

#72

FINDING AN IDEAL MODEL FOR COMPACT CITIES WITH MULTIPOLE NETWORKS

TSUYOSHI KIGAWA

Wakayama University

kigawa@center.wakayama-u.ac.jp

KYUNG WOOK SEO

Northumbria University

kyung.seo@northumbria.ac.uk

ABSTRACT

With diachronic changes in the philosophy surrounding urban planning, Japanese cities seem to have transformed dramatically. However, many conventional rules remain the same and continue to be inherited. Residents may remember the location of the original downtown area and their narratives reveal their city's history to their descendants, showing that the collective senses cannot be demolished easily. When analysing a city, we may observe some spatial layouts for which we cannot find any rationale from the perspective of mathematical analysis. However, if we read these layouts more carefully and study their background in the evolutionary process, we may find a rationale for them. Some such layouts are caused by the collective senses, and have worked as an implicit norm. This norm, to be defined as an 'urban kernel', is an important keyword when reading a city morphologically. However, there seems to have been little discussion to date about Japanese local cities from a morphological perspective.

The purpose of this study is to investigate a contentious issue in Japanese local cities – compact cities with multipole networks – by means of space syntax, and discuss the plausibility of such cities from the viewpoint of urban morphology.

In Japan, a new system of urban planning has been proposed by the government and is spreading rapidly; this new system aims to establish compact cities with multipole networks, rather than the conventional compact city, which contains a single pole. In space syntax analysis, local integration is distributed across multipole networks, while global integration comprises unipolar networks. By using these characteristics in the distribution of numerical values, we examine the urban kernel and explore the ideal form of the compact city with a multipole network.

KEYWORDS

Space syntax, Japanese cities, Compact Cities, Urban Kernel

1. INTRODUCTION

As well as being a practical method in urban planning, space syntax also comprises a philosophical theory as a tool that analyses the urban space in which individuals reside. A city does not merely comprise a shape to satisfy the rationale of efficient mobility derived with numerical targets, but is, rather, an ideal form that embodies culture and people's lives. In comparing different cities, space syntax is important for extracting a city's underlying philosophy and ultimate shape.

Space syntax extracts the topological structures of cities, thus rendering them comparable. The comparison is then used to calculate common rules among cities in various cultures, leading to the emergence of their respective points of uniqueness. As Rapoport has pointed out, 'The forms of primitive and vernacular buildings are less the result of individual desires than of the aims and desires of the unified group for an ideal environment' (Rapoport 1967, p.47.). Regarding cities, we can observe the desires of a unified group of people in relation to their ideal environment because a city's shape is constituted by the lives of its people. However, the ideal form of a unified group is difficult to analyse without making comparisons with other forms.

Over the past century, there have been various attempts to standardize cities via the powerful flow of modernisation, but they have not yet been consolidated into a single type. In Japan, modernisation began after the country's opening up to foreign nations in 1869. Yet, while Japanese cities were thereafter subject to contemporary urban planning and the country's landscape underwent a striking transformation, its traditional cities and villages were preserved. Change was swift but strengthened with the times, and cities became patchworks of new and old norms. Natural disasters and damage from wartime propelled modernisation forward. In large metropolitan centres such as Tokyo, Kyoto, and Osaka, urban problems arose due to concerns over how to control immigrants from rural areas. To solve these challenges, Japanese planners imported new techniques from Western countries and after practically applying such techniques to large cities, the method was then transferred to rural cities.

Currently, planners are attempting to determine how to shape Japanese cities given the country's declining population. As people move from rural areas to large metropolises, the question remains how to revive local cities, which is a major issue. With an eye on solving this problem, the Japanese government has advised planners to use the concept of compact cities. Over the last twenty years, this notion has been applied to rural cities, but there have been many cases of failure. One of the reasons is that these cities did not consider their urban kernels (to be defined in the latter part of this paper). In this paper, we examine this new design by exploring the idea of the urban kernel as well as space syntax.

Before this examination, we will discuss what the urban kernel is by introducing our previous works. We will then conduct a case study on Minoh City, which is the first city to announce plans for a compact city with a multipole network.

2. THE URBAN KERNEL

2.1 THE AUTONOMIC NERVES THAT FORM A CITY

Japan experiences frequent earthquakes and due to its humidity, crops may rot easily. Therefore, Japanese wooden houses have been rebuilt continuously. As a result, the metabolism of Japan's urban fabric tends to be relatively high. Just as the cells of the human body die and are reborn, Japanese cities are also constantly rebuilt and formed by implicit norms. We classify this implicit norm as the urban kernel. The word kernel is a technical term used in the domain of IT. To use a computer, we require an operating system such as Windows or Mac OS. The kernel is the core system and basement of these systems. It controls the computer, but we cannot see it and require a user interface to view the work. We may also use the concept of kernel in urban research. Just as a computer's operating system is updated, modernisation has come to Japanese cities. We may feel that the appearance of the computer has changed, but we do not care much about the function of the kernel. In fact, the kernel's real function cannot be changed easily: A city comprises the aims and desires of the unified group, and that group has a culture and is tied to its traditions.

Japan enforced its first City Planning Act in 1920, the main purpose of which was to suppress unregulated urban expansion. During this era, people could choose where to live freely for the first time, and tended to seek jobs in big cities, a phenomenon that was occurring globally at that time. Big cities require more land for residential use, so over time, cities expanded and new residential areas were formed.

