CENTRALITY PROCESS IN ORTHOGONAL GRID – CASE STUDY SUZHOU

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Abstract:

This paper presents findings of a study on the centrality process of Suzhou across seven centuries. It is aimed to improve our current understanding about the form-function relationship, in particular, complementing Hillier’s work on live centres in deformed grids (Hillier, 1999) by a case study of orthogonal grid. Previous study on Suzhou has shown that there were twice major centre-shifts within the evolution process from 13th century. However, since the early 20th century, the centre-shift process seems to cease somehow, despite the fact that the expanding speed of the city was even faster than before. This puzzle, referred as “absence of centre shift”, brings into foreground the research question of “what are the key spatial factors for generating live centres”. By investigating spatial and social dimensions of the city in five historical moments, this study verifies Hillier’s findings and sheds light on the puzzle. It goes further to relate this study to the current debate about the applicability of Space Syntax in regular grids raised by Ratti (2004). Whilst, it points out that there are considerable difference between these two types of grids in terms of centrality process.

Introduction and Literature Review:

Suzhou, located in southeast of China, was originated as the capital of Wu Dynasty (222 - 80 B.C.). In the time span of this study, dating from 13th century to present, the city has been functioned as a local town, famous for its textile industry and trading. The physical form of Old Town of Suzhou (inside the city wall/moat) is an orthogonal grid. In the urban evolution process, the city has been expanding itself consistently to the periphery while there are not many changes happened in the inner area. In terms of expanding speed, the pre-1949 period alongside the road system, there is a paralleled canal system, which shows a signification impact on the formation of the centre, especially the westward centre in the 18th century. (Dai, 2004) For the sake of word count limitation, this part of analysis is not included in the paper.
could be regarded as a kind of incremental growth, and the one after 1949 is a kind of massive growth.2

There has been a study focused on the evolution process of live centres of Suzhou, which identifies three generations of centres dating from 13th century (Chen, 2003). (Fig. A) The first was Happy Bridge Area in Southern Song Dynasty (1127-1279), sited in the geometric centre of Old Town; the second was Chang Gate Area in Ming and Qing Dynasty (1368-1911), in the spill-out area out of Old Town; the third generation is the ‘dual centre’ from the Republic of China period (1912-1948) until the present, one sited in Chang Gate Area, the other in Guanqian Area inside Old Town. Chen points out that Suzhou had generated the “dual centre” form in the early 20th century with a built-area of 20 square kilometres, and that has been kept until today despite of the fact that the city is four times as big as the one in 1930’s (Chen, 2003).

Why does such a massive expansion of Suzhou in the post 1949 period not trigger a further shift of centre? Is this ‘absence of centre shift’ due to any underlining spatial reason or just an outcome of social/economic effect? This puzzle reminds us to review a theoretical question - what are the key spatial factors for generating and sustaining live centres.

Fig. A: Three generations of centres in Suzhou (Chen, 2003)

The question has being investigated by Hillier by a series of case studies on deformed grids. His main findings include three points - centrality is a spatially-led process; global spatial configuration of the city plays a crucial role in generating and sustaining an active centre due to ‘natural movement’ and ‘movement economy’; to reflect the need for inter-accessibility, the local grid property of the centre is also vital (Hillier, 1999). The legitimacy of conducting a study on a similar topic is based on two reasons. Firstly, although Hillier noted that centrality is a

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2 The built-area of Suzhou in 1229, 1930’s, 1986, 2001 and 2004 is 14, 20, 34, 80 and 114 km² respectively. (Suzhou ZiShi, 1995) 1949 is the year The People’s Republic of China founded. It is commonly used as the transition point of modern China and pre-modern China.
process rather than a state, the approach adopted in his paper is to ‘try to identify the process by its products’, due to the absence of time-series data (ibid, p.109). In contrast, facilitated by Chen’s comprehensive study and the recent published ‘The Atlas of Ancient Suzhou’\(^3\), this paper is able to scrutinize the town-centre evolution process over centuries. Although it is aware that a massive changes of lifestyle, transportation technology etc, in such a long time period might have impact on the feasibility of a historical comparison\(^4\). In this paper it is suggested that the relationship between spatial configuration and movement flow indicated by Hillier is one of the invariable laws working across time and cultures. Therefore, such a study would present new understanding on the issue of form-function relationship. The second reason is because this paper attempts to examine the question in a different type of grid. Would the spatial rules identified in deformed grids also work in a town with orthogonal grid such as Suzhou? Clearly, it is related to the recent debate on the applicability of Space syntax in regular grid raised by Ratti (2004), who questioned the applicability of Space syntax in regular grid by arguing that integration values would be exactly the same in all streets. Here, it is attempted to using this case study to reinforce the argument that in practice such ideal orthogonal grids just not occur (Hillier and Penn, 2004).

