visible on the pattern field immediately, Professor Bekkering's clusters need to be programmed to be visible. This was because he was not looking for clusters in the first place. He reflected in the workshop

there is such richness in differences of the individual patterns. So it is pretty hard to combine them but not hard to relate them. I had much more difficulties in grouping (clustering) than relating one to the other.

Once the connections are made, the intensity of it reveals the importance of individual patterns.

Then I would think, ok, let us see what I can do in the sense of designing public spaces to accommodate the important patterns.

In his language, those are *9. Mixed use, 3. Eating on the street, 18. Inside out.*

Then when I have done the beginning of design for it, or begin to understand what I would want to do, I would check all the patterns related to these important ones. I will check if the design would facilitate those as well or it would have to be modified in such a way that would work for those too.

From his explanation, we can see that there are implicit clusters that appear once the connections are made. He sees a cluster as a checklist that could ensure the resulting design does not exclude any of the individual patterns within the cluster.

3. Difference in the role of linkages:

NAME OF PARTICIPANTS	AUTHOR	DR. VAN DORST	PROFESSOR BEKKERING
Roles of linkages	Structuring elements reveal the hierarchy of PL.	Relations and path	Relations; the direction of linkage indicates the hierarchy of the language

TABLE 8.4 The role of linkage in the three languages

In author's language, the linkage has scales that indicate the hierarchy. The thickest black bars structure the whole pattern field as first level linkages. They connect the upper level individual patterns (the first level anchoring points) with the lower level ones. Then the bold black lines with arrows are the second level linkages, which connect different clusters. The linkages within each cluster are the lowest level.

The linkages in Dr. van Dorst's language reveal the complexity of the rich individual patterns and their relations. It seems like every pattern is related with other patterns in some way. At the same time, it shows every individual pattern's own path. The linkages do not have hierarchy or indicate hierarchy in the language.

In Professor Bekkering's language, the amount of connections indicates the importance of individual patterns. Furthermore, the linkages have direction and the direction indicates the hierarchy of the language. Please see explanation in 8.4.2, table 8.1.

§ 8.4.4   **Conclusive social characteristic: inclusiveness and its practical implication**
....

The richness of the above 20 individual patterns and the well-connected pattern languages developed by the three participants in the workshop show *inclusiveness* as the main characteristic of the lived space in Hanzheng Street area. HZJ has been a rather inclusive city over the last 500 years, and only partly still is today. Diverse groups of people in different levels of the society, different occupations, and from different regions could make a living and find their own position here. It is a social entity where collective life unfolds. The events, inhabitants, physical urban spaces, daily routines, everyday life, etc., connect, overlap, layer, and integrate all together. HZJ itself is a *life theatre* where local identity unfolds and new possibilities evolve.

The *Inclusiveness* manifests itself in three situations in the city in relation to the three types of homogenous areas on the metropolitan area scale of the city: compact urban tissue, strong internal structure, and crossroad [34](see Section 7.4.1-3).

1. The first situation: in the homogeneous areas that are defined as **'compact tissue'** — areas that have kept the traditional urban tissue—, most of these patterns still exist. Not only the physical forms but also these patterns represent the identity of the city. However, these areas have been facing the challenges of transformation while trying to keep their identity, such as Tanhualin (THL) in Wuchang and Hanzheng Street area (HZJ) in Hankou. In most of the cases, the areas are planned to either be replaced radically by a new CBD (HZJ), or to be restored with fake historical buildings and completely different (urban) functions (Jianghan road), or only regenerated the street interface (TanHualin), etc. These uncareful dealings have a big influence not only locally, but on the city scale.

2. The second situation: in the homogeneous areas with a **'strong internal consistency'** — areas have been built according to clearly recognizable design and have retained this characteristic—, the "form" and "time" matter regarding the existence of the above individual patterns. Either the from still facilitates these patterns, or even though the form does not accommodate the patterns at the beginning, if the environment is given enough time, the inhabitants adapt the environment according to their needs and as a consequence some patterns emerge.

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[34]   Below is an example of the combined effects of the two research approaches, as it uses the distinction between the three basic types of homogenous areas.

A   In the areas that were built according to the early Russian ideology — community, such as Hongshan square areas and danwei, most of the above patterns exist or represent it in other forms. It is mainly because Danwei contains the type of public space that is originally designed for communal use and thus accommodates these patterns.

B   In the areas that have been largely or completely transformed and areas that have been newly developed into economic and technological zones or large scale residential districts, such as Zhuankou, Guanggu and Liusu, etc, most of the above patterns have disappeared. This is because the newly built forms do not facilitate these patterns at all. The big footprint individual buildings with little relation with the surrounding buildings stand in poorly defined open spaces. The "thin skin" of buildings cuts sharply in the urban spaces to separate outdoor public spaces and interior privatised spaces. Not only the buildings, but also the actual urban design excludes these patterns. The plots are so huge and there are little sub-streets inside to allow patterns such as eating on the street for example. The outside roads are for cars, in most cases 6 to 8 lanes.

C   In the areas that are relatively new and have not yet been transformed in the processes of modernization, such as Yangyuan in Wuchang and Changfeng residential district in Hankou, the above patterns emerge slowly over time. Most of these areas were built in the 80s or 90s. As this is now 30 to 40 years ago, which in the rapid urbanization processes in China is a long time. Though the areas were not intentionally designed in the way to facilitate the above patterns, there is a great flexibility in people who actually adapted the areas to their needs.

3. The third situation: in the homogenous areas with crossroad(s) that also play the role of connecting to adjacent elements, either urban to nature or urban to urban:

A   In the areas that connect the urban areas to the lakes or mountains (Urban—Nature), the areas are mainly small villages or smaller scale high profile gated communities, the physical settings are extremely introverted which excludes most of the individual patterns developed above.

B   The areas between the urban built up areas (Urban — Urban) are mainly intercity small-scale housing projects. These are areas most of the time with less identity itself. They are located in the innercity of Wuhan. In this way, the city itself turns out to be the living room of the inhabitants who live in these areas. As such, the above individual patterns still exist, not literally in the areas itself, but in the city.

The possible application of *individual patterns*, *anchoring points*, *clusters* and *linkages* of pattern languages is listed to work towards *inclusiveness*.

1. Individual patterns

A. Constrained possibilities for urban design

In any project, try to set up a few connected individual patterns. "*The patterns do not determine the design. By imposing constraints, they eliminate a large number of possibilities while still allowing an infinite number of possible designs.*" (Salingaros, 2000, p. 152)

B. Diverse coexistence

In any project, the designer is trying to create an urban design that accommodates diverse patterns and sub patterns. Otherwise, if the individual pattern tends to shrink as one or two of it sub patterns, the pattern tends to become homogeneous. This raises the risk of losing the rich overlapping between individual patterns and reduce the possible connections. For instance, the current urban spaces (the big shopping mall) only accommodate C: *Concentrated hairdresser shop* of *NO.4 Hairdresser*. Then

the *NO. 4 Hairdresser* individual pattern tends to appear only as C. This implies the overlapping and connection with *NO.2 Space appropriation*, *NO.19 Stairs* and *NO.6 Up sleep+down business/Back home+ front shop* will disappear in time. Then these patterns, in theory, will become less relevant to each other; the whole pattern field will dissolve and the city falls apart.

C. Recreation: emergence of new patterns

The above individual patterns provide a basic dictionary for urban designers to understand and have a starting point. Designers can also create new space typology and urban form, which might facilitate new types of use and social needs based on the original patterns. Then new patterns might emerge. For instance, the D-Under infrastructure in the *NO.2 Space appropriation* shows due to the large-scale urbanization, a new type of urban space (the left over space under infrastructure) appears and it facilitates a new type of space appropriation (that reclaims the left over under infrastructure). Therefore, it is always a dynamic and open process.

D. Accumulation: grow your own design pattern library

Dealing with complexity in the built environment, designers learned to sharpen their skills overtime. They learn what to do to create results. The apprentice learns from the master more than from the book, as design is a learning by doing process (Cross, 2007). While working, some of the patterns turned out to be universal. One would use these in any assignment. They can be considered as patterns from HZJ. Though they are generated based on HZJ context, these ones can be used and considered elsewhere as well. Working with patterns, over time designers should be able to collect, which they can use in any assignment, any design projects they get. This can be seen as a starting point for designers to set up in their mind their own library. Of course, there is always discussion about how generic things can be. This is also one of the criticisms of *the pattern language* from Alexander (Dovey, 1990). People criticize it as difficult to use in specific locations. But they can be starting point and can always be made more specific.

2. Anchoring points

In any project, try to look for the anchoring points to:

A. Set up initial design goals

These anchoring points indicate the main intention of the design as well as the possible solutions to the major problems. Designing around them will give a first round design proposal to set up the main design strategies as well as the structure of design. Starting from there, incorporating other patterns, which these anchoring points connect to, can lead to adaptation of the design.

B. Inspire ideas: one generates another

Designing from these anchor points might inspire designers to look for other relevant patterns. Sometimes, these relevant patterns are already developed and sometimes not. Then more research or investigation is needed.

3. Clusters

"A set of connected patterns provides a framework upon which any design can be anchored"
(Salingaros, 2000, p. 151). A cluster can also act as a checklist for designers to make sure the resulting design does not exclude any of the individual patterns in the cluster.

4. Linkages

These linkages are not physical in the urban form, but in the designers' mind. In any project, make sure to develop a set up patterns which can be linked, otherwise, they are not relevant to this design.

§ 8.5 Reflection on working process:

§ 8.5.1 Recursive process when making individual patterns

When making individual patterns the steps explained in Section 8.2.3 are not rigid step-by-step linear processes. The later phases always assist to deepen one's understanding of the pattern itself and help to narrow down and set up focuses. Different people with different goals can always start from different points, too. For instance, one can also write the practical implications while making the list to give a first indication and focus. Starting from a practical implication is about setting up design goals. What is expected to be achieved in design then develops a pattern according to it. It reverses the processes from investigation to a solution-oriented approach. One can also start by selecting pictures which give a direct impression so as to set the first focus.

§ 8.5.2 Relating and clustering individual patterns

The relating and clustering of the individual patterns can make a pattern language. In other words, it is a way to understand the relation and reveal the structure of patterns. A comparison of the working processes from three people is shown in the following table. A further discussion is made afterwards.

JIAXIU CAI (AUTHOR)	DR. VAN DORST	PROFESSOR BEKKERING
1. An evaluation on scales and abstraction.	1. An evaluation on specification and generalization	1. An evaluation on the relations between the individual patterns.
2. Settle the structuring patterns resulting from the above evaluation in the axis.	2. Settle the clusters appeared from the above evaluation in the axis.	2. Make a matrix to have an overview of the relations between patterns.
3. Position the other patterns in the axis in relation with the existing patterns.	3. Make linkages.	3. Translate and program the codes in the matrix in Gephi to visualize the relations and set up a database.
4. Make linkages between the clusters that appear from the above steps.	4. Look for anchoring points which inspire ideas and have the most linkages.	4. Interpret clusters and hierarchy from the visualization

TABLE 8.5 Working processes when developing the three languages

Not only is the individual pattern an efficient format to organize and convey information, but also from the workshop we learned that by relating and clustering individual patterns the pattern language approach could allow for different dealings and grasping of abundant aspects and information by different designers. Three participants have different starting points and go through different paths towards a pattern language. Table 8.5 shows their own way of structuring and organizing information. The author thinks in layers and structure, Dr. van Dorst thinks with inspiration and relations, while professor Bekkering thinks with relations and provides a way to set up a data base. Though the working process is different, the resulting three languages are not contradictory. We could use the aspects and insights gained from the three languages in design practice. For example, the similarities in the pattern languages can be seen as shared aspects of an assignment, based on which possible common goals can be set. The differences in the pattern languages indicate that more clarity is needed, and discussions are necessary to mediate different interests among stakeholders.

