MORPHOLOGICAL TRANSFORMATION OF THE OLD CITY OF BEIJING AFTER 1949

Tao Yang

t.yang@ucl.ac.uk

Abstract: The old city of Beijing has been recognized as the greatest masterpiece of urban planning and urban design. However, since 1949 it has experienced extensive and fast constructions and demolitions, a large number of papers argued that physical and social structure of old city of Beijing has been fading away. In order to find a proper way to protect and redevelop the old Beijing city, it could be better to answer the questions that what is the essence of urban morphology of the Old Beijing (the city before 1950s) and further how it has been transformed during last 50 years since 1949. The paper tried to provide a whole spatial morphology of the old city of Beijing and its transformation from the perspective of space syntax, a syntactical and topological approach. Based on which, it argued syntactical representation of the Old Beijing could give the light on the dual spatial structures, both for ceremony and for everyday life. Further, it argued that the transformation of syntactical morphology of the old city of Beijing had been on the way to make the spatial configuration more intelligibility for every day life since 1949. However, the continued large scale regeneration and urban extension have begun to impair the vitality of the old city due to both weakening spatial synergy and damaging compactness.

1. Introduction

The old city of Beijing, with a square inner city on the north built between 1409 and 1420 and a rectangular outer city to south constructed between 1521 and 1566, has been recognized as the greatest masterpiece of urban planning and urban design (Wheatley, 1971; Bacon, 1975; Liang, 1951, 1986). However, since 1949 it has experienced extensive and fast constructions and demolitions, a large number of papers argued that physical and social structure of old city of Beijing has been fading away and appealed to protect the whole urban structure of old city (Wu, 1993; Abramson, 1994; Eckholm, 1998; Fang, 2000; Daniel, 1997; Rui, 1989; Tan, 1994). Preservation and regeneration in the old city of Beijing are on the horns of a dilemma. In order to find a proper way to protect and redevelop the old Beijing city, it could be better to answer the questions that what is the essence of urban morphology of the Old Beijing (the city before 1950s) and further how it has been transformed during last 50 years since 1949. Many researchers have already given the study on urban morphology of Beijing. Most of them focused on physical and spatial composition (Liang, 1942, 1951, 1986; Wheatley, 1971; Bacon 1975; He, 1985; Liu, 1986; Zhu, 1993, 1998; Wu, 1994, 1999; Steinhardt, 1999), land plot and its use (Wu, 1994, 1999); metric structure and human scale (Fu, 1998; Gao, 2000; Zhang & Huo, 2002; Deng & Mao, 2003). The paper tried to provide a whole spatial morphology of the old city of Beijing and its transformation from the perspective of space syntax, a syntactical and topological approach. Based on which, it argued syntactical representation of the Old Beijing could give the light on the dual spatial structures, both for ceremony and for everyday life. Further, it argued that the transformation of syntactical morphology of the old city of Beijing had been on the way to make the spatial configuration more intelligibility for every day life since 1949. However, the continued large scale regeneration and urban extension have begun to impair the vitality of the old city due to both weakening spatial synergy and damaging compactness.

2. Space Syntax

Space syntax theory, developed by Professor Bill Hillier and his colleague at the Space Syntax Lab of UCL, seeks to a holistic way to cope with spatial complexity of built environment, and to answer the question of whether there exist the generic spatial laws mediating pattern of space use and movement and further having social consequences (Hillier & Hanson, 1987; Hillier, 1993, 1996, 1999, 2000, 2001, 2002, 2004). Through their last more than twenty years' researches, it proved that the emergent spatial layout is not the background of social patterns, but matters social groups and activities. The framework of the theory basically invented the spatial configuration, that means 'spatial relations taking into account other relations' (Hillier, 1996:1) to overcome the difficulties of modeling complex spatial layout of built environment. The configuration is topological, that is, the number of the depth one needs to take to go from one node to all others. It is proved by various empirical case studies, including cases in East Asian cities(Kasemsook, 2000, 2003; Dai, 2004), that spatial configuration, not metric distances, could act as the independent entity to impact on

movement patterns, social interacts and land uses choices, both locally and globally.