People began to live in areas where no one had ever lived before. Naturally, the method of urban planning in new areas differed from that in existing areas. However, new locations and old towns remained relevant. Cities function as whole systems, so while old and new towns function independently, urban planners tend to either be bound by old norms, or ignore them because they comprise the urban kernel and are difficult to read clearly. In the past, urban planners did not view cities holistically and thus caused them to dysfunction. Here, we will introduce several cases of urban kernels from our previous research.

2.2 KYOTO: A COLLECTIVE SENSE IN TERMS OF BOUNDARIES

Kyoto is Japan's former capital, founded in the year 794 AD. Its original shape was a strong grid pattern derived from Chinese philosophy. Although this urban shape only existed in blueprints, the land was divided according to the plan even if some areas were not densely populated.

Japan's political power was transferred from the emperor to the samurai; however, Kyoto, where the emperor lived, was a city where people fought for power and thus it became a focal point of war. For this reason, it was burnt down many times, and subsequently regenerated.

Rakuchu Rakugai Ohezu (See Fig. 1. Kyoto 1701) illustrates the conditions of Kyoto in 1701. At that time, Kyoto spread from north to south. Although we can see a strong grid, the layout has shifted from the original grid. At the end of the 18th century, Hideyoshi, the most powerful man of that era, implemented new urban planning in Kyoto. He built castle walls in the centre and established a strong boundary between the city's interior and exterior space. Temples located in the centre were forced to move to the boundary line. As well as temples, important urban

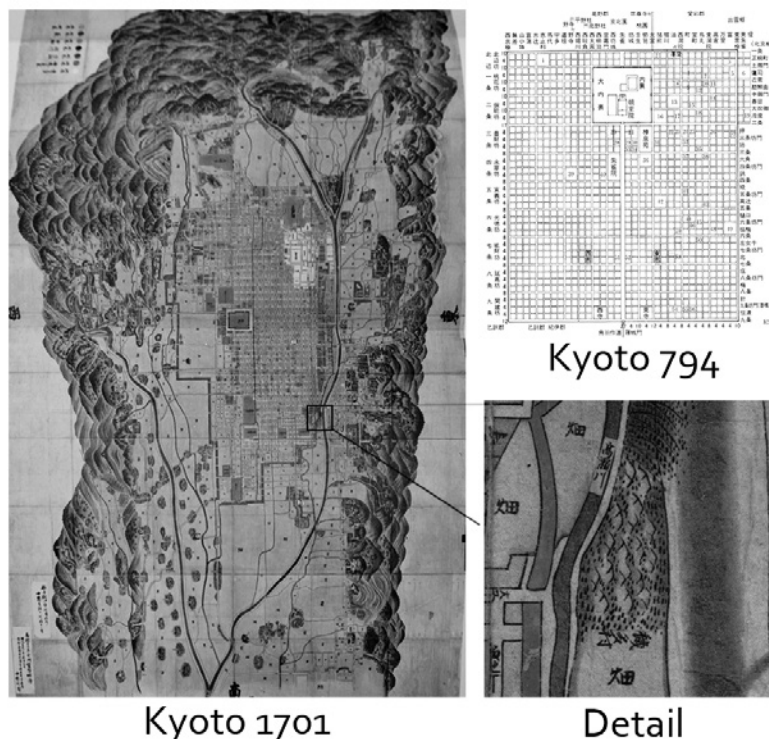


Figure 1 - Historical maps of Kyoto

settlements were formed around the boundary, as shown in the map (See Fig. 1. Detail). These settlements were called etamura, meaning villages in which people of the eta class lived. The eta comprised a social class of outcasts in the era of Japanese feudalism and were discriminated against based on privilege rights; for example, ordinary citizens could not engage in certain kinds of work, such as the leather industry.

The district in which the eta lived was along Kyoto's historical boundary. Today, Kyoto's boundary has expanded and the former eta district now lies inside the city. Although Japanese feudalism no longer exists, discrimination continues, not only toward the people who live there, but also in terms of land. Although the rent in this area is relatively inexpensive and the location is convenient, people in Kyoto do not wish to live there. Thus, while the zone around Kyoto station is excellent in terms of convenience, historical and social reasons have impeded its development. This fact, which is difficult to see from the outside, can be called the urban kernel.

2.3 TAIPEI: URBAN PLANNING BY OCCUPIERS

Taipei, located in Taiwan, is one of Asia's largest cities and was under Japanese rule from 1895 to 1945. Unlike Kyoto, Taipei was designed in such a way that immigrants from Japan, who were unaware of the local urban kernel, broke taboos that pertained among conventional residents.

Before 1895, Taipei consisted of three villages: Mengjia, Dadaocheng, and Castle. Figure 2 shows their locations. Castle was built by China's Qing Dynasty, which ruled during that period. Mengjia and Dadaocheng were spontaneous settlements created by immigrants from southern China who first moved to Mengjia. Then, after a century, another group of immigrants moved to Taipei; however, they faced challenges coexisting with the older residents, so they decided to build their own village, Dadaocheng, which is downstream of the Tamsui River (Kuo 1986).