§ 8.6   Recommendations for future research

This research is a first attempt to use the pattern language as a tool to translate people's everyday life into a design language. The workshop organized in TU Delft was an attempt to test and discuss the properties and characteristics of the pattern language approach when applied by different people. However, the sample in this research was only three people. A broader participation is recommended for future research. Participants from different cultural and professional backgrounds would also make it possible to discuss the individual patterns' generalizations and adaptations when applied in different contexts. Also, the differences and similarities in setting up the pattern languages by diverse groups of people could test the linkages, clusters, anchoring points' context and profession sensibility. This might provide more practical implications for design practice.

In addition, the patterns developed in this research are mainly about the relations between public and private. Broader themes are needed in future research, such as transportation, density, demography, economy, etc. This might make it possible for the city to set up an online data base which could assist any professions and even laymen to quickly understand the city and its sub-categories. A selection of a set of patterns from the database could also assist designers, or any other professions, to have a grip on the complex situation in the city, which makes work and communication somewhat simpler and more explicit.

§ 8.7   Conclusion

This chapter presents the research of life style transformation in Hanzheng Street area and the author has critically reflected the application of a pattern language approach along the research process to answer the sub research question 5 and its background questions:

Sub research question 5:

How can *the pattern language approach* assist urban designers in the urban design processes to achieve historical continuity?

Background questions:
1   How to use the pattern language approach to represent the everyday life style in the Hanzheng street area in Wuhan? (Section 8.2)
2   What are the representative individual patterns regarding the everyday life transformation? (Section 8.3)
3   What are the pattern languages of everyday life in the Hanzheng street area? What are the practical implications of the languages' properties? What are the everyday life characteristics of the Hanzheng street area? (Section 8.4)

This research is a first attempt to systematically use *the pattern language approach* to study public life in China. The Dutch interpretation of a pattern language approach is applied in particular by: 1, using individual patterns as an entity to organize and convey information from people's everyday life into design languages; 2, building pattern languages as a way to structure the complex social spaces as well as a way to communicate with others.

Section 8.3 presents the main result of the research: a pattern book consisting of 20 individual patterns. These 20 patterns are the representative life styles in the Hanzheng Street area, and traditional Wuhan in general. These are not patterns at a particular moment in the history, but patterns that show transformation. Each individual pattern has a few sub-patterns showing how the pattern transforms in time, or how new patterns emerge in time. These 20 individual patterns depict quite a rich Chinese authentic public life style and its transformation. They are dynamic and are developing forward.

The three pattern languages developed based on the above 20 individual patterns were the second result of the research. They reveal not only the possible structure of everyday life spaces of the area, but also, by doing so to reflect the properties and characteristics of *the pattern language approach* when applied by different people. Individual patterns, clusters of patterns, linkages and anchoring points are suggested to be used as handles for any urban design using this research. (Section 8.4)

The presented individual patterns and the resulting three pattern languages show that the current social spaces in the area are quite *inclusive*. Each individual pattern is quite diverse and most of its sub-patterns still exist in the city in some way. The individual patterns form clusters that relate to and overlap each other. However, due to the on going exclusive urban transformation model (to radically transform the area into a CBD and reallocate the inhabitants and businesses outside the city), some of the individual patterns have a risk of either disappearing totally or becoming homogeneous, shrinking to appear as one of its sub-patterns. This results in loosing individual patterns and reducing the diversity as well as the richness of a pattern language with internal linkages, clusters and hierarchy, with its social implications. If so, the city becomes an exclusive city that only works for certain groups of people and in worst case scenario a ghost city. (see Section 8.4.4)

Section 8.6 suggests more diverse participants, who are from different cultures and professional backgrounds, for further exploration of the characteristics of *the pattern language approach*. In addition, broader themes than only the *public and private* in this research are needed in the future, such as transportation, density, demography, economy, etc. It eventually proposes the possibility to accumulate patterns of different themes and build up an online data base for the city.

In the end, a critical reflection on the working process and working method indicates that:

1 When designers work with a pattern language approach they work on all levels of scales and of abstraction, but they have a clear tendency to work from smaller scale to larger scale and from concrete to abstract.
2 An individual pattern is a tool to organize and translate information, a pattern book is a toolkit, and a pattern language is an approach to structure complexity as well as a communication platform.
3 Individual patterns and a pattern language are interpretations. There is no single truth.
4 Individual patterns and pattern languages are reductions. They are heavily deducted from the real world. (It is up to the designer to decide what to show and not to show.)
5 Individual patterns and pattern languages are abstractions. They are external representations of designers' thinking.
6 Individual patterns and pattern languages provide a means for intra-personal and interpersonal communication.
7 The anchoring points (specific individual patterns) can be seen as structural elements (that determine the logic and hierarchy of the pattern field) and joint elements (that connect the cluster with patterns outside).
8 A cluster of patterns can be seen as a narrative, a scene, a test, as well as a checklist for urban design.
9 A linkage can be seen as a structuring element (that reveals the hierarchy of the pattern language) as well as relations between patterns.

Systemically and symmetrically presented together with Chapter 7, where *the morphological approach* is applied and urban form transformation is studied, Chapter 8 investigates the life style transformation by applying *the pattern language approach*. These two chapters provide the insights for further comparison and synthesis of the two approaches with urban design in Part 4.

PART 4 Synthesis and outlook

Part 4 has one chapter. It intends to synthesize the previous findings and discussions, conclude the research, and provide an outlook for future researches.

9 Synthesis and outlook

Research conclusion and discussion

The research was set in the current context that 55% of the world population lives in cities and is expected to increase to 68% by 2050. The future urban population increase is highly likely to be concentrated in a few countries; India, China and Nigeria are the top three in the list (United Nations Department of Economic and Social Affairs, 2018). The unstopped Chinese rapid urbanization pace and China's ambition to introduce its urbanization model abroad has led to unprecedented challenges for urban designers. It demands systematic design approaches that could assist designers to be as objective and precise as possible, to have a relatively precise and fast start, to quickly grip on new emerging topics in the constant changing situation, and to be efficient in communication with other professions and laymen.

Furthermore, as a consequence of the unprecedented urbanization pace and economic oriented development, cities in China have lost tremendous amounts of old urban tissue and consequently social structure. Fortunately, the awareness of the value of a local identity and the importance of the welfare of the marginalized group of urban population is growing. Distilling and incorporating the underlying determined elements in physical and nonphysical aspects of the city in urban design is an urban designers' inevitable responsibility. This research is focused on urban form and people's everyday life. This, too, demands systematic design approaches to do so.

Yet, the 'designerly way of thinking' and how designers approach design is usually implicit. Though design theory and methodology in the architecture and industrial design domain have been elaborated remarkably since the Design Methods Movement of the sixties in the last century, little attention was given specifically to the urban design domain. Aiming to contribute to the design study in the urban design domain, and responding to the above challenges and responsibilities that urban designers are undertaking, this research investigates:

How can *the morphological approach* in combination with *the pattern language approach* assist urban designers to achieve historical continuity in *urban design*?

In order to answer the above question, the research was set mainly in 2 parts, reflecting the two approaches on both theory and application levels. It first reviews and reflects the developments and application of the two approaches worldwide (the Part 2 in the dissertation), and then applies and reflects the two approaches in two respective cases (the Part 3 in the dissertation).

Part 2 consists of Chapter 2, 3, 4 and 5. They set up the context and build up the theoretical frameworks for the main elements of this research, *urban design*, *the morphological approach* and *the pattern language approach*.

Chapter 2 answers the first sub research question and its background questions:

Why is it necessary to preserve historical continuity in urban design and how can it be achieved? (Chapter 2)

Background questions:

1 What is urban design? (Section 2.2)
2 What is historical continuity in urban design? What are the inevitable components of historical continuity? (Section 2.3)
3 What are the characteristics of Dutch urban design? (Section 2.4)

Chapter 2 sets up the professional conviction and theoretical base for this dissertation. It distinguishes urban design from planning with its direct relation to morphology and different ways of thinking. It defines that urban design deals with all scales and it is a process that consists of analysis and synthesis (Lawson, 2006) as well as a well-presented end product that shapes the form of the city and the public realm. It concludes that in order to understand and respect the meaning contained in historical layers and carefully add another layer that contains contemporary meaning is the way to pass down and at the same time incrementally change tradition, resulting in historical continuity and thus in permanence in urban design. The chapter ends by pointing out the distinctive characteristics of Dutch urban design in the world, the integration of planning and design, and the integration of research and design. These characteristics provide the fundamental reason why the Dutch approach is emphasized and applied in this research.

Then the research goes into the two approaches respectively. In order to compare the two, *the morphological approach* and *the pattern language approach*, the research is set in a symmetrical manner. Therefore, the sub research questions, background questions and therefore the corresponding sections in each chapter are set symmetrically to facilitate comparison and reflection.

Chapter 3 answers the second sub research question and its background questions:

Sub research question 2:

How is the *morphological approach* used in the urban design process?

Background questions:

1 What is the morphological approach? What are the developments and application of it in different contexts? (Section 3.2)
2 What are the characteristics of the Delft morphological approach? (Section 3.3)

The investigation in Chapter 3 has established the theoretical foundation and understanding of *the morphological approach*. The overview on the three traditional morphological schools, Italian, French and British, and further developments in the Netherlands, the United States and China, together show that *the morphological approach* usually possesses a birds-eye view and focuses on urban form, its structure, and transformation. The Delft morphological approach's most representative characteristics— (a) reduction and (b) design and future oriented analysis— have been discussed as effective means to meet Chinese cities' current challenges— (a) the complexity of enormous scale and overwhelming size of the data, as well as (b) the ambition to develop forward with an unprecedented speed while keeping city's identity.

The overview and reflection on *the morphological approach* in Chapter 3 points out that next to the form itself, there are many other aspects of a city that need to be incorporated in the designer's conceptual domain, such as how people experience the city, how the inhabitants define their territory, and how the city can be understood from the eye level perspective. This gradually introduces Chapter 4 which introduces *the pattern language approach*.

Chapter 4 answers the third sub research question and its background questions:

Sub research question 3:

How is the pattern language approach used in the urban design process?