The space, in configuration analysis, starts with the representational techniques: 'convex spaces', defined by polygons where no line drawn between any two points in the space goes outside it; 'axial lines', defined as the longest and fewest straight lines of visibility and permeability that cover all the convex spaces, to represent the one-dimensional organization of the spatial layout (Hillier & Hanson, 1984:98). Depth of axial line measures how many necessary steps from a given axial line are needed to go through to another given axial line. There are five key syntactic measures of spatial configuration of axial map. Radius-n (Rn) or global integration measures the relative depth of each axial line to all other lines of the system. The most integrated line is the shallowest in the system, the least integrated, the deepest. Radius-3 (R3) or local integration measures the accessibility up to three steps away. Connectivity measures the degree of intersection or one step possibilities of each axial line. Intelligibility is defined as the degree to which what can be seen and experienced locally in the system allows the large scale system to be learnt without conscious effort (Hillier, 1996:215). The intelligibility value is calculated by the degree of linear correlation between connectivity and global integration value (Hillier & Hanson, 1984). Synergy, calculated by the degree of linear correlation between R3 and Rn, is used to lessen the influence of system size (Hillier, 1993). Axial map is the representation of spatial configuration. Warmer colour axial line has, high global or local integration value, vice versa. For example, red line represents the highest integration value; dark blue line represents the lowest integration value, in other words, the most segregation.

3. The Spatial Morphology of the Old Beijing

In order to analyze and further evaluate urban spatial transformation of the old city of Beijing since 1949, it is necessary to distinguish the main spatial morphology of the Old Beijing, the city before 1950s.

Many researchers reached consensus on urban morphology of the Old Beijing from physical composition. It is agreed that the Old Beijing was laid out exactly according to the concept of the Chinese utopia capital city in the book Kao Gong Ji, Notes on Works written more than 2,000 years ago. The ideal city form is 'a walled square city of nine by nine li (4.5 kilometers) with nine north/south main streets and east/west main avenues, three gates on each side, the ancestral temple on the left and an altar on the right of the palace, municipal administration buildings in front of the palace and a marketplace behind it' (Fu, 1998; Liu, 1986). Besides which, the Old Beijing had a 7.9 kilometers central axis (Fig. 1), chess board or fishbone-like lane-street system (Hu Tongs), 'T' shape city boundary with nested tri-cities of imperial cities, inner cities and outer cities and modular system at both urban level and single building level (Liang, 1942, 1951, 1986; Liu, 1986; Wu, 1994; Steinhardt, 1999). However, there still existed disagreement on the backbone structure of the central axis and urban fabric of lane-street system (Hutongs). With regard to the central axis, Zhu (1993, 1998) argued the nested walls, planned from top to down, and the nested courtyards, constructed from bottom to up, were more essential than the central axis in the Old Beijing. Li (2003) hinted the central axis could be the psychological axis for emperor and had more morphological character of centre not linear axis. To the urban fabric, the words of 'chess board' and 'fishbone-like', that describe the different morphologic form, have not been distinguished clear in the most of research documents, even in the classic books about Chinese ancient city. And some researches argued the importance of the oblique streets in the Old Beijing (Tang, 1999; He, 2001).
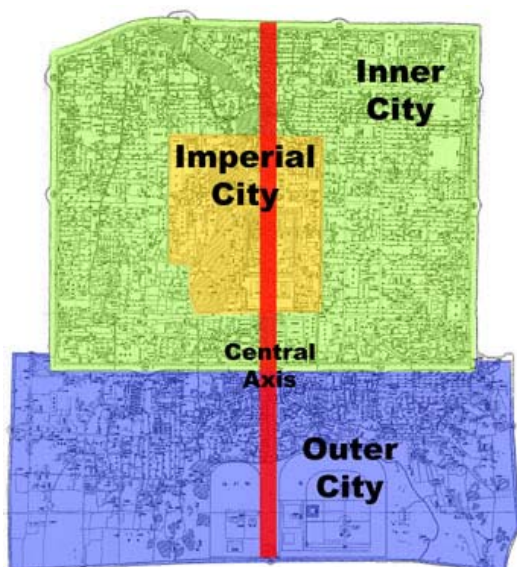