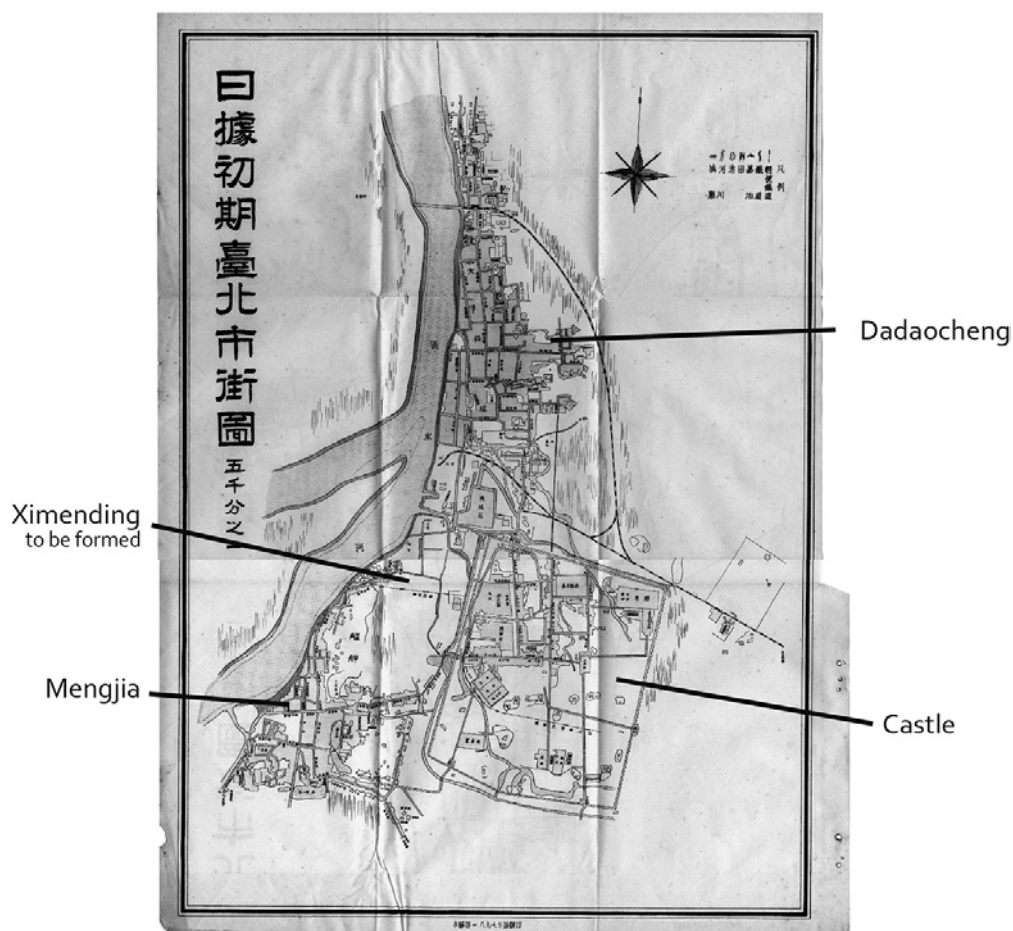


Figure 2 - Historical map of Taipei in 1897

Today, the district in the middle of the three villages is called Ximending, but at the time, it was uninhabited due to the presence of wetlands, and because it served as a buffer zone between two Chinese villages that were in conflict with each other. It was also used as a cemetery for Chinese people. The original settlers of Taipei never resided in this area, but when Japanese colonisation began, Japanese people began to settle there, leading it to become one of the most popular urban centres in Taiwan (See Fig.2). Figure 3 displays the results of the axial