Background questions:
1 What is a pattern language approach? What are the developments and application of it in different contexts? (Section 4.2)
2 What are the characteristics of the Dutch pattern language approach? (Section 4.3)

The investigation in Chapter 4 has set up the theoretical foundation and understanding of *the pattern language approach*. The overview on the application of the approach in the United States, England, Japan, the Netherlands, and France together show that different from *the morphological approach* introduced in Chapter 3, *the pattern language approach* usually initiates from eye-level, small scale and more concrete scenery and then slowly builds up. It is often used as a translating tool to convey information from other domains into design. It is more an approach to structure information and communicate with other people, rather than merely focus on a certain content (either energy, form or human behavior, etc). The Delft pattern language approach's characteristics, (a) reduction, (b) translating, (c) communication and (d) open and facilitating changes, have been discussed as effective to suit Chinese cities' current situation. The current situation involves (a) the complexity of enormous scale and ample data, (b) the necessities to integrate multiple disciplines into urban design as well as to bridge research and design, (c) the necessities to effectively mediate complex stakeholders in the design process as well as (d) longing for flexibility to accommodate changes.

The above three chapters, 2, 3 and 4, have provided conviction for urban design profession, set up the context and built the theoretical frameworks for the main elements of this research, *urban design*, *the morphological approach* and *the pattern language approach*.

Chapter 5 closes off Part 2 by pointing out that *urban design*, *the morphological approach* and *the pattern language approach* deal with all scales though each has a different starting point. *The morphological approach* posses the birds-eye view and often initiates from large scale to small scale. *The pattern language approach* often holds a human eye perspective and initiates from small scale to large scale. Whereas, *urban design* can start from any scale and work with multiple scales at the same time.

The two approaches are both tools to assist analysis and synthesis in the urban design process. They both deal with *form*. *The morphological approach* focuses on urban forms, reveals form system and transformation. Whereas, *the pattern language approach* is more used as a translating tool to convey information from any other profession into urban design. It relates any domain to form. In addition, urban design works on public space and public space systems. The two approaches can be focused on public space and the public, but they can tackle broader domain than public realm.

The morphological approach and *the pattern language approach* provide means for urban designers to systematically recognize historical layers in order to distill the meaning in the physical and non-physical context respectively. Considerately adding another layer that contains the contemporary meaning (design intervention) to these recognized layers in order to pass down and at the same time incrementally change tradition. This results in historical continuity and thus in permanence in urban design.

The morphological approach can be used to interpret first space (perceived space) and convey its information into second space (conceived space), whereas *the pattern language approach* can be used to interpret third space (lived space) and convey its information into second space (conceived space).

These theoretical frameworks structure the following case study in Part 3 that consists of Chapter 6, 7 and 8. Chapter 6 gives a general introduction of Wuhan as background for Chapter 7 and 8.*Conceive the perceived space: Mapping urban form transformation-- reveal the structure of physical spaces* and *Conceive the lived space: A pattern language of life style transformation, reveal the structure of public spaces.*

Chapter 7 answers the forth sub research question and its background questions:

Sub research question 4:
....

How can the *morphological approach* assist urban designers in the urban design process to achieve historical continuity?

Background questions:

1. How can the morphological approach be used to analyze the physical urban form in Wuhan? (Section 7.2)
2. What are the urban form transformations of Wuhan on different scales (Metropolitan area scale, Inner city scale, Hankou riverside scale)? (Section 7.3)
3. What are the spatial structural elements of Wuhan on these three scales? What are the practical implications of the spatial structural elements? What are the spatial characteristics of Wuhan? (Section 7.4)

The *Mapping Wuhan* research is the first time a multi-scalar morphological analysis according to the Dutch method applied in a Chinese city. The Dutch reduction technique, defining homogeneous areas and additionally looking for secondary connections, and Geo-referencing and working backwards in time are the three main working methods. The research presents a timeline of 8 periods (starting in 1870) that condense towards the present (2013), as the city develops ever faster. (Section 7.2)

Section 7.3 presents the main results of the research: an Atlas consisting of four series of analytical maps. The transformations of the Inner city and the Metropolitan area are presented in historical order from 1870 to 2013. (see Section 7.3.1 and 7.3.2) By comparing the maps to one another, they show not only the growth of the city in time, but also the existence, importance, and sometimes the emergence or disappearance of spatial structural elements in the urban form. The next series shows the development of the urban spatial structure in sketches on a higher level of abstraction. (see Section 7.3.3) The analysis of Hankou riverside zooms in to the level of scale of a constituting part of the city that holds one of its important centers, including one of the three original Chinese towns out of which Wuhan developed, and the former Foreign Concessions. (see Section 7.3.4)

The research detects 13 spatial structural elements over three scales and concludes *fragmentation* as the city's main physical characteristic. (see Section 7.4) A short description of each spatial structural element with its meanings for the structure of the city as a whole, and their practical implication to the future city transformation and extension are enclosed. The research proposes that the homogeneous areas and secondary connections can possibly be used as handles for any urban design using this research.

Section 7.6 suggests that additional morphological analyses are needed on other levels of scale: the scale of the metropolitan region with its satellites cities as well as the relevant level(s) of scale for the location. In addition, a few aspects of the city ask for detailed attention, such as agricultural production and nature conservation, connected by ecology, water and water management, and green structure, both for its ecological and recreational aspects; the relation between urban forms and transportation systems and the reorganization of urban form through emergence of new centralities, etc.

In the end, a critical reflection on the working process and working method indicates that:

1   When designers work with the morphological approach they work on all scales and across scales, but they have a tendency to work from larger to smaller scale.
2   Mapping is a tool to conduct the morphological approach as well as produce a representation (product) of the research.
3   Maps are interpretations. There is no single truth.
4   Maps are reductions. They are heavily deducted from the real world. (It is up to the designer to decide what to show and not to show.)
5   Maps are abstractions. They are external representations of designers' thinking.
6   Maps provide a means for intra personal and interpersonal communication.
7   A homogenous area can be seen as a basic entity for form reduction, a structural element and a connecting element.
8   A secondary connection is a connecting element and as such a structural element.

Though Chapter 7 systemically represents the urban form transformation, detects the determined spatial structural elements, and shows the city's physical characteristics, other aspects are missing in the research, such as, how people actually use the physical space and how the life style transforms overtime. Chapter 8 is presented symmetrically to Chapter 7 to investigate how *the pattern language approach* can assist urban designers in the urban design process to achieve historical continuity.

Chapter 8 answers the fifth sub research question and its background questions:

Sub research question 5:
....

How can the pattern *language approach* assists urban designers in the urban design processes to achieve historical continuity?

Background questions:
1   How can the pattern language approach be used to represent the everyday life style in the Hanzheng street area in Wuhan? (Section 8.2)
2   What are the representative individual patterns regarding the daily life transformation? (Section 8.3)

3   What are the pattern languages of everyday life in the Hanzheng street area? What are the practical implications of the languages' properties? What are the everyday life characteristics of the Hanzheng street area? (Section 8.4)

This research is a first attempt to systematically use *the pattern language approach* to study public life in China. The Delft interpretation of a pattern language approach is applied in particular by: 1, using individual patterns as an entity to organize and convey information from people's everyday life into design languages; 2, building pattern languages as a way to structure the complex social spaces as well as a way to communicate with others.

Section 8.3 presents the main result of the research: a pattern book consisting of 20 individual patterns. These 20 patterns are the representative life styles in the Hanzheng Street area, and traditional Wuhan in general. These are not patterns at a particular moment in the history, but patterns that show transformation. Each individual pattern has a few sub-patterns showing how the pattern transforms in time, or how new patterns emerge in time. These 20 individual patterns depict quite a rich Chinese authentic public life style and its transformation. They are dynamic and are developing forward.

The three pattern languages developed based on the above 20 individual patterns were the second result of the research. They reveal not only the possible structure of everyday life spaces of the area, but also, by doing so to reflect the properties and characteristics of *the pattern language approach* when applied by different people. Individual patterns, clusters of patterns, linkages and anchoring points are suggested to be used as handles for any urban design using this research. (Section 8.4)

The presented individual patterns and the resulting three pattern languages show that the current social spaces in the area are quite *inclusive*. Each individual pattern is quite diverse and most of its sub-patterns still exist in the city in some way. The individual patterns form clusters that relate to and overlap each other. However, due to the on going exclusive urban transformation model (to radically transform the area into a CBD and reallocate the inhabitants and businesses outside the city), some of the individual patterns have a risk of either disappearing totally or becoming homogeneous, shrinking to appear as one of its sub-patterns. This results in loosing individual patterns and reducing the diversity as well as the richness of a pattern language with internal linkages, clusters and hierarchy, with its social implications. If so, the city becomes an exclusive city that only works for certain groups of people and in worst case scenario a ghost city. (see Section 8.4.4)

Section 8.6 suggests more diverse participants, who are from different cultures and professional backgrounds, for further exploration of the characteristics of *the pattern language approach*. In addition, broader themes than only the *public and private* in this research are needed in the future, such as transportation, density, demography, economy, etc. It eventually proposes the possibility to accumulate patterns of different themes and build up an online data base for the city.

In the end, a critical reflection on the working process and working method indicates that:

1   When designers work with a pattern language approach they work on all levels of scales and of abstraction, but they have a clear tendency to work from smaller scale to larger scale and from concrete to abstract.
2   An individual pattern is a tool to organize and translate information, a pattern book is a toolkit, and a pattern language is an approach to structure complexity as well as a communication platform.
3   Individual patterns and a pattern language are interpretations. There is no single truth.

4 Individual patterns and pattern languages are reductions. They are heavily deducted from the real world. (It is up to the designer to decide what to show and not to show.)

5 Individual patterns and pattern languages are abstractions. They are external representations of designers' thinking.

6 Individual patterns and pattern languages provide a means for intra-personal and interpersonal communication.

7 The anchoring points (specific individual patterns) can be seen as structural elements (that determine the logic and hierarchy of the pattern field) and joint elements (that connect the cluster with patterns outside).

8 A cluster of patterns can be seen as a narrative, a scene, a test, as well as a checklist for urban design.

9 A linkage can be seen as a structuring element (that reveals the hierarchy of the pattern language) as well as relations between patterns.