Fig. 1   Layout of Old Beijing

Fig. 2 Global integration of Old Beijing 1751

From the spatial syntactical view, what is the basic spatial morphology in the Old Beijing? Two axial maps were generated, one based on the map of the Old Beijing in 1750 (Fig. 2), the other based on the map of the Old Beijing in 1951. First, the axial maps of global integration exhibited the 'interrupted' grid that 'comes about by placing buildings and other facilities to interrupt some lines rather than others' (Hillier, 1996:368), compared to generic 'deformed' grid, a semi-grid or hub of lines somewhere central, spokes reaching out from the hub towards the periphery in all main directions, and maybe rim or parts of periphery, in most of European city (Hillier, 1996, 1999, 2002, 2004). Thus 'interrupted' grid in the Old Beijing had its own character. The red lines and yellow lines, the lines with higher global integration values, formed a 'donut' around the imperial city, regular spokes, orange lines, toward the direction of both the periphery and the centre, horizontally and vertically, a complex 'interrupted' wheel grid. Hillier (1996) suggested the 'interrupted' grid in Graeco-Roman or American cities usually achieved a well-defined pattern of integration. Compared to which, the Old Beijing seemed to have similar syntactical value as the cities in UK that have the 'deformed' grid, but lower syntactical value than the cities in the USA that have the similar 'interrupted' grid (Table 1). Why? The reason could be the walled imperial city, as a mega opaque block, located at the centre of the inner city to interrupt many axial lines. The underlying spatial law is the principle of centrality that 'blocks placed more centrally on a line create more depth gain-that is reduce integration' (Hillier, 1996:362; 1999).

Table 1

	City number	Avg. Lines	Conn	Loc Int	Glob Int	Syn
Beijing(1750)	N/A	6198	3.260	2.010	1.102	0.237
OCB (1951)	N/A	5252	3.950	2.413	1.286	0.275
OCB (1971)	N/A	5171	3.971	2.438	1.424	0.318
OCB (1993)	N/A	3861	3.677	2.258	1.053	0.386
OCB (2003)	N/A	3873	3.680	2.252	0.828	0.385
USA	12	5420	5.835	2.956	1.610	0.559
Euro	15	5030	4.609	2.254	0.918	0.266
UK	13	4440	3.713	2.148	0.720	0.232
Arab	18	840	2.975	1.619	0.650	0.160

OCB: old city of Beijing; Conn.: Connectivity; Loc Int: Local integration or R3; Glob Int: Global integration or Rn; Syn: Synergy
Source: syntactical values of USA, Euro, UK and Arab are from Hillier (2002)

Second, the axial maps of global integration suggested that symbolic axis for ceremony coexisted with instrumental axis for everyday life, which might build spatial structure with central symbolic axis and mundane 'donut' and its spokes. The symbolic axis aggregated buildings with the function of ceremony or authority, while the instrumental axis with nature movement collected everyday buildings with the function of mundane life (Hillier, 1996).The axial map in 1750 indicated the 7.9-kilometer central axis, named by other researchers at the Old Beijing, had the different integration

values in it segments. The segments inside the imperial city had very low integration value, locally and globally, which were mainly serviced for ceremony; but the other segments outside the imperial city, such as the Bell & Drum Commercial Street and the Qian Men Commercial Street, had higher integration value, which corresponded to everyday life. Thus it hinted that the central axis might not be the backbone of morphologic structure of the Old Beijing for all residents. Further, compared to two reddest lines, Dong Dan Street and Xi Dan Street on both side of the imperial city, the commercial streets at the central axis had less integration values and less high integrated lines attaching to them. It suggested that the thickness of 'donut' surrounding the imperial city varied according to its syntactical distance to the symbolic axis inside the imperial city. When the wall of imperial city had been breached since 1920s, which means ceremony function became weaker, the thickness of the south of 'donut' became wider in the axial map 1951. Moreover, the 'donut' surrounding the imperial palace included three global integrators for everyday life, Dong Dan Street, Xi Dan Street, Qian Men Street, corresponding three city centres in balladry about old Beijing, the collective cognitive memory of Beijinger.

Third, the axial maps, both global and local one, demonstrated the overlapped structure of deformed chess board layout together with fishbone-like street-lane system (Hutong), which is smaller 'interrupted' wheel grid at the neighborhood level. The fishbone-like street-lane system were mainly built by lines of red, orange, yellow in axial map of global integration, and by lines of red, orange, yellow and yellow-green in axial map of local integration, which had covered the most part of the Old Beijing. The more integrated line, the more obvious fishbone-like structure, such as the urban structure in the east part of the inner city. Within the fishbone-like structure, there existed many semi-square blocks built by the green lines at the edge and the blue lines at the centre, which formed deformed chess board layout. Generally, more fishbone-like structures were near the most integrated lines, such as three main integrators of Dong Dan Street, Xi Dan Street and Qian Men Street; while more chess board structure were far away the most integrated lines. It also hinted the conflict of administration system of the closed community (Lifang Zhi) and the open street-based community (Jiexiang Zhi).