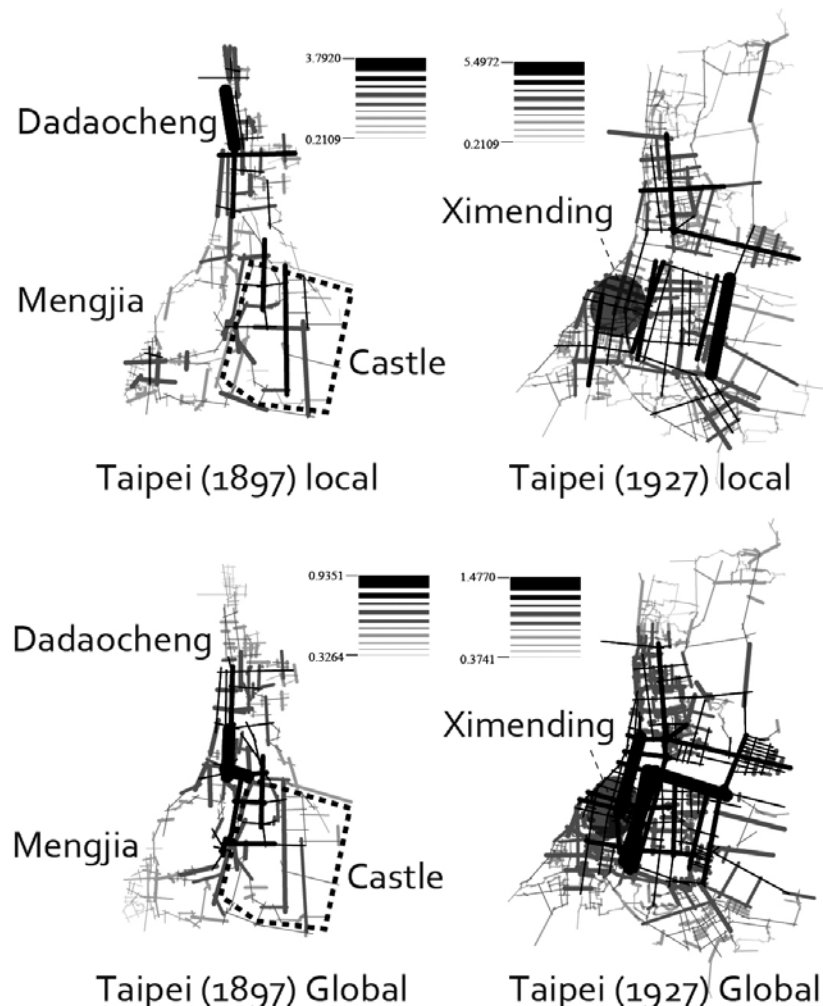


Figure 3 - Evolutionary processes of Taipei

analysis of Taipei's evolutionary process. Regarding the outcomes of local integration, we can see that each village has a 'crest', which means that a street has a higher integration value than all the adjacent nodes.

On the other hand, in the global distribution, the crest is aggregated in one place. It is inevitably dependent along the boundary. At the global level, Ximending is the most integrated site.

Although Ximending had the most potential for integration, it could not become a metropolitan centre due to the influence of the urban kernel among Chinese people. Before colonisation, people in Taipei held a worldview that functioned like the city's local layout. When Taipei changed due to modernisation, the concept of 'global' emerged. When newcomers crushed the idea of the urban kernel that had pertained among the Chinese residents, the local belief in a barrier faded away.

2.4 TSURUGA: THE URBAN KERNEL AS FORMED BY AN AIR RAID

Tsuruga is a port city in central Japan. At one time, it was an important transport hub and the starting point of the route from Japan to Europe via the Korean Peninsula and Russia. Therefore, before World War II, it had a number of hotels and consular offices, and was densely populated. During World War II, the city experienced an air raid and the central area was burnt down, losing all its functions. To revive this area, Tsuruga became a port for importing coal. Then, once oil replaced coal, Tsuruga's economic vitality declined and shifted to nuclear power generation, which made the city thrive until 11th March 2011. After the Fukushima Daiichi nuclear disaster, the city's generator was shut down and the city is now economically stagnant.

Although the downtown commercial zone was compact before the war, the severe devastation from the air raid temporarily shifted trade and business to adjacent sites. For restoration, the government applied a 'war damage revival plan' to the burnt area. In this plan, the government needed to set a range and this was set naturally on the burnt area, which then became the new central area of commerce after the war. Daido analysed the restoration process, asserting that 'the merchants who lived in the burnt block needed to move to another place. This led to distribution in the business district. Within the range of the new commercial area, the centre was established close to the station instead of in the conventional spot' (Daido 1983).

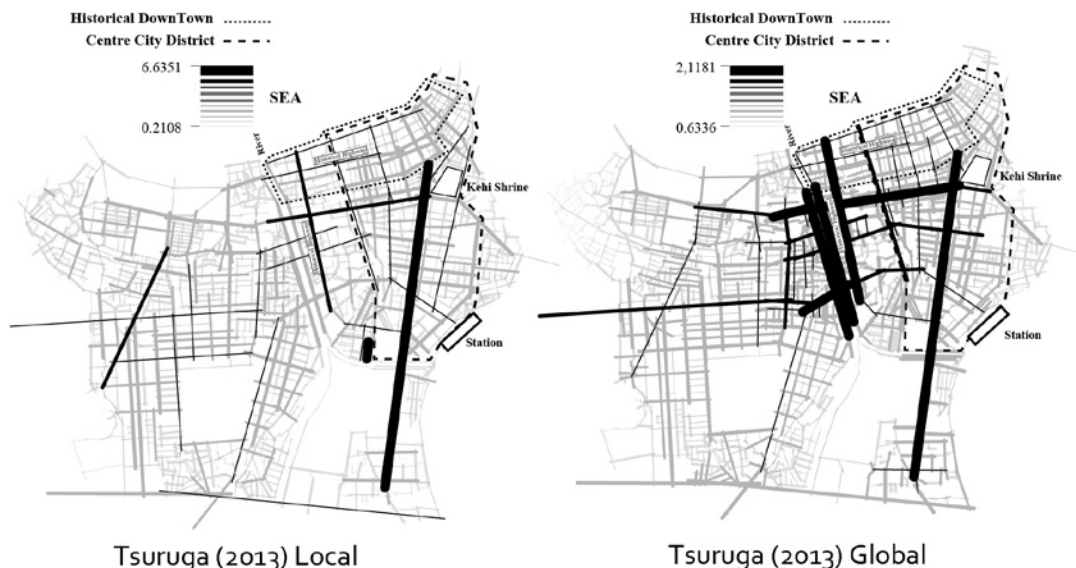


Figure 4 - Axial Analysis on Tsuruga 2013

The air raid significantly impacted Tsuruga. At the time of the war, shopping centres in Japan were used for both residential and commercial purposes. People ran shops on the ground floor of buildings and lived on the upper floors. After the air raid, merchants needed to settle down in the suburbs, and visit shopping malls for their business. As a result, places that had burnt down were rapidly revived and modernized, and became popular.