Systemically and symmetrically presented together with Chapter 7, where *the morphological approach* is applied and urban form transformation is studied, Chapter 8 investigates the life style transformation by applying *the pattern language approach*. These two chapters constitute the Part 3 where the two approaches are applied and reflected on in two respective cases. Together with the Part 2, where the application and developments of the two approaches are reviewed in the international context and reflected on, it provides insights and understandings to answer the main research question. Synthesizing and reflecting on the above conclusions and insights, the research concludes:

The morphological approach can be used to interpret first space (perceived space) and convey its information into second space (conceived space), whereas the pattern language approach can be used to interpret third space (lived space) and convey its information into second space (conceived space).
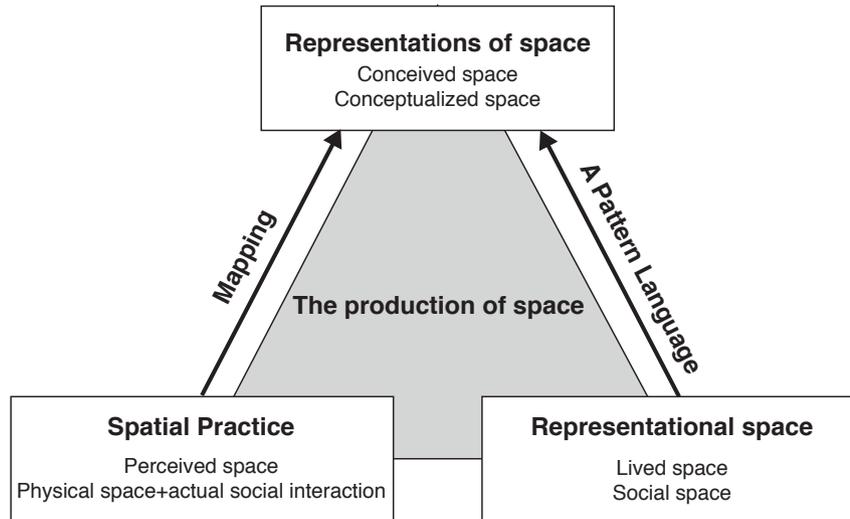
FIGURE 9.1 How the two approaches assist urban designer working through three spaces

§ 9.1.2 The morphological approach has a tendency to work from large scale to small scale and the pattern language approach tends to be built up from small scale to large scale, whereas urban design works with multiple scales at the same time.
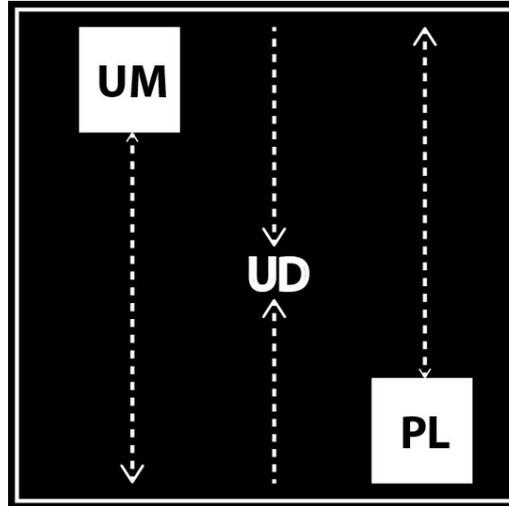
FIGURE 9.2 Working through scales

§ 9.1.3　The morphological approach and the pattern language approach provide means for urban designers to systematically recognize historical layers so as to distill the meaning in the physical and non-physical contexts respectively. Considerately adding another layer that contains the contemporary meaning (design intervention) to these recognized layers is the way to pass down and simultaneously generate incremental change in tradition. This results in historical continuity and thus in permanence in urban design.
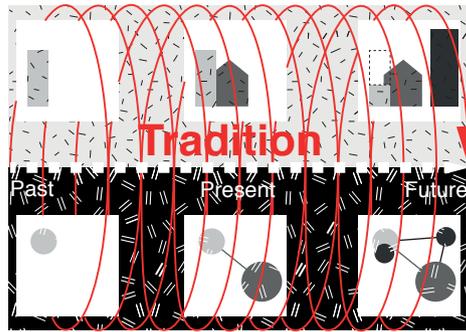
FIGURE 9.3　The permanence in urban design

The morphological approach, the pattern language approach, and urban design are processes in themselves and can be combined into one integrated process.

Figure 9.4, the integrated framework depicts the relation between urban morphology (UM), pattern language (PL) and urban design (UD). The proposed framework is inspired by Stephen Marshall and Olgu Çaliskan's paper < *A Joint Framework for Urban Morphology and Design* > that was published in Built Environment in 2011 (Marshall & Çalişkan, 2011). It proposed a joint framework that related urban morphology and design and discussed the nature and significance of the essence of the two and their relation. This research adds *The pattern language* into the discussion and proposes an integrated framework to relate urban morphology, pattern language and urban design (CAI, 2015).

Urban morphology is a static product. Whereas *the morphological approach* is the process of understanding, interpreting and representing the urban form and formation. The pattern language can be a final product and a few constructed pattern languages for a certain case. Whereas *the pattern language approach* is the process of developing individual patterns and building up pattern languages. Urban design can be the design product before implementation as well as the process of evidence based creative (re)organization of different urban elements. The three can be seen as three separate domains each with a different tradition; they can also be seen as parts of the same domain if we are able to make them work together.

The processes of UM, UD, and PL are shown in Figure 9.4. Both UM and PL perform as an act of cognitive interpretation of the real world, while design is an act of creative (re)organization.

UM1 shows that UM first goes from the physical reality of an urban fabric to the abstraction of urban morphology. Then that information is further reduced into different layers and the combination of different layers provides better understanding of the morphology or morphology in relation to other aspects if necessary. (UM2) Both UM1 and UM2 represent the morphological approach as a process to recognize urban spatial patterns, reduce and abstract information, and interpret and represent selected information. The actual act of creative reorganization (MD1) takes place to take away some of the forms and at the same time puts in new forms. It is a phase where UM results are seen as input and based on which UD is elaborated. MD1 is an experimenting phase in which different compositions and possibilities are tried. It can take more than one round (MD2) to arrive at a design product. From the final product, C1 is the phase of construction or implementation that converts design into the physical world. However, next to the above procedures that require professional skills, it is also possible to intervene directly in the real world, which happens quite often in the local communities. The local inhabitants, as laymen, do not have to go through all the above described procedures, the designers' abstract domain to intervene in the built environment. They can directly make and build something in the existing built environment that results in the future urban fabric (M1). This is called 'making' in Christopher Alexander's term (Alexander, 1979).

Similarly, PL1 is a process used to recognize and abstract the actual scenes from the real world and present into individual patterns. PL2 links and relates different individual patterns to in order to build up one or a few pattern languages. Both PL1 and PL2 are interpretations of the real world. Then PD1 eliminates some of the less relevant individual patterns and adds some new patterns. It also deconstructs as well as combines and clusters patterns. PD1 is also an experimenting phase in which a newly proposed network is generated. (PD2) Similar as C1, C2 is the phase of construction and implementation that converts design into the physical world. However, C2 only works on the small-scale patterns. For example, if a resulting individual pattern indicates how a communal square can be built. A direct implementation instructed by this individual pattern can be done in the physical world.

(C2) Nonetheless, large scale and relatively abstract individual patterns, and pattern languages cannot directly be constructed in the real physical world. It needs an extra converting step into physical form on different scales (S1,S2,S3).

Different patterns can be incorporated into different scales. The large scale and more abstract patterns often are integrated into the large scale or middle scale of homogeneous areas. (S1) Then the relatively small scale and more concrete ones can be converted into building blocks and urban form. (S2) The smallest and most concrete ones can be directly used to construct. They often appear on the scale 3, the immediate scale to human being. Though these patterns are converted into forms on different scales, they are not separated. They are connected and form a pattern language. Whenever any other professions' input is needed, this information can be translated into patterns and be integrated into the form. They together lead to a final design result which can be constructed in the real world. (C)

To summarize, in the implementation phase, M1 equals M2, indicating direct making in the built environment by the local inhabitants. However, C2 does not equal C1. C2 only works for the small-scale patterns which can instruct construction directly. Other patterns and the pattern language have to be integrated with UM.

The above are all 'open' processes. They are open in the sense that they offer continuous interaction within various realms of abstraction levels; as well as in the processes continual dialogue and discussion between the designer and different stakeholders is possible; in addition, 'open' also indicates the final result is unpredictable and leads to a unique result.

This lead to the question, where does the design start? Are *the morphological approach* and *the pattern language approach* only analytical tools for understanding and interpreting the reality and giving input that provides 'raw materials' to design? Then the design starts from MD1 and PD1? Or does the design actually start already at the phase UM1 and PL1 when designers are being selective and decisive on what is relevant and what not? Are M1and M2 also urban design? This framework could assist us to interpret UD in both broad and narrow views. In a broader sense, UD embraces all the processes shown in the Figure 7.4. Conversely, UD can also be interpreted in a narrow sense, including only MD1, MD2, PD1 and PD2. These are the phases that demand mastery professional skills and occur in the designers' abstract domain before the implementation in the real world. The above pre-assumption excludes M — direct intervention in the built environment (Curry, 2017). Then this implies that the UM1, UM2, PL1 and PL2 are inevitably essential to design. These would be necessary ways for designers to get input and even have a chance to bridge to design. The above argumentation shows that in either way, the UM and PL are inextricable from UD. They are either the prerequisite of UD (narrow) or they are an integral part of UD (broad).

The abstract domain

form+operation+performance
individual pattern, a pattern language

The physical world

Human behavior,
and the spatial settings

The Pattern Language

The existing built environment

The Urban Design

The future

The Urban Morphology

The existing urban fabric

Forms, spatial patterns, types,
hemogenous ares, etc

The abstract domain

the building/lot, the street/block,
the city, and the region

The physical world

FIGURE 9.4 Integrated framework relating urban morphology, the pattern language and urban design

The morphological approach, the pattern language and urban design are characterized by reduction, abstraction, interpretation, and communication.

1. UM, PL and UD as reduction

The concept of '*reduction*' is taken from the term '*reduction drawing*' used in the Delft School of morphological analysis. It means to reduce the amount of visual information in a complex situation in order to better understand the main formal structure or structuring system (see Section 3.3.2).

Not only UM, PL and UD also act as a reduction.

The first development of a few patterns or making the pattern list is the first attempt to set up focus and have a grip on the complex urban environment. There is always enormously more information and aspects for designers to process and incorporate. However to reduce the complexity, convey the useful information and organize them in a structured format making individual patterns must be a reduction.

UD cannot solve everything by itself. The themes and elements dealt with in the process are selected. These are based on client's request and designers' personal, political and professional experiences and intuition. The degrees of reduction and the capacity to abstract information affect the complexity and efficiency of the design process and the accuracy of the final product.

2. UM, PL and UD as abstraction

Figure 9.4 shows that UM, PL and UD all take a step away from the physical world to work on a more abstract level. UM is firstly a projection, a 'shadow' of the real world (Marshall & Çalıskan, 2011). PL can be seen as an abstract network of scenes of the real world. A design can be seen as a 'fore-shadow' as well as 'pre-scenes' of a future reality. The interpreted urban forms (after UM1) and patterns (after PL1) from the real world and the design products before implementation in the real world (before C1 and C2) are conceived via mental construction in the designers' abstract domain (representations of space). They need to be communicated and represented via the process of mapping and constructing a pattern language, from Soja's 1st and 3rd space to 2nd space (see Chapter 5-3 and Figure 5.1).

3. UM, PL and UD as interpretation

UM, PL and UD are all interpretations. Protzen argued that patterns are mostly not falsifiable and have less empirical content in the scientific sense (Protzen, 1978). All three methods are not hard science and the processes as well as the outcome relies heavily on interpretation which is subject to direct individual and professional experience. One might question if so, does that mean different people will come up with totally different processes and results? The answer is no. Indeed, there will be differences but not entirely different. The workshop with students in defining homogenous areas in Hankou Riverside shows that there are little discussions on some small differences but not on the overall understanding of the structure (Section 7.4.3-9). These small differences are useful, because they raise discussion and indicate that certain areas are interesting and need more attention and more detailed research. These differences in understanding and interpretations also happened in the workshops and seminars with local authorities. However, the bigger picture and the common understanding is dominance. These are the shared profession and common sense. In general, UM

is more objective than PL in the sense that it shows how urban forms are and how they transform. Whereas, what to show through individual patterns already has stronger personal bias. For instance, the Delft school of PL is more optimistic, because in most scenarios it shows possibilities (what might work), whereas Alexander posts problems (see Section 4.3.1). UD too, cannot be proven, even if it is realized. We can only make some researches afterwards and then conclude something has worked out well or not.