4. The Urban Transformation After 1949

Since 1949, the old city of Beijing has experienced massive urban transformation. It could be divided into two periods, from 1949 to 1989, and from 1990 to 2003. During first period, many landmarks have been demolished or regenerated. For example, the city wall of the old city was replaced by the second ring road and tube line below, Tian'an Men Square was enlarged, Chang'an street was widened and extended to connect the east part and the west part of the inner city, and some large scale public buildings were added into the old city. However, the whole physical structure didn't change much. But, during the second period, the old city was under the large scale market-led regeneration since the 'Old and Dilapidated Housing Renewal Program' set up in 1990 (Wu, 1993). Not only a huge number of old courtyards and Hutongs were demolished and replaced by new apartments and the gated community, but many Hutongs along the main streets were replaced by mega office and commercial buildings, even high-rise complex with shopping mall inside standing next to the Imperial Palace. Various scholars gave the criticism from the angles of urban conservation, urban planning, urban economy, and urban policy since the beginning of the regeneration. But this transformation is still going ahead.
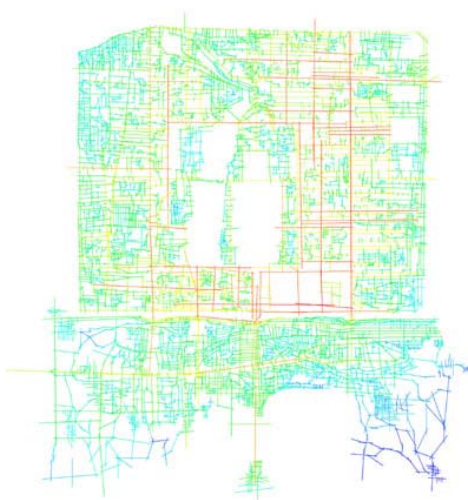

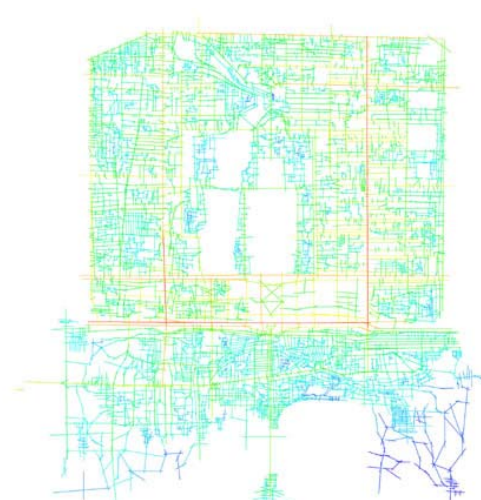Fig 3. Global integration   1951   Fig 4. Global integration   1971

Fig 5. Global integration   1993

Fig 6. Global integration   2003

Fig.7 Local integration 1951

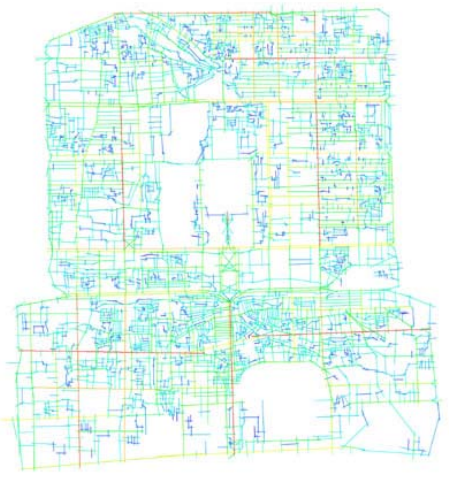Fig.8 Local integration 1971

Fig.9 Local integration 1993

Fig.10 Local integration 2003

What morphologic transformation has happened in the old city of Beijing? The axial map in 1951, 1971, 1993 and 2003 (Fig.3,4,5,6, 7,8,9,10)   were generated by the aximan program of the Space Syntax Lab. All the axial maps of the old city of Beijing were extracted by the axial map of the whole Beijing city in order to study the old city under the background of the rest of the whole Beijing, which is the start point of syntactical way to explore morphology.