However, after the 1990s, people no longer travelled to the central area for shopping. During the process of revival, a number of residential towns were developed, the size of the city expanded, and urban sprawl occurred. Urban residents tended to visit large shopping malls in their own cars and as a result, the downtown area saw a severe decline in commerce.

To stimulate the central zone, the city of Tsuruga adopted the Act on Vitalization in City Centers in 2009, which continued until 2015. To implement the Act, the city needed to set a range for the space to be revived, which was almost the same as the range that had been established after the war. Although the size of Tsuruga city differs considerably from its size immediately after the war, the same range of planning was set (See Fig.4). This has happened not only in Tsuruga, but also commonly in local cities that have adopted the Act on Vitalization in City Centers.

Thus, we can see that although the downtown boundary was created accidentally by the air raid overnight, the city made the downtown range the same as it had been 70 years previously. Therefore, we can understand the boundary as an urban kernel.

2.5 BOUNDARIES AS URBAN KERNELS

As mentioned in this chapter, there is a sense in the worldview of a city's residents that differs from the perspective of a top-down plan. Space syntax reads top-down intention from the morphological standpoint, and expresses it in numerical values; the morphological result then distils the residents' ritual viewpoints.

Kyoto's boundary was maintained due to religious sentiments toward the temples and covert discrimination, while foreigners broke Taipei's early taboos. In the example of Tsuruga, the boundary that was set accidentally by air-raid 70 years previously cannot be forgotten. Thus, we can read the urban kernel in these phenomena.

In the next chapter, we will use this concept to discuss Japan's current urban problems.

3. CURRENT URBAN PROBLEMS IN LOCAL CITIES

3.1 COMPACT CITIES WITH MULTIPOLE NETWORKS

Today, as Japan experiences a declining population, a new issue has arisen: how to curtail the size of cities. This problem is unprecedented and, in order to solve it, the Japanese government passed the Act on Vitalization in City Centers in 1998, and tried to create an ideal model of the compact city. Based on this Act, local governments have tried to stimulate their central zones by bringing in residents and commercial functions from the suburbs. However, many cities have not succeeded. We have studied these phenomena and concluded that the plans lack the proper concepts regarding how to distribute urban functions in appropriate locations (Kigawa et al. 2013; Kigawa and Seo 2009). In 2014, after a number of failures, the government abandoned the conventional policy (the Revised Act on Special Measures Concerning Urban Reconstruction) and developed a new model (Compact Cities with Multipole Networks). In the conventional model, the central urban area was set as the sole hub.

3.2 THE MODEL

Based on the restoration of city centres promoted by local governments, a city's central urban area is set up in one zone. The purpose of making cities compact is to promote central urban areas. In many cases, central urban areas were established based on the old zones, which were formed before the 19th century. Major railway stations were built around old sites, and commercial streets developed along with the process of modernisation. Over the past 20 years, in addition to central zones, large-scale shopping malls have been built in the suburbs, as Japan has become a car society. Consequently, 'conflicts' between 'old shopping areas' in front of stations and 'large-scale retail stores' in the suburbs have become an urban problem and have been discussed. This is a typical conflict in local cities.

However, in the new model of the compact city, emphasised by the Revised Act on Special Measures Concerning Urban Reconstruction, suburban-urban areas (such as large-scale retail stores) are included as part of the urban induction zone, which comprises the compact city. This zone is incorporated into the network, which is connected to the 'centre city district'. In terms of the Act, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has declared that, '[The act] promotes a new model, the compact city, to support residents by considering the structure of the entire city'.

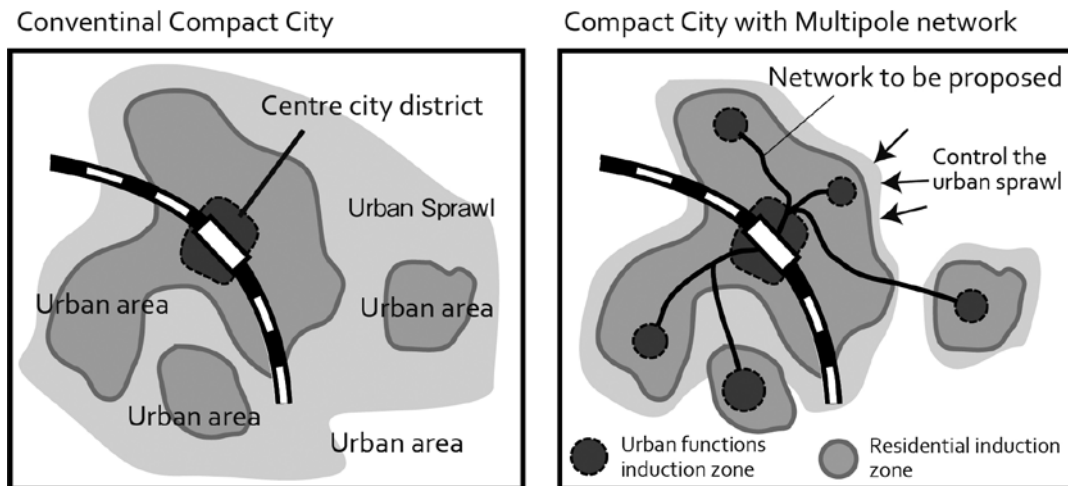


Figure 5 - The models of conventional and new compact cities proposed by MLIT

Figure 5 illustrates the model proposed by MLIT. In Japan, over 300 cities are preparing for redesign based on the concept of the new compact city utilising a multipolar network. As shown in the figure, the conventional model of the compact city only has one centre. Nevertheless, a number of urban areas have already formed. To control urban sprawl, the Revised Act on Special Measures Concerning Urban Reconstruction established urban induction zones in metropolitan locales and built up networks in city centres and surrounding urban areas. This concept is called *dango-to-kushi*, a metaphor that roughly translates to 'dumpling on a skewer', with the dumplings representing urban areas and the skewers representing networks