4. UM, PL and UD as communication

UM, PL and UD are communication tools among professionals as well as with laymen.

Communication with professionals:

No doubt the three are visual communication tools among professionals. Reading maps and recognizing spatial patterns, and working with forms are what designers are trained to do. Make individual patterns to externalize and explicate running ideas. Building pattern languages together shares an understanding and raises discussion for further development in urban design. The above are trained skills for designers, therefore these two approaches provide means and set up common ground for designers to exchange ideas and communicate. Whereas UD is a communication tool on another level, among different disciplines, that understands the dynamics in the city and explores the future.

Communication with laymen:

UM attributes to the mastery of professional skills which sounds elite and is less accessible to the public. Analytical maps and diagrams might be too far away from daily life and too abstract for laymen to understand. However, there might be ways around it. For instance, to make heavy degree of reduction of maps and associate them with local knowledge, such as names of the streets or local history, can make it understandable for laymen. In the end, the communication based on maps are starting point of design processes with laymen and stakeholder.

Next to the fact that PL can efficiently be used among designers (see Section 8.4), it is also a tool for designers to communicate with laymen and invite public participation. As designers we do not impose or force our thoughts on people, but we invite other people's opinions. Designers can use PL as a tool to invite public participation. Imagine a situation where we, together with laymen, different stakeholders and clients in a community, have a design proposal and we want to ask them if they like or not. Their opinions and preferences are of course invited and encouraged. We can formulate the proposal in different patterns and ask people to do the following exercise. Put the set of developed patterns on the wall and distribute one green and one red marker to the public. The participants are asked to read the patterns one by one carefully, to choose the patterns they like and mark with green color, as well as to choose the patterns they dislike and mark with red color. Afterwards, discussions and reflections are organized. If we have a pattern with the most "likes" this makes it clear that people accept certain ideas. If we have a pattern with half likes and half dislikes, this invites debate. If we have a pattern with most dislikes, this invites argument or it is made very explicit that people do not like that certain idea. For instance, we propose we will change the communal garden to an entrance square in front of the future shopping mall of the neighborhood. The inhabitants might all dislike such an idea. This way, the designers detect the wishes of the laymen and are able to show this explicitly to the developers. Consequently, it is also smart to develop some patterns that might cause conflict. We

can even leave a blank piece of paper and invite people to contribute. To sum up, there are mainly two roles for patterns: designers can make a pattern book for themselves and their design partners, with whom they can share ideas and use as a design tool. Designers can also develop patterns to discuss, debate, argue, communicate, and create a common ground for those involved (different stakeholder and laymen) (CAI, 2015).

The above descriptions have shown how the two approaches work as communication in the urban design process. Furthermore, the urban design products can be communicated with laymen through perspective renderings, both bird eye perspective and human eye level perspective. Written and spoken texts are also necessary in the communication. This is because laymen are often not trained to read maps and drawings. Nowadays new technology, such as virtual reality (VR) and augmented reality (AR), could also assist laymen participation.

§ 9.1.6   **Some properties of the two approaches can be seen as counterparts, because the roles these properties play in the design process tend to be similar: Individual homogeneous areas vs Individual patterns; Structural homogeneous areas vs Anchoring points/ Structuring patterns; Secondary connections in homogeneous areas vs Linkages between patterns; ?/ Typology of homogeneous areas vs Clusters of patterns.**

This effort looking for common ground of different approaches can be inspiring for interdisciplinary researches and urban design practice. City is complex and a socially responsible urban designer has to incorporate different aspects and disciplines, especially related to, economics, politics, transport, and geography. These disciplines usually have totally different ways of thinking, handle different kinds of data and deliver different types of results. To make them more relevant, accessible and applicable for urban designers, structuring the information in the above way might be a way out. (Figure 9.5)
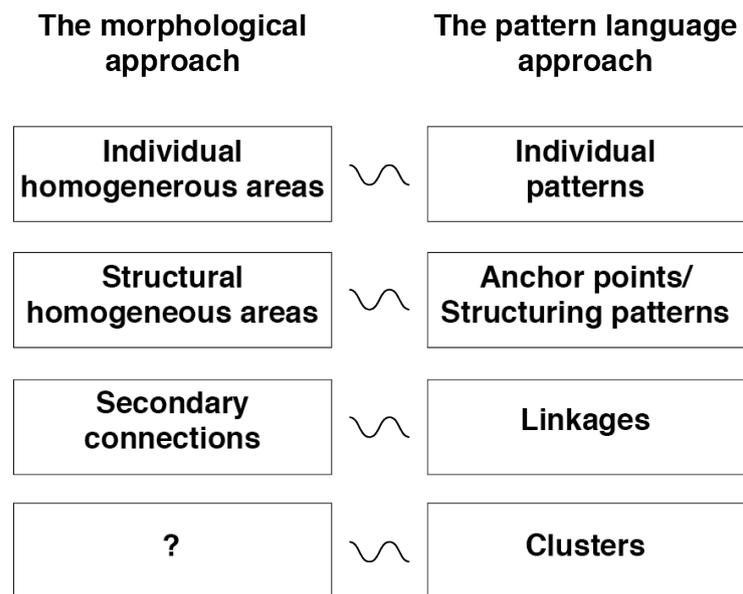

FIGURE 9.5 The counterparts in the two methods

1. Individual homogeneous areas vs. Individual patterns

1. Both are used as basic entities to reduce and organize information.
2. Both are identified for further structuring.
3. Both are joint elements that link one scale up and one scale down.
4. Both are connecting elements, together with the other homogeneous areas, and individual patterns on the same scale make up the whole city or pattern field.
5. Further identify different types/categories to correlate with each other. Such as in Section 8.4.4, different types of homogeneous areas accommodate different kinds of individual patterns.

The detailed explanation on homogeneous areas and how homogeneous areas aid UD is shown in Section 7.4.2-1 and 7.4.4-1&3&4. Whereas the individual patterns and its practical implication is shown in Section 8.2.2 and 8.4.4.

2. Structural homogeneous areas vs. Anchoring points/ Structuring patterns

1. Play their roles as structural elements anchoring the urban structure and public life (or any theme) structure respectively
2. Play as nodes that determine the characteristics on the large scale
3. Both are joint elements that link one scale up and one scale down. (Same as the above C)
4. Both are connecting elements, together with the other homogeneous areas, and individual patterns on the same scale make up the whole city or pattern field. (Same as the above D)
5. The anchoring points PL can also be an inspiration for designers as a starting point to explore the interests and focuses in design (see Section 8.4.2-2). Whereas, next to inspiration, the individual homogeneous area and a set of homogeneous areas of UM indicates city development and intrigues further research (see Section 7.4).

The detailed explanation on structural homogeneous areas is shown in Section 7.4.1. Whereas the anchoring points and its practical implication is shown in Section 8.4.3 and 8.4.4.

3. Secondary connections vs. Linkages

1. Both are structural elements that determine the hierarchy of urban structure and pattern field.
2. Both are connecting elements, though in UM secondary connections indicate real connections in the physical world whereas in PL linkages are virtual, meaning designers build them in the mind.

The detailed explanation on secondary connections and how secondary connections aid UD is shown in Section 7.4.2-2 and 7.4.4-2, where linkages and its practical implications are shown in Section 8.4.3 and 8.4.4.

4. ? vs. Clusters

The author finds it difficult to find the counterpart of clusters in UM. The results from the PL workshop in Section 8.4.3 shows that the clusters can be a narrative, a scene, a validation process of individual patterns and a checklist. However, seems there is no property in UM that has similar functions. The reason might be that by nature these two approaches have different cores and starting points. In UM, designers systematically take the city apart and scale it down. In contrast, PL starts with small sound

bites and scales up towards a city. That is why clustering is necessary and it is part of the building process. If we are forced to represent a counterpart from UM, it might be something like a structure that a set of homogeneous areas form. Furthermore, the method used in the Mapping Wuhan project distinguishing three different types of homogeneous areas and showed the distribution of them in the city is showing clusters. It is not literally the same as the clusters in PL, but it shows similar ways of design thinking. In addition, the clusters in PL are more meaning related and less scale dependent. Though a cluster can be detected and formed according to individual patterns' scale and abstraction, the cluster itself does not indicate any scale. However, the structure in UM does. In the end, maybe there is indeed no counterpart in UM as clusters in PL. This might be another difference between the two[35].

§ 9.2   Outlook: limitations and recommendations

Alexander (1979) states:

Many people find it hard to make their design ideas precise...[and]... are unwilling to express them with the precision needed to make them into patterns. Above all, they are unwilling to express them as abstract spatial relations among well-defined spatial parts.

and

it is at least as hard as anything in theoretical physics."

(Alexander, 1979, p. 261)

Indeed, trying to make things explicit, especially in the design domain is a challenge, but it is necessary for communication in the design process and it is an inevitable task for a scientist in the design discipline.

This research is a first attempt to discuss the essence of *the morphological approach*, *the pattern language approach*, *urban design*, and their relations on both theory and application levels. It not only represents the intrinsic relations between the two methods and their relation with urban design, but also reflects their potential and limitations in the urban design process.

The morphological approach and *the pattern language approach* both contribute to an effective urban design process. Both are tools for analyzing, synthesizing, designing and communicating in a multi-actor design process. This research shows that they are complementary and that the design process potentially needs a multi-method approach.

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35   Professor Frits Palmboom provides an illuminating insight in this discussion. "If the upper level of complexity within PL is 'clusters', the upper level of complexity within UM can be the 'narrative' of the urbanized landscape, with its formal structure through different levels of scale, understood as the solidification of the process of landscape genesis, human occupation and the basic networks of flows (water, traffic, energy etc.); facilitating a wide variety of 'patterns' of daily life – in a specific combination of tradition and transformation." (Written comments on this dissertation from Professor Frits Palmboom, November 2018) This touches upon the core of the layer approach in the Delft morphological school that is not further applied in this Ph.D research, but is surely meaningful and worthy to explore in future research.

Besides the literature research and self-reflection while applying the two approaches in this research, investigations of the actual relations between them in urban design education and real design practice are needed. Moreover, further comparative research is needed on how the two approaches differ between novice designers and experienced designers. This is interesting in relation to the discussion about the necessity of training systematic design methods in the design profession and when to do so. Dealing with complexity in the built environment, experienced designers have sharpened their skills over time. They have learned from the previous experiences what is needed to produce good results. The question is: is it necessary to train experienced designers systematic design methods when they have already developed their own ways of working? Do they need to step out of their comfort zone, switch and try different approaches, and how much this can contribute to their professional career? Or should training design methods begin during design education to the novice designers? Organizing workshops, experiments and education programs to systematically observe the process and interview participants can facilitate these investigations.