The representation of the whole spatial configuration of each axial map had been checked. First, the axial maps of global integration demonstrated that the 'donut' around the imperial city, a cluster of red, orange and yellows lines, had dwindled into a single red ring with few orange lines and some yellow from 1951 to 2003. In other words, high global integration values were centralized at a few of lines. The 'donut' changed dramatically from 1951 to 1971, most of red lines in axial map 1951 becoming yellow and green lines in axial map 1971. The frequency distribution graph also showed that global integration in 1971 had wider range and had fewer axial lines with higher integration (Figure 11). Further, it seemed that the south part in the 'donut' of the axial map 1971 was thicker, which could suggested syntactical centre moved to the south part of inner city. The axial map 1993 showed that a large number of greens lines crossing or next to red ring in 1971 became orange and yellow in 1993, which hinted the 'donut' had more impacts on larger areas. But axial map 2003 demonstrated that yellow lines mainly aggregated between Chang'an Street and Ping'an Street.   The frequency distribution of global integration in 2003 also showed the bell shaped distribution curve became narrower and steeper quickly, and the average of global integration declined quickly (Figure 11, Table 1). However, the axial maps of local integration indicated that the local integrator didn't change. It hinted that urban extension of the whole Beijing could give more impact on the morphological change of the old city than the regeneration within it. It also suggested the first phase of urban regeneration before 1971 negatively influenced live centre, but the second phase since 1990s positively contribute to live centre. Second, the number of axial lines declined, from 5252 in 1951 to 3901 in 2003, but average length of axial line rise up, from 272.542 meter in 1951   to 301.994 meter in 2003. It suggested that more and more large block appeared in the old city. Third, axial map 2003 demonstrated that large scale chess board came out, while the fishbone-like street-lane structure gradually faded away, though the fishbone-like structure was always the dominate structure in axial map 1051, 1971 and 1993. Fourth, synergy of the old city went to top in 1990s, while the intelligibility went up gradually from 1951 to 2003. If looked at the inner city and outer city separately, synergy of both them declined in 2003, and intelligibility of the outer city also declined (Figure 12). Generally, the intelligibility and synergy of the old city gained the higher value since 1949, which means it could attract more potential movements and then it could be transformed to a more vital centre. In fact, more and more business and commercial activities have moved into the old city since 1949. But the synergy and intelligibility of the old city seemed to be declined.
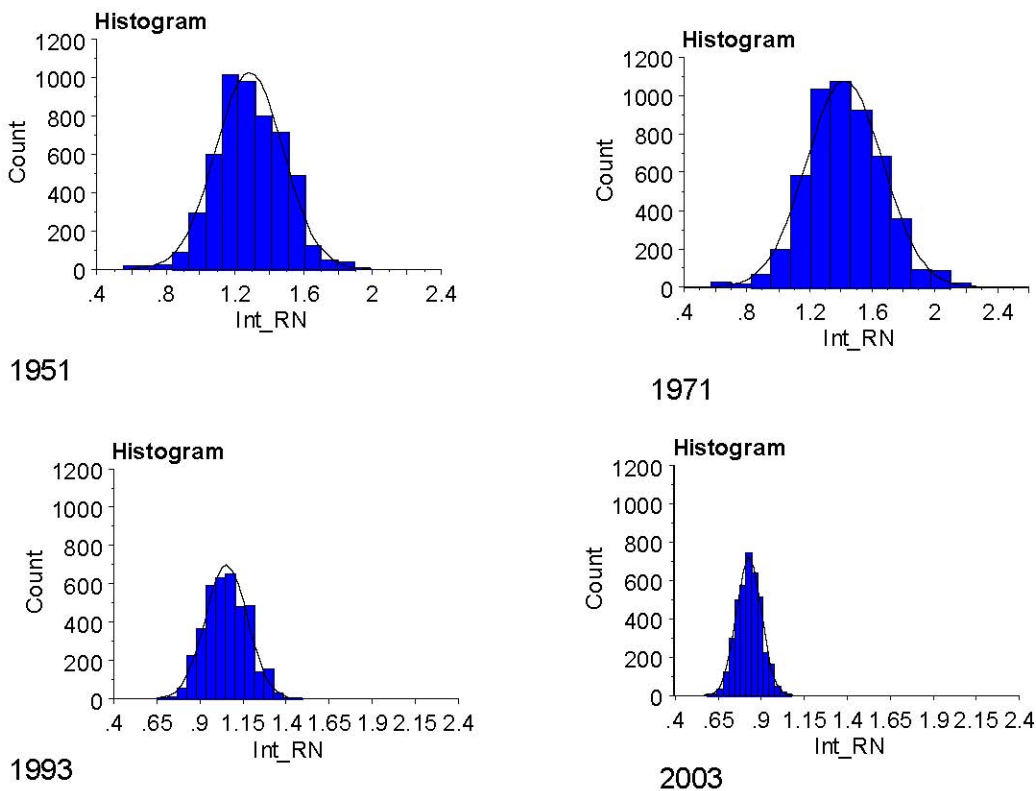