3.3 PROBLEMS WITH THE MODEL OF THE NEW COMPACT CITY

From our analysis of conventional compact cities, we have found that although such a policy could work well in a certain type of urban centre, the process might not be successful when applied to other metropolises. When local governments executed national policy at the local level, the concept of the compact city was understood differently from the original model (Kigawa and Furuyama 2006).

After many municipalities failed to properly implement the notion of the compact city, the government decided to develop a new idea that could be interpreted differently. Since there is no established clinical method that takes elements such as history and culture into account, and since inhabitants construct a subjective image of their cities, planners should consider creating ideal forms morphologically.

As pointed out by Kamata, an officer of MLIT, 'The perception that each municipality plans with the goal of [building a] compact city based on a multipole network is widespread. Meanwhile, because public awareness is very strong in relation to describing the urban structure of the base and the transportation axis, and to establish the area according to the conditions indicated by the law and operation guidelines, there is no extraction of the task, target, no story. There are cases in which a city's necessary functions are not sufficient, and it is necessary to determine what facilities need to be established in order to attract residents' (Kamata 2016).

In this context, we will explore ways in which morphological thinking can be adapted via space syntax, and what proposals are possible.

4. CASE STUDY

4.1 MINOH

Minoh is a city in northern Osaka Prefecture, with a population of 130,000. This centre contains a forested area and the city is divided between north and south. Our analysis mainly focuses on the south, which is split into three districts: the western part (the oldest), the eastern part (where development has progressed since the monorail was built in 1997), and the central part (which already has a large shopping mall). In Minoh, city planning is already advanced. Two stations are currently planned for the central district. In a time of population decline, growth is predicted to rise in the coming decade (City of Minoh 2016).

Minoh has chosen the west as its target for revitalising the centre. Another two areas are also improving via good railway access from Osaka; there is currently no direct railway access to either of these two respective sections from the western part, meaning that Minoh is divided. Therefore, the city aims to apply the new concept of the compact city to Minoh and it is the first municipality to have officially released a plan to become a compact city with a multipole network.

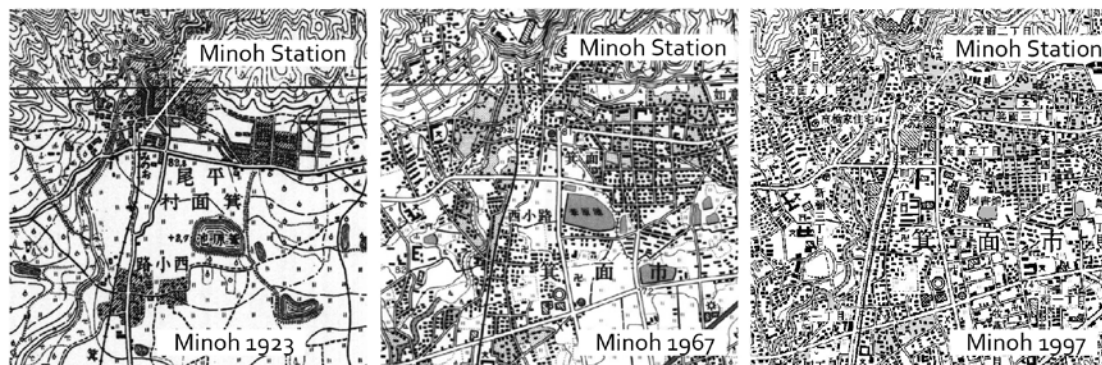


Figure 6 - The map of conventional centre of Minoh

4.2 PLANNING FOR COMPACT CITIES WITH MULTIPOLE NETWORKS

Minoh was once a typical rural village in Japan. Due to its proximity to Osaka, its railroad was built relatively early and Minoh developed into a commuter town (City of Minoh 2016).

Figure 6 shows a map of the western part of Minoh in 1923. Several settlements formed spontaneously, and a railway runs through the villages; some stations were built next to the town. In the beginning, the railway was only built in the western part, while the central and eastern parts were rural.

By 1967, in addition to the old settlements, the town had expanded around the stations (see Fig. 6). Some of the expanded sections are planned in a grid-like pattern, and most have a labyrinth-like form, which shows that they overtook the old settlements. In that era, Minoh was known as an excellent suburban residential zone.

From the map of 1997 (Fig. 6), we can see a new town with a strong grid-like pattern. Development occurred rapidly and condominiums were also built in the surrounding area. In 2003, a large shopping mall was erected along the road coming from the direction of central Osaka. This will create a suburban zone with large-scale stores.