In addition, this case study specifically used the Dutch interpretation of the two approaches in a Chinese city, Wuhan. This is because of the author's personal and professional background. However, this specificity limits the external validation of the findings in relation to a broader context. Both approaches can be used separately on different locations around the world; one could use this material and apply the other method on the same location. A good starting point is a pattern book on Detroit, complementary to the design research titled *Mapping Detroit* (Bekkering & LIU, 2015). The findings on the project level, the urban form and life style transformation, surely will be different from this research. However, on the methodological level, the essence and design thinking when applying these two approaches might be similar.

In different research fields, a complex topic is normally approached with different methods at the same time (observations, open-data, open interviews with experts, etc.). The fact that *the morphological approach* and *the pattern language approach* are not (or hardly ever) combined in urban design practice also raises questions for a research on multi-method approaches in urban design.

The recommendation for future research on the project level regarding urban form study and life style in Wuhan has been discussed in Section 7.6 and 8.6.

Appendix A An individual pattern on an A4 page

PATTERN NUMBER:	
Title	
Hypothesis	
Theoretical back up	
Practical implication	
Image (sketch)	
Relation with other patterns	

Appendix B List of selected maps for analysis

This appendix displays—in small sizes—the most important maps that were used in the research, in historical order. The maps on these pages have different scales.
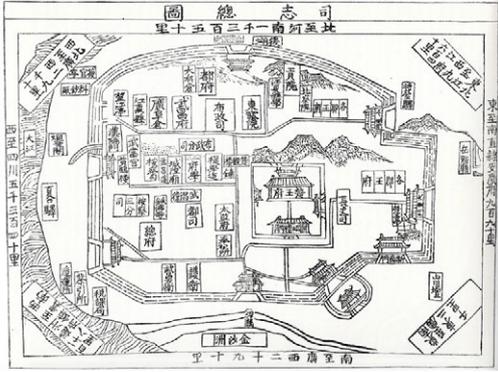
1   1521 Wuchang
From: The Historical Atlas of Wuhan, 1998, p 2
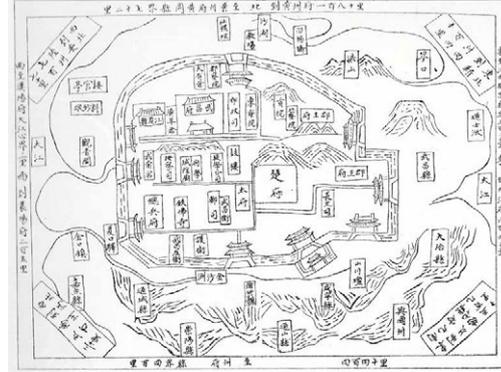
2   1521 Wuchang
From: The Historical Atlas of Wuhan, 1998, p 2

3   1748 Hanyang, Wuchang, Hankou
From: The Historical Atlas of Wuhan, 1998, p. 13
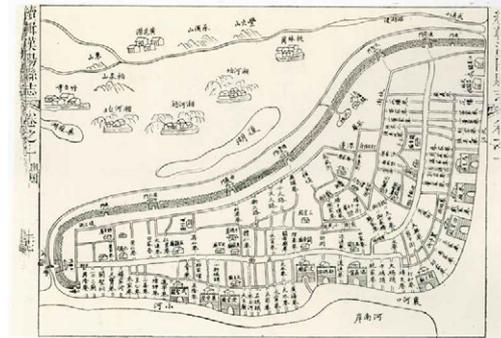
4   1868 Hankou
From: The Historical Atlas of Wuhan, 1998, p. 18

5   1876 Hanyang, Wuchang, Hankou
From: The Historical Atlas of Wuhan, 1998, p. 22

6   1877 Hankou
From: The Historical Atlas of Wuhan, 1998, pp. 20–21

7   1877 Wuchang
From: The Historical Atlas of Wuhan, 1998, p. 23
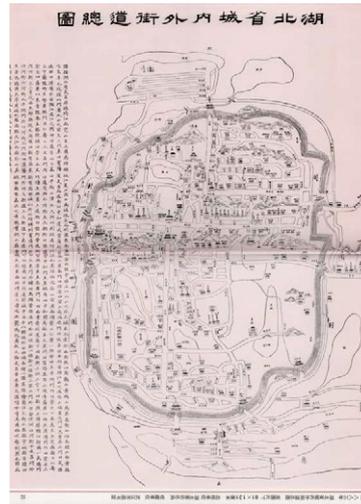
8   1883 Wuchang
From: The Historical Atlas of Wuhan, 1998, pp. 24–25
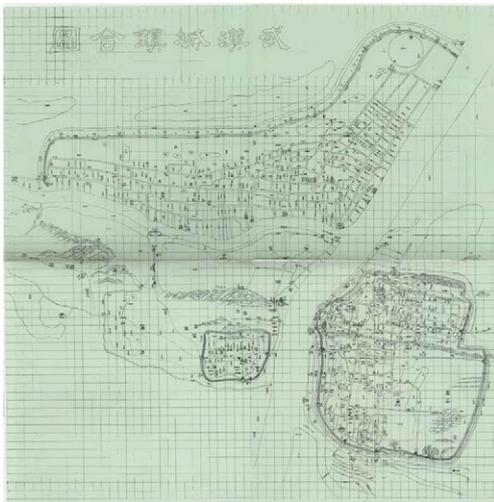
9   1890 Hanyang, Wuchang, Hankou
From: The Historical Atlas of Wuhan, 1998, pp. 42–43
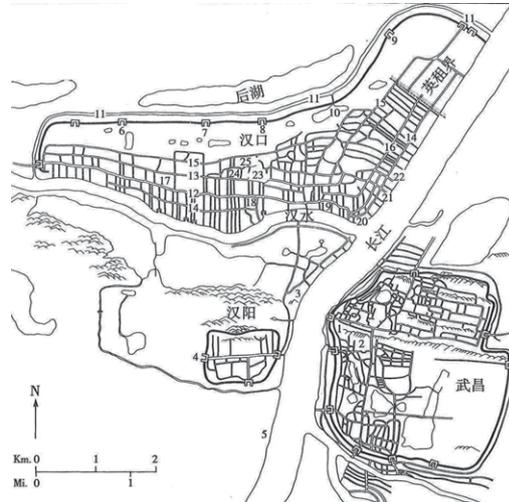
10   1890 Reconstruction Plan Hanyang, Wuchang, Hankou.
From: Rowe (1989, p. 72)
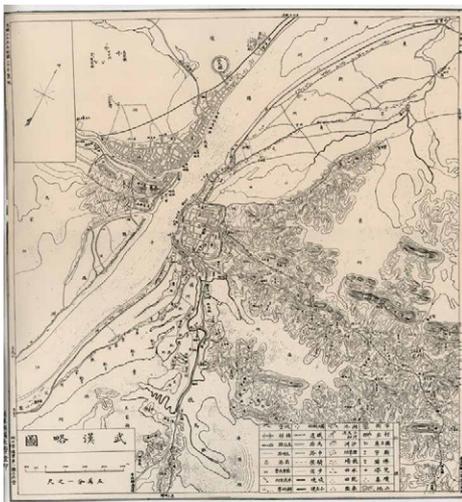
11   1899 Hanyang, Wuchang, Hankou
From: The Historical Atlas of Wuhan, 1998, p. 27
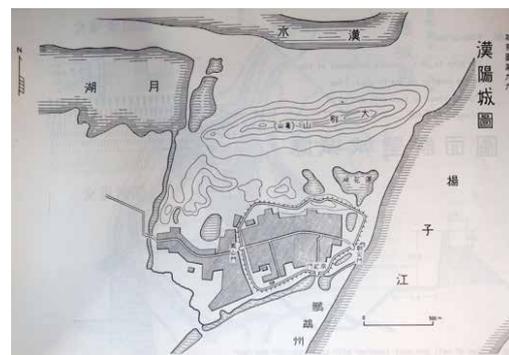
12   19.. Hanyang
From: Heizō & Wallbacker (1979, p. 245)
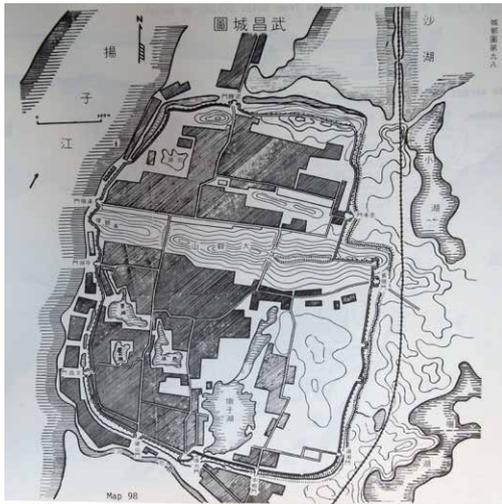
13   19.. Wuchang
From: Heizō & Wallbacker (1979, p. 244)

14   1900 Hanyang, Wuchang, Hankou
Source: Wuhan Archive
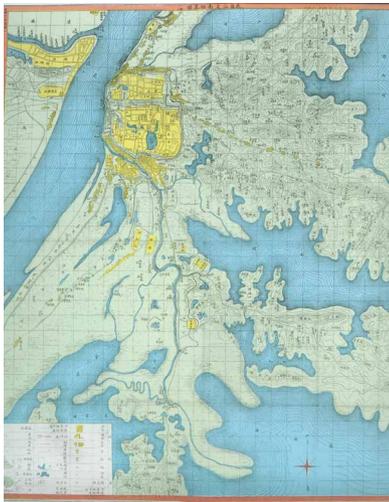
15   1904 Hanyang, Wuchang
From: The Historical Atlas of Wuhan, 1998, p. 28

16   1909 Wuchang
From: The Historical Atlas of Wuhan, 1998, pp. 30–31

17   1909 Hanyang
From: The Historical Atlas of Wuhan, 1998, pp. 34–35
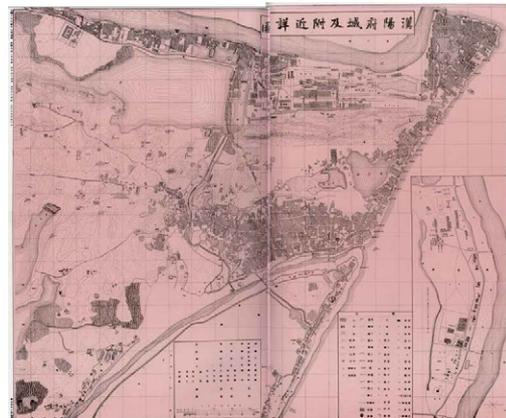
18   1909 Hanyang
From: The Historical Atlas of Wuhan, 1998, pp. 36–37
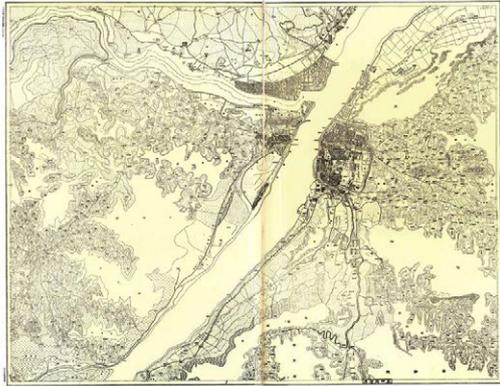
19   1912 Hanyang, Wuchang, Hankou
*From: The Historical Atlas of Wuhan, 1998, p. 47*