Fig. 11 Frequency distribution of global integration

Furthermore, if checked the axial map closely, there existed more detailed morphologic transformation and process that could explain the global change. First, the axial maps of global integration exhibited that the west part of the inner city had more yellow lines, the moderate integrated lines, after the extension of Chang'an Street. However, the east edge of the inner city gradually had more global integration value, from green in 1951 to red in 2003, while west edge of the inner city from green in 1951 to yellow in 1971 and 1993, back to yellow green 2003, which means that the east edge has more potential for syntactical centre. It could be proved by the fact of the fall of the financial wall street at the west edge and the rise of financial office at the east edge since 1996 (Fang, 2000). Second, comparing axial map in 1951 with in 1971, the 'donut' with a cluster of red, orange and yellow lines around the imperial city shrank into a single red ring partly due to the widening and extending of the Chang'an Street and Tian'an Square, the largest projects at 1958. Further, Qianmen Street, a global integrator in 1951, gradually lost its ability. From the axial map in 1993 and 2003, it could be found out that Chang'an Street has become more potential to integrate the whole structure. However, the second ring road, replacing the old city wall, has not become the main integrator in the old city, except the east second ring road in 2003. Third, the large scale regeneration since 1990 has swept many of short Hutongs, especially in the segregated blocks in 1951 and 1971, but preserved most fabric of longer Hutongs, especially related to the fishbone-like structure. It is the result of the spatial law of preserving long space in the cost of short line (Hillier, 1996). However, the fishbone-like structure was weakened, while chess board structure emerged at a large scale level. It could be due to large scale development producing various large blocks, even super blocks, which is more obvious in the axial map 2003. Moreover, the most segregated sub-area could be exactly corresponding to 25 historical conservation areas approved in 1999 (Beijing Planning Bureau, 2002) (Figure 13). But Ping'an Avenue, a similar project as Chang'an Street in 1998, has become a global integrator at the north of the old city, where is next to the Shicha Hai, the largest but last segregated conservation area. It doubts that new development might sweep this conservation area in the near future. A new development proposal has emerged recently and the debates followed (Wen, 2004). Fourth, the global integration of four commercial streets, Dongdan Street, Xidan Street, Wangfujin Avenue and Qianmen Street, supposed as the global integrators in Beijing, declined in 1971, but go up since 1990s, nearly reaching to the highest value in 2003. It also corresponded to the whole process of revitalization of these four streets (Figure 14). Fifth, the 7.9-kilometer central axis crossing the old city from north to south, defined by various scholars, changed its syntactical values much. It ignored the part of the central axis in the Palace Museum and Jing Mountain Park because it is not free for anyone to cross everyday. North part of the central axis, including Bell and Drum Tower area, lost its syntactical values, locally and globally, since 1951. The axial map 1993 demonstrated its global integration went up, but the axial map 2003 indicated its global integration went down dramatically, but local integration stable. South part of the central axis is mainly Qianmen Street that had still less global and local integration compared to other commercial streets within the old city.
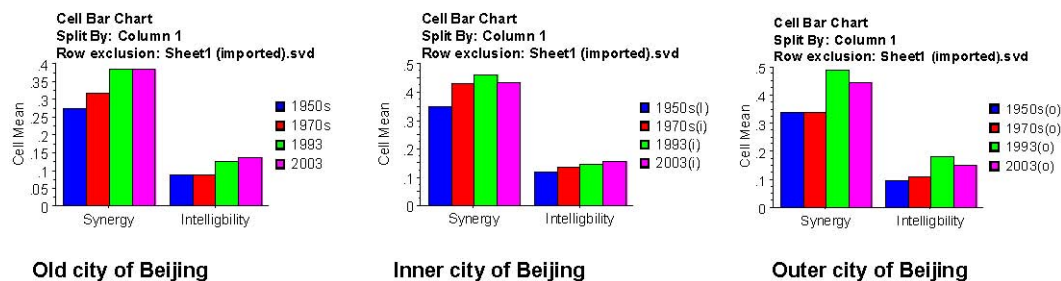