While such developments progressed, the decline of existing shopping districts became a major problem. For this reason, Minoh formed zones in the western section to encourage people to visit old-fashioned commercial streets around Minoh station. From 2005, the city applied the Act on Vitalization in City Centers to promote the area; simultaneously, Minoh is planning to adopt the concept of the compact city with a multipole network. Figure 7 shows the network

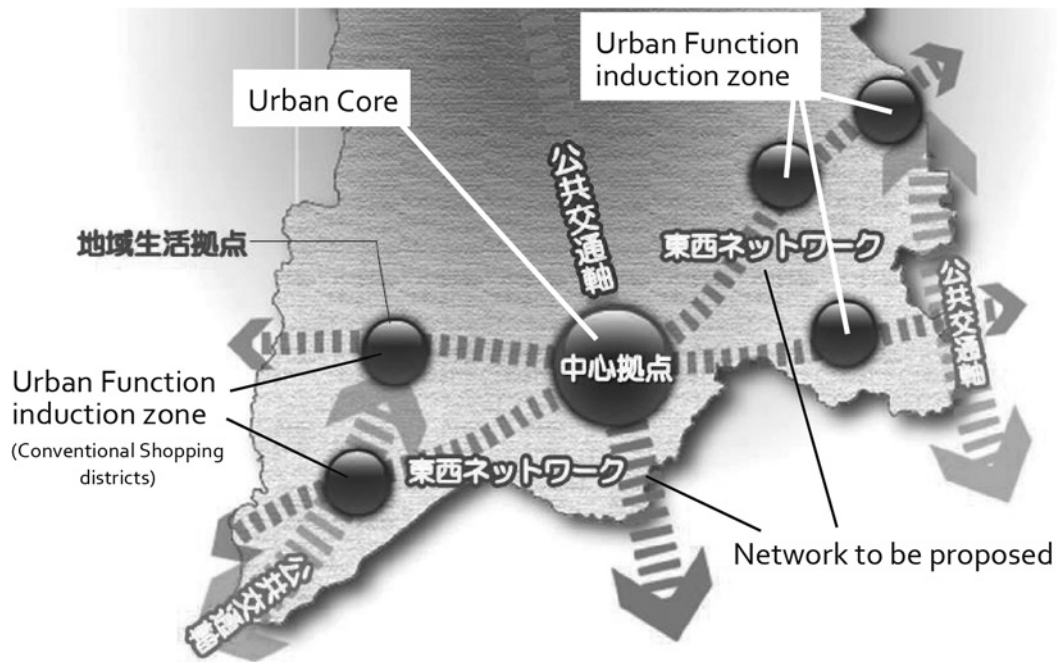


Figure 7. The network system proposed by the city of Minoh

proposed by the city, which connects three areas. Although the downtown area was set in the west, the core is in the centre. In the west, there are two urban induction zones, while in the east, two urban induction zones have been proposed; the core is designed to be the hub between them. Here, we can observe a different route from Osaka, which is divided as a city, and connects each of the three districts.

Regarding this plan, Kamioka, the officer of Minoh, wrote, 'Minoh's area is not so large, especially in the urban sector. It is a very compact city that spans 4 km from north to south, and 7 km from east to west, but it is narrow. It is not necessary to push for the concentration of one pole, but it is necessary to aim toward developing a town that can be balanced as a whole, while also considering the formation of the town and the characteristics of each area' (Kamioka 2016).

In terms of stimulating the centre, the western area has been targeted, and in the model of the compact city with a multipole network, the central area has been targeted. Perhaps it is necessary to ensure fairness due to government administration in the region.

4.3 SPATIAL ANALYSES

The results of axial analyses on Minoh are shown in Fig.8. In the result of Minoh in 1923, we can read strong crests in local. The crests of integration in fact synchronize with the location of stations. In global integration, we can read a strong centre around Minoh station and, in fact, the oldest city centre district was formed around this location.