20   1911 Hankou reconstruction plan
Source: Library, University of London

21   1912 Hankou reconstruction plan
From: The Historical Atlas of Wuhan, 1998, p. 134
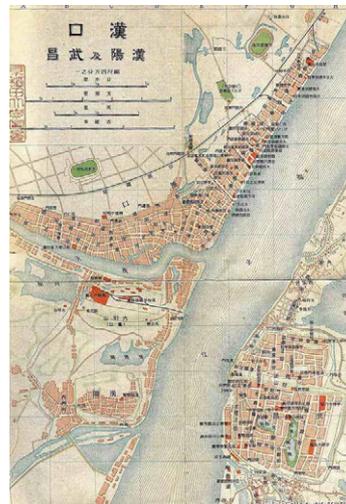
22   1915 Hanyang, Wuchang, Hankou
Source: Waseda University Library
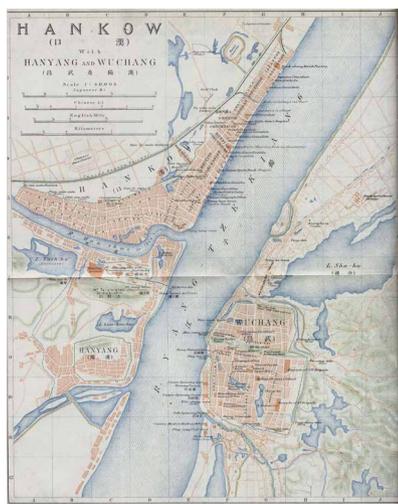
23   1915 Hanyang, Wuchang, Hankou
From: Wuhan Archive

24   1918 Hankou
From: The Historical Atlas of Wuhan, 1998, pp. 48–49

25   1918 Hankou
Source: www.kongfz.com
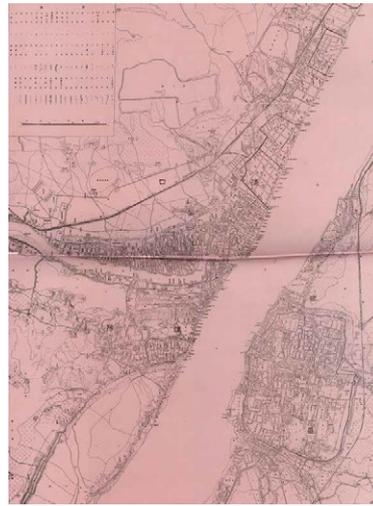
26   1922 Hanyang, Wuchang, Hankou
From: The Historical Atlas of Wuhan, 1998, pp. 52–53
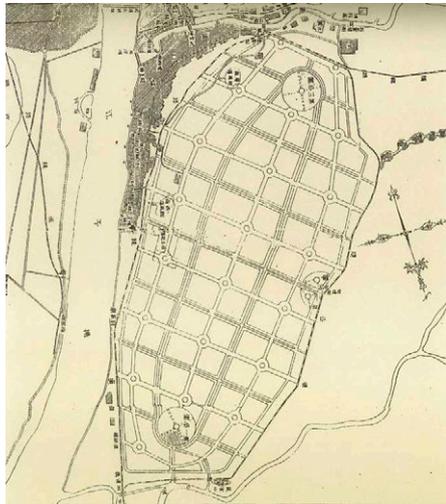
27   1923 Wuchang reconstruction plan
From: WU (2009, p. 45)
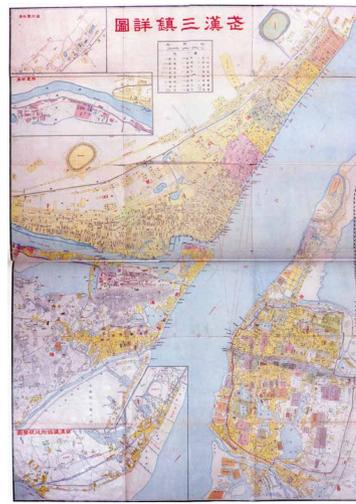
28   1926 Hanyang, Wuchang, Hankou
From: The Historical Atlas of Wuhan, 1998, pp. 56–57

29   1929 Wuchang
From: The Historical Atlas of Wuhan, 1998, pp. 60–61

30   1930 Wuhan
Source: Wuhan Archive
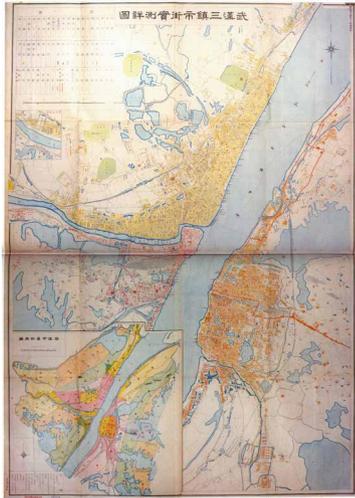
31 1930 Wuhan
From: The Historical Atlas of Wuhan, 1998, pp. 64–65

32 1931 Hankou, British Concession
From: The Historical Atlas of Wuhan, 1998, p. 70
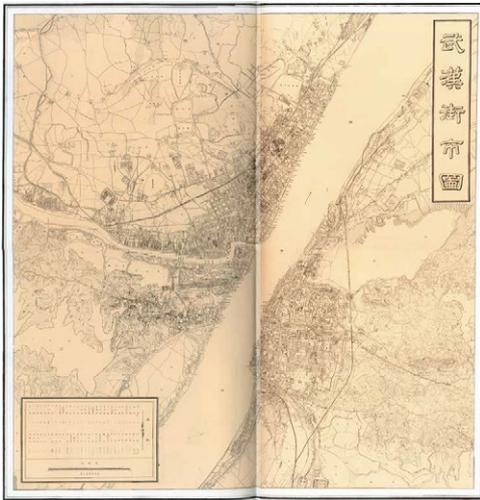
33 1931 Wuhan
From: The Historical Atlas of Wuhan, 1998, pp. 72–73
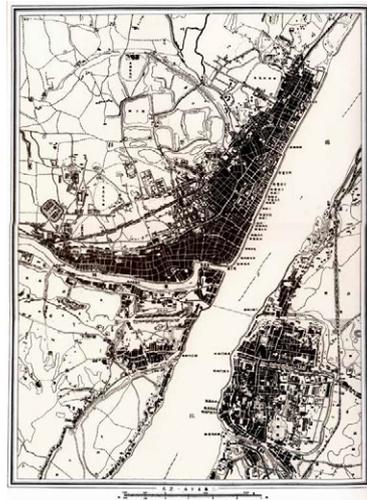
34 1932 Wuhan
From: The Historical Atlas of Wuhan, 1998, p. 74
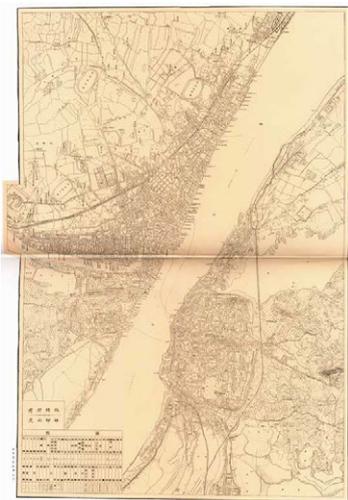
35 1933 Wuhan
From: The Historical Atlas of Wuhan, 1998, pp. 76–77
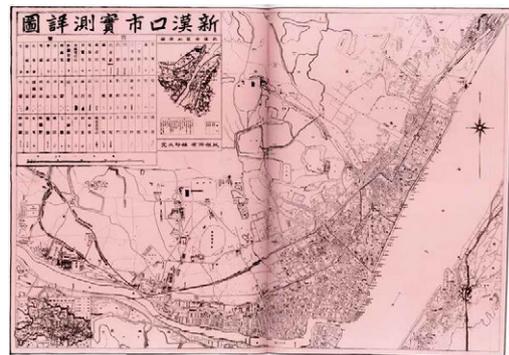
36 1933 Hankou
From: The Historical Atlas of Wuhan, 1998, pp. 80–81

37　1934 Hanyang
From: The Historical Atlas of Wuhan, 1998, pp. 82–83
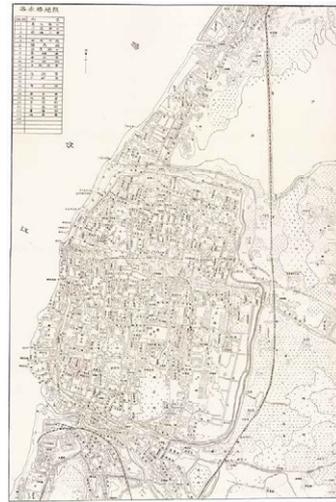
38　1936 Wuchang
From: The Historical Atlas of Wuhan, 1998, p. 86

39　1938 Hankou
Source: China cartographic publishing house

40　1945 Wuhan ("Map of Hankow")
Source: Wuhan Archive
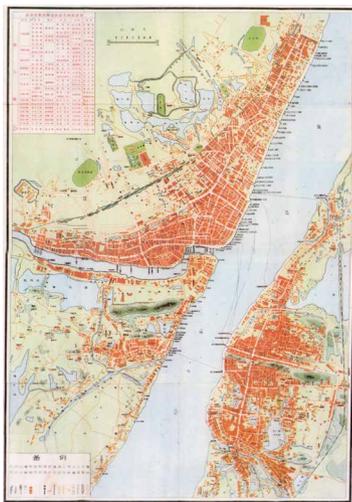
41　1949 Wuhan
From: The Historical Atlas of Wuhan, 1998, p. 93