Fig 12. Syntactical values change

5. Conclusion

From the syntactical analysis, it could be suggested that the Old Beijing had a complex 'interrupted' wheel grid: a 'donut', composed by an array of red and orange axial lines, around the imperial city; regular spokes, orange axial lines, toward the direction of both the periphery and the centre, horizontally and vertically. The centre of the 'donut' were a group of spaces for ceremony and power, and periphery of the 'donut' were various kinds of spaces for everyday life, and then the 'donut' and its spokes, fishbone-like street-lanes (longer Hutongs), integrated the whole spatial structure together. Due to the layout of the symbolic space inside the imperial city having stronger north/south direction from the geometric view, it might syntactically weaken the thickness of 'donut' in both the north and the south parts, where was the buffer for the conflict of the symbolic function and instrumental function. When the physical wall of the imperial city was breached since 1920s, the south of 'donut' became thinker soon but north of 'donut' remained stable due to the lake crossing by, which was demonstrated in the axial map 1951. Further, between interstices of spokes, 'interrupted' wheel grid patterns randomly appeared in the neighborhood level, according to its context, which was represented as the chess board structure overlapping the fish-bone like fabric at the high level. Thus it hinted that the axial map of the Old Beijing represented a complex morphologic picture of 'interrupted' wheel grid, deformed by conflict between symbolic axis at the centre and instrumental axis surrounding. However, three global instrumental

integrators, Xidan Street, Dongdan Street, and Qianmen Street, built a multi-centre structure for the Beijinger's everyday life.

Further more, it could be said that the 'interrupted' wheel grid, including one most powerful and most symbolic space at centre and three instrumental integrators for the mundane life is the communication of spatial laws of centrality that blocks placed more centrally on a line create more depth gain and of linearity of coiled blocks create less depth than linearly arranged contiguous blocks (Hillier, 1996: 362).

Based on the syntactical understanding of morphology of the Old Beijing, the paper came cross the axial maps of the old city of Beijing in 1951, 1971, 1993 and 2003 to try to give the light on the urban spatial transformation. Generally, it could be concluded that the thickness of the 'donut' around the imperial city have shrank much and then the most global integrated values have gradually concentrated on two horizontal avenues crossing the inner city, Chang'an Avenue and Ping'an Avenue. But the effect of Chang'an Avenue might be more important, which is also the most impact on the urban transformation before 1990s. Besides which, most of fishbone-like street-lanes (longer Hutongs) have been remained, but many relative short Hutongs composing square community block in the Old Beijing have been demolished. However, at the urban level, it is the large scale chess board, surrounding by traffic roads, come forth other than fishbone-like street-lanes structure. From the axial map 1993, it seemed that synergy and intelligibility of the old city of Beijing have went up, which could be benefited from the renewal project. It has also been correspondent with the economic revitalization of the old city. But, the axial map 2003 demonstrated that the synergy and intelligibility of the old city began to decline, which might be explained by too much mega buildings and super residential blocks, even gated community forced into the fabric of the old city. It reduced the compactness of the old city, the vitality of the city centre. Moreover, the axial map 1993 and 2003 also exhibited that the rest of Beijing gave more influences on spatial configuration inside the old city. For example, the east ring road has the potential to gain more integration value than main commercial streets inside the old city. Thus, it hinted that the large scale regeneration inside and larger scale urban extension outside the old city began to impair the intelligibility and synergy of morphology, which are fatal to build the live centre in the old city.

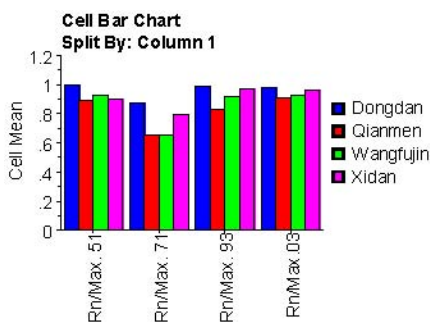Fig 13. 25 historical conservation areas

Fig 14. Global integration value change in four commercial streets

Reference

Abramson D. B. (1998) Neighborhood redevelopment as a cultural problem: A Western Perspective on Current Plans for the Old City of Beijing, Architecture Journal, 1998, p.47-49

Bacon E. N. (1975) Desing of Cities, Thames and Hudson, London.

Beijing Planning Bureau (2002) 25 historical conservation planning (in Chinese)

Daniel, A. (1997) 'Neighbourhood redevelopment as a cultural problem: A Western perspective on current plans for the Old City of Beijing', doctoral dissertation, Qinghua University School of Architecture, Beijing.(in Chinese)

Deng & Mao (2003) gave the analysis on the dimension of block of the Old Beijing city through the technique of GIS. (in Chinese)

Dong Guangqi (1998) Strategic concept of Beijing Urban Planning, Beijing Industry Architecture Press. (in Chinese)

Dong Guangqi (2003) Some Problems in Business Layout in City Master Plan (Part I), 5/2003, Beijing City Planning and Construction Review, p.47-52. (in Chinese)