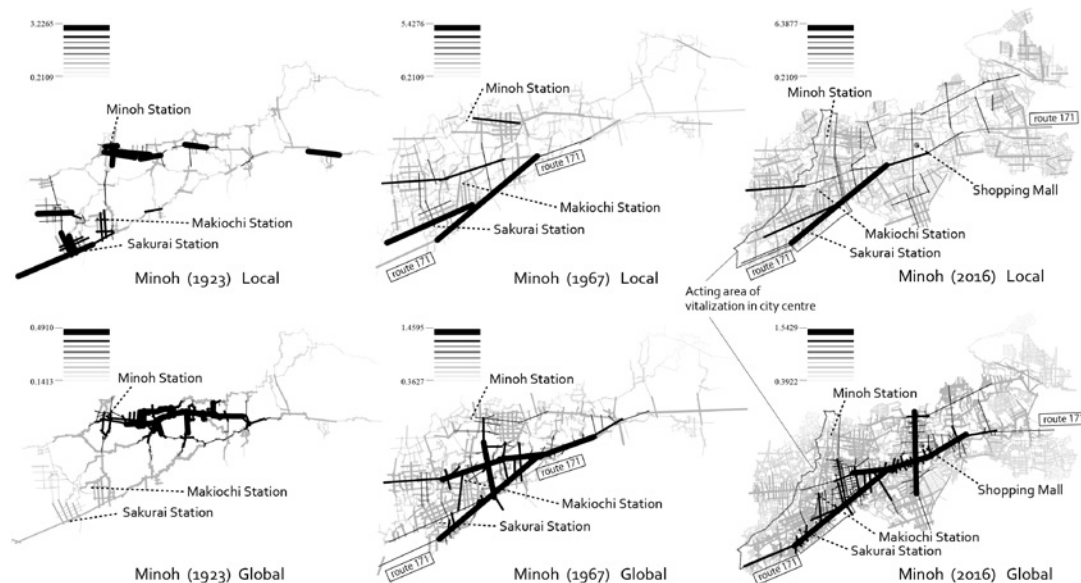


Figure 8 - Axial Analyses: Evolutionary processes of Minoh

The distribution of integration in Minoh 1967 predicted the future constitution of the city. Route 171 was planned in 1953 and this road brings a strong centre both in terms of global and local integration. Relatively, the integration of the conventional downtown area was lost.

Due to the analysis in Minoh 2016, we can see that the urban road, route 171, functioned strongly in the southern part of Minoh, which is important because it connects the three areas. However, this road was built in the past to avoid the centre and is not directly adjacent to the former centre. In the east, there are condominiums with a strong grid-like pattern, the integration value is homogeneous, and there is a street formation that does not reveal a clear centre. Due to the effects of this layout, the gravity in the centre has a centre-to-west integration across the entire city.

In addition, we can see that global integration is high in the central area where the shopping mall was built. On the other hand, global integration is relatively low around Minoh station, which was once the centre.

4.4. ANALYSES

The case of Minoh reveals problems common to many regional cities in Japan. At the beginning, the centre of Minoh was established in one area, which can be read from both the viewpoints of spatial analysis and urban kernel. The residents understood the area around Minoh station to be the centre of the city and the image of the city, its urban kernel, was formed around this time. As time passed, many developments were carried out in suburban areas, and the size of the urban area of the city changed. The centre that had matured at the beginning could not be derived as the centre from spatial analysis. Thus, the conventional centre could not be deemed the centre of the city. Nevertheless, this centre was fixed in people's minds, for which reason the city carried out the Act on Vitalization in City Centers with respect to the conventional centre of the city.

The new concept of the compact city could be understood as a vector to strengthen the network, such as route 171 in Minoh. This route does not pass the conventional centre, and therefore this vector weakened the old town. This is relatively far from the purpose of compact cities with multipole networks. It is necessary to incorporate the old town into the network before strengthening the network. In this sense, the plan of Minoh could not satisfy the government's concept, but from another viewpoint, the plan does suggest a relatively new image of the city, released from its urban kernel.

5. CONCLUSION

The model of the compact city with a multipole network has a major purpose in restoring existing downtown areas as the core of older parts of cities. However, this is not the best solution in terms of the conflict between the city centre and the suburbs because the network is strengthened in the suburbs and does not mesh well with the city centre.

As shown in the example of Kyoto, the beliefs of people within the city's boundary line cannot be totally eradicated. The circumstances today are not like those of Taipei, where people from abroad established a top-down system. Furthermore, even if a top-down system were established, Mengjia and Dadaocheng still exist as distinct cities and are important in terms of immigrants' identities.

Based on our analysis, we can conclude that urban planning in Japan lacks a morphological perspective. Connecting points does not equal constructing a network. It is necessary to understand the current sizes of cities and to read their functions using spatial analysis. Based on such analysis, further study on urban kernels is necessary. This clinical method is required, and so, we believe that space syntax can contribute greatly to Japanese cities.

REFERENCES

- City of Minoh (2016): The location planning system in Minoh [Minohshino Ricchitekisei kakeikaku], written in Japanese, City of Minoh
- Daido, Y. (1986): Local town's transformation [Henbosuru chiho toshi], written in Japanese, Kouseisha-kouseikaku
- Kamata, S. (2016): Towards utilization of the location planning system [Ricchitekisei kakeikakuseido no katsuyou ni mukete], written in Japanese, City Planning Review, Vol.65 No.2, pp.92-93, The city planning institute of Japan
- Kamioka, T. (2016): About the location planning system on Minoh City [Minohshino Ricchitekisei kakeikaku ni tsuite], written in Japanese, City Planning Review, Vol.65 No.3, pp.76-79, The city planning institute of Japan
- Kigawa, T., Furuyama, M. and Seo, K.W. (2013): Distilling 'urban kernel' from the revival processes from war damage in Japanese local cities, Proceedings of the Ninth International Space Syntax Symposium
- Kigawa, T. and Seo, K.W. (2009): Using space syntax to trace the Japanese urban renovation from JYOKAMACHI to modern cities - What formed the city, the centre or the boundary?, Proceedings of the 7th International Space Syntax Symposium
- Kigawa, T. and Furuyama, M. (2006): Using space syntax to examine an evolutionary process of a local town, A case study on the modernization of Otsu city in Shiga prefecture, Journal of City Planning Institute of Japan, No.41-3, pp.229-234
- Kuo, C.D. (1986): A port town to which Tansui River gave birth and raised [Tansuigawaga Umisodateta Minatomachi], written in Japanese, in Kato, Y. ed. "Asian city and architecture", Kajima institute of publishing
- Rapoport, A. (1969): House form and culture, Pearson