42　1951 Hankou
From: The Historical Atlas of Wuhan, 1998, p. 94

43　1951 Wuhan
From: The Historical Atlas of Wuhan, 1998, pp. 100–101

44　1952 Wuhan
From: The Historical Atlas of Wuhan, 1998, p. 97

45　1954 Wuhan Master Plan
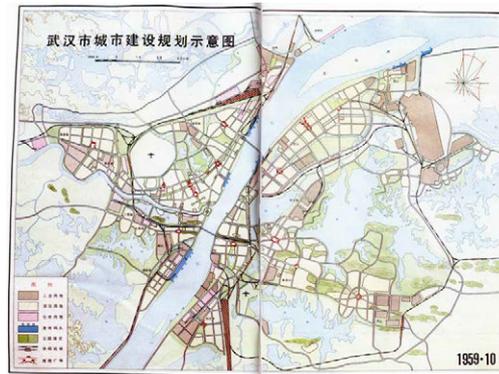
46　1959 Wuhan Master Plan
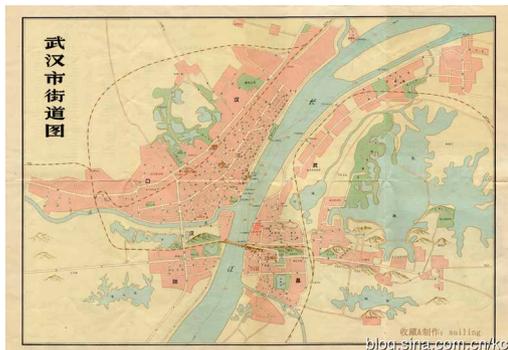
47　1970 Wuhan
Source: blog.sina.com.cn/kcj
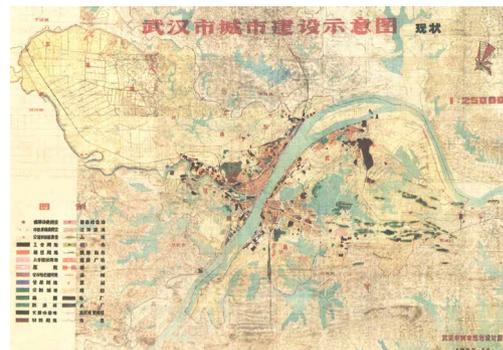
48　1973 Wuhan
Source: Wuhan Planning & Design Institute Archive
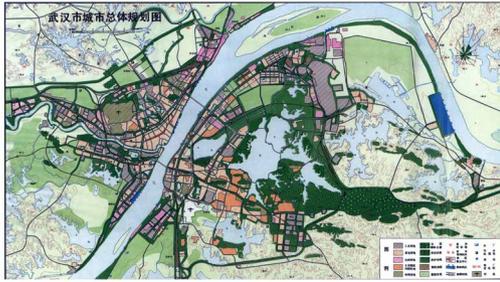
49　1982 Wuhan Master Plan

50　1988 Wuhan Master Plan

51　1996–2020 Wuhan Master Plan
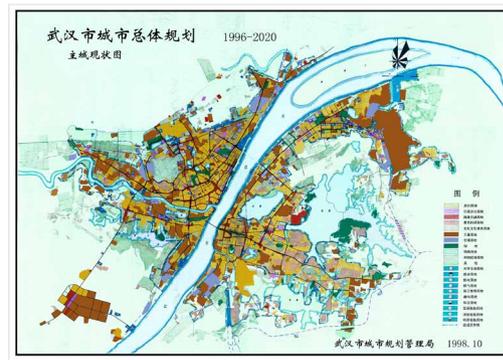
52　1996 Inner city land use situation
From: 1996–2020 Wuhan Master Plan

53　2001 Aerial photograph
Source: Wuhan Geomatic Institute
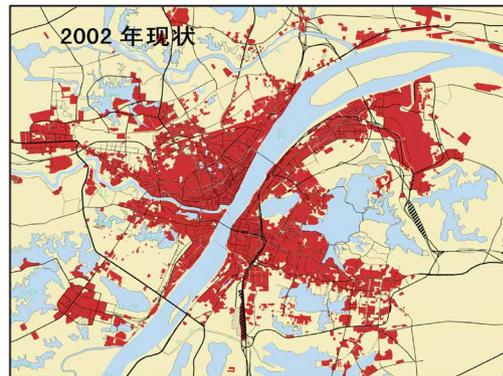
54　2002 Land use situation
Source: Wuhan Planning & Design Institute Archive
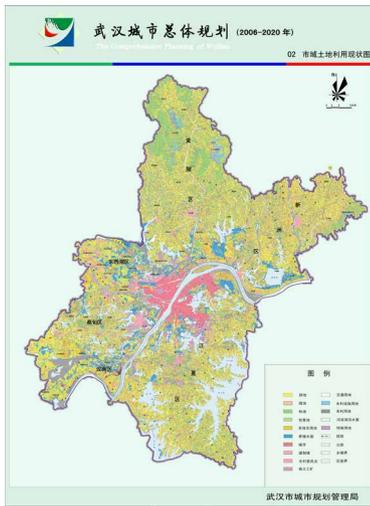
55   2006 Metropolitan land use situation
From: 2006 Wuhan Master Plan
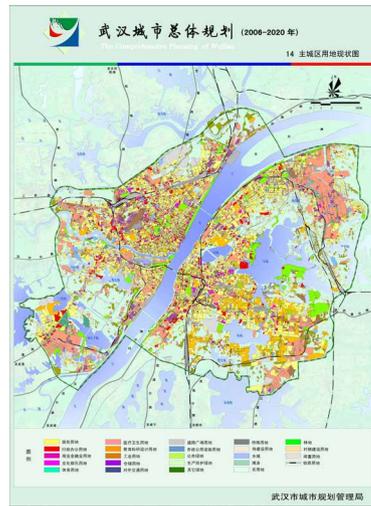
56   2006 Inner city land use situation
From: 2006 Wuhan Master Plan

57   2010 Inner city land use situation
From: 2010 Wuhan Master Plan
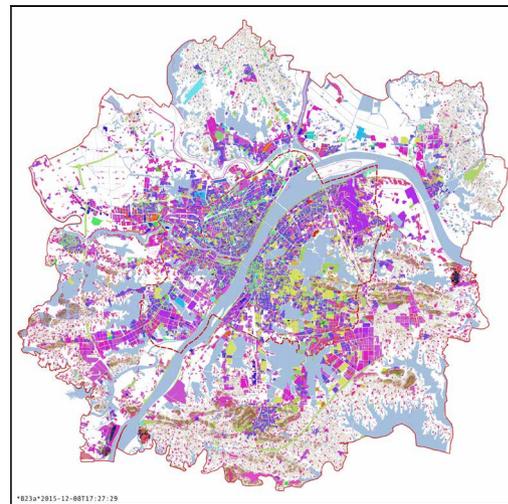
58   2013 Metropolitan area land use situation in GIS-format
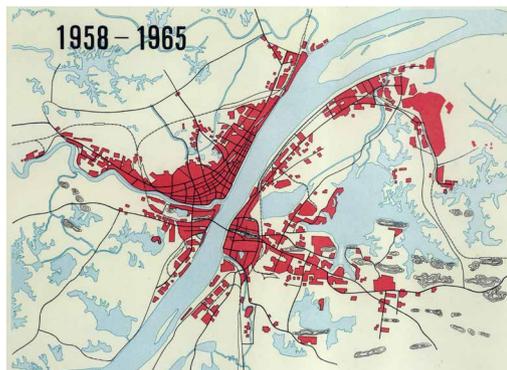
59   1958–1965 Urban land use situation
Source: Wuhan Planning & Design Institute Archive
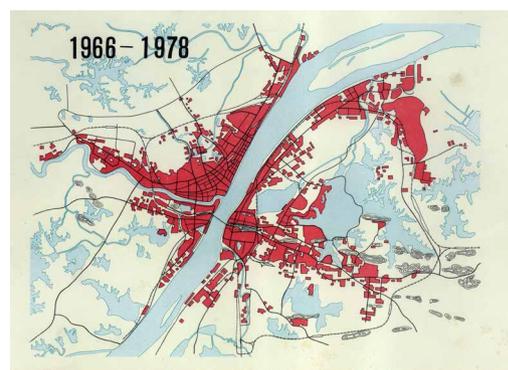
60   1966–1978 Urban land use situation
Source: Wuhan Planning & Design Institute Archive

313   List of selected maps for analysis

61 1989 Inner city built-up area
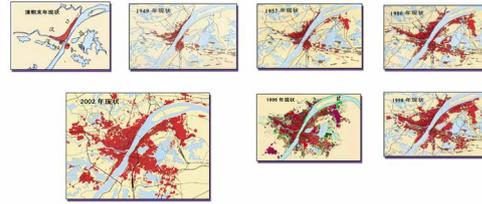
62 Qing Dynasty to 2002 urban land use situation
Source: Wuhan Planning & Design Institute Archive
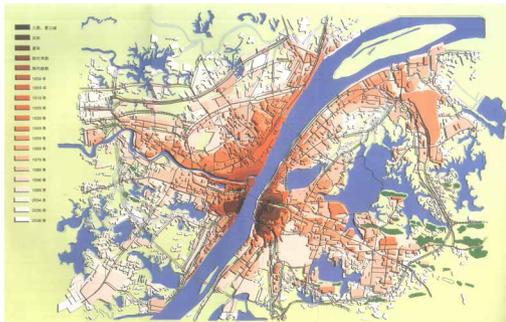
63 Wuhan Inner City Expansion from the Three Kingdoms period to 2008
From: YU (2010, p. 330)
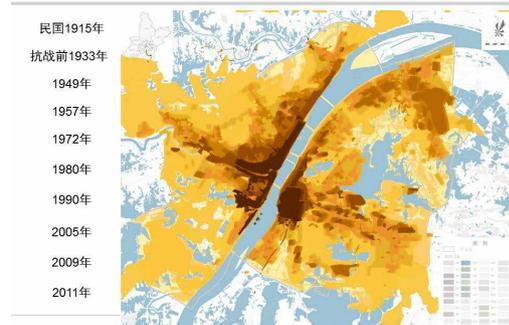
64 1915–2011 Mapping Wuhan in Time
Source: Wuhan Planning & Design Institute Archive

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Curriculum Vitae

Jiaxiu CAI (1985) was born in Changchun, Jilin province, P.R. China. She obtained a Bachelor of Architecture (2008) and a Master of Architecture in Architecture Design and its Theory (2012) in the School of Architecture and Urban Planning in Huazhong University of Science and Technology in Wuhan. During her master studies, she was teaching in the bachelor design studio as an assistant and involved in a local architecture firm working on a series of market driven architecture and urban design projects. From 2008 to 2009, she participated in the Poverty Alleviation Relay Program of the Central Committee of the Communist Young League. It is a state-led relay program sending postgraduate students to the poorest villages in China to teach for a year.

In 2012, she received a scholarship from China Scholarship Council to support her Ph.D research at the chair of Urban Design in the Department of Urbanism, Faculty of Architecture and the Built Environment, Delft University of Technology (TU Delft), the Netherlands. From 2016, she has been teaching in design studios in the Urbanism Master Program and Minor Program.

She was the international collaboration coordinator of two municipal urban planning and design institutions in China, Wuhan Land Use and Urban Spatial Planning Research Centre (2014 to 2017), and Changchun Institute of Urban Planning and Design (2016 to 2017). She has been the international design studio coordinator and guest teacher of the School of Architecture and Urban Planning in Huazhong University of Science and Technology (HUST), Wuhan, China (2014 to 2017). She was awarded a half-year fellowship by the Urban Knowledge Network Asia (UKNA) at the International Institute for Asian Studies (IIAS), the Netherlands, to conduct research and give lectures in leading Chinese universities and institutions (2015 to 2016).

Being a curiosity-driven and internationally oriented person, with her Chinese and European educational background and working experiences, she feels the deep desire and strong wish to explore the world, especially in the urban design profession. She is always delighted and very enthusiastic to work together with colleagues and aim for any international collaborations in research projects and urban design practices.

List of publications

J, CAI. (2018 November, book). Design with Forms as well as Patterns. A+BE | Architecture and the Built Environment.

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