Gao Yicun (2000) Hu Tong Scale in the Old City of Beijing, 4/2000, Beijing City Planning and Construction Review, p.14-16. (in Chinese)

Fang, K. (2000) Contemporary Redevelopment in the Inner City of Beijing: survey, analysis and investigation,Beijing: China Construction Industry Publishing House. (In Chinese)

Fu Xinian (1998) Collection of architecture history essays by Fu Xinian, Cultural Relic Publish. (in Chinese)

He Guoju (1985) The research on urban planning in Kao Gong Ji, Chinese architecture industry publishes. (in Chinese)

He Yanwei (2001), Reasons for the Formation of Beijing Old City's Oblique Streets, Journal of Beijing Union University, Mar. 2001, Vol. 15, No.1, P89-92. (in Chinese)

Hillier, B (1996) Space is the Machine, A Configurational Theory of Architecture, Cambridge University Press.

Hillier, B (1997) The hidden geometry of deformed grids - or, why space syntax works when it looks as though it shouldn't, the 1st International Space Syntax Symposium, London

Hillier, B (1999) Centrality as a Process: Accounting for Attraction Inequalities in Deformed Grids, Urban Design International, 4(3&4), 107-127.

Hillier, B (1999) Centrality as a process: accounting for attraction inequalities in deformed grids. Environment and Planning B: Planning and Design, 1999.

Hillier, B (2001) Society seen through the prism of space - outline of a theory of society and space, the 3rd International Space Syntax Symposium, Atlanta, also published in Urban Design International

Hiller, B (2003) The knowledge that shapes the city: The human city beneath the social city, the 4th International Space Syntax Symposium, London

Hiller, B (2003) A Theory of the City as Object - Or, how spatial laws mediate the social construction of urban space, the 4th International Space Syntax Symposium, London

Hillier, B (2004) The Space-Time City As a Self Organizing Systme: the emergence of the living city.

Hillier, B. & J. Hanson (1984) Social Logic of Space. Cambridge: Cambridge University Press.

Huo Xiaowei (2002), Human Scale in the Planning and Design of Ancient Beijing, Master thesis, Tsinghua University. (in Chinese)

Li Dong (1999) Conflicts Analysis of Old Town Conservation in Beijing and Their Treatment Proposal, Urban Planning, 2/1999, p23-27(in Chinese)

Li Luke (2003) Historic Study on the Central Axis of Beijing, City Planning Review, 4/2003, p.37-44. (in Chinese)

Liang, S. (1986) Beijing: An Unparalleled Masterpiece of Urban Planning, in Z. Lin (ed.),The Collected Papers of Liang Sicheng, Volume 4, Beijing: China Construction Industry Publishing House. (In Chinese)

Liu Dunzhen (1986) Ancient Chinese Architecture History, Beijing: China Construction Industry Publishing House. (in Chinese)

Nancy Shatzman Steinhardt (1999) Chinese Imperial City Planning, University of Hawaii Press.

Rasmusse S. E. (1969) Towns and Buildings, M L T press.

Rui Jingwei (1989), "Preservation the Old Beijing as a Whole". Beijing City Planning and Construction Review, No.4, pp. 5-6 (in Chinese)

Tang Ming (1999)   Urban Text, Master thesis, Tsinghua University. (in Chinese)

Wheatley P. (1971) The Pivot of the Four Quarters ; A Preliminary Enquiry into the Origins and Character of the Ancient Chinese City. Chicago: Aldine Pub. Co.

Wen Aiping (2004) Widening Road or Reducing Traffic, Beijing Planning and Construction.

Wu Liangyong (1994) The Old Beijing City and Juer Hu Tong. Beijing: China Construction Industry Publishing House.   (in Chinese)

Wu Liangyong (1998) The suggestions to the detailed urban planning in old Beijing city, Urban Planning, 2/1998, p.6-9. (in Chinese)

Wu Liangyong (1998) Essays of Urban Planning and Urban Design, Beijing Yanshan Press. (in Chinese)

Zhang Jian & Wan Suchun (2002) Ideas about Building Height Control in the Old Beijing City, Architectural Journal, 11/2002, P.25-28. (in Chinese)

Zhu Wenyi (1993) Space Symbol City: A theory of urban design. Beijing: China Construction Industry Publishing House.   (in Chinese)

Zhu Wenyi (1997) From axis (symmetry) to 'yard around yard', Architectural Journal, 1/1997, p.67-69. (in Chinese)