**Methodology and Analysis**

According Chen’s study and other historical documents, this study picks five moments in history, to represent the morphological changes and centre-shift process. The first three were within the eras of three generations of centres, based on the town map of 1229, 1745 and 1938; the fourth and fifth are two samples in the post-1949 period when huge morphological changes took place, indicated on the map of 1985 and 2004\(^5\). Axial analysis is conducted to explore the spatial structure and its changes. It needs to note that the map of 1745 did not depict the “new” development outside Old Town in the northwest direction\(^6\). As the main live centre at that time was in the “new” spill-out development, this becomes a negative factor for

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\(^3\) This is a collection of reprinted nineteen ancient maps of the Suzhou, dating from 1229 to 1949, which provided a rich source of historical spatial data for this study.

\(^4\) The impact of changes of transportation mode to centre position has been unveiled, but not including in the paper. (Dai, 2004)

\(^5\) The map of 1985 and 2004 is chosen in order to reflect the change of strategic guidance on city development. The planning policy before 1985 encouraged new development mainly towards the west of old town; however, the one after 1985 proposed a triple structure - new developments in both side of old town. The east part is high-tech Industrial Park fund in corporation with overseas funding; the west part is high-tech industrial park funded only by the state.

\(^6\) Actually, the west part of development outside the city wall/moat in the 17-19th century did not been recorded on any atlas of that period. Xu’s study suggested that this is due to the fact that there was a strong believe in imperial China that only the place defined by the city wall and moat are the urban area, no matter how affluent and urbanized that place is. (Xu, 2000)
the research. In order to supply a gap, a conjecture is made basing on 1938’s map.

The results of syntactic analyse show in fig. B. Comparing the integration cores with the live centre positions, it shows that in 1229, the centre position and the integration core was identical; in 1745, the functional centre was not likely to have any syntactic significance due to the big barrier - city gate; in 1938, the west part of “dual centre” still did not have any syntactic priority, although the east part belongs to the top 30% of most integrated lines; in 1986 and 2004, both of the dual centres belong to the top 20% of most integrated lines. Generally speaking, the positions of live centres show a certain degree of syntactic significance. However, as there are many long axes with the top-ranking integration values, this criterion cannot fully account of the position of the functional centre. This is not a surprising result as Hillier has already pointed out the limitation of syntactic analysis, in terms of identification of live centres. While, it leads the study going to the second step: investigating the local spatial property - would that provide the part of missing reason for the location of centres?

![Fig. B: Global integration graph of Suzhou in the year of 1229, 1745, 1938 (from left to right first row) 1985 and 2004 (from left to right second row)](image)

The map of 1938 is picked up to conduct the pilot analysis. In Figure C, four sub-areas are chosen in Old Town, all of which are surrounded by highly integrated axial lines. Area 1 is
Guanqian Area, the centre; the other three are picked randomly but with a similar block size. The question presented here is whether Area 1 provides better local spatial condition than its counterparts in terms of optimising the inter-accessibility. Visual inspection suggests that the grid of Area 1 has a smaller block size and allows more circular routes. A further Depthmap analysis shows that Area 1 holds the smallest value of “Mean Metric Distance” (Table 1), which indicates Area 1 is the more inter-accessible sub-area. This analysis confirms the significance of “Siksna Process” for centrality proposed by Hillier. And it is due to this grid intensification that Guanqian Area distinguished itself from other sub-areas to become the centre.

![Fig. C: four sub-areas comparison](image)

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Table 1: Data from Depthmap Analysis

In the same principle, a visual inspection is carried out based on 1985 and 2004’s maps. It is clearly shown that there is a substantial difference between the block size of Old Town and that of the new development. Figure D chooses two urban tissues from Old Town and the new

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7 This part of Analysis is conducted in the help of Professor B. Hillier, August 2004.
developed areas from 1949, both with a size of 500 by 500 metres. The study area in Old Town contains 3 urban blocks; in contrast, the one in the new part even cannot accommodate one single block. (The grey space in Figure D.2 is semi-private paths belonging to the gated community\(^6\), therefore not accessibility for the majority.) This gives us a clue for solving the Puzzle. On the one hand, as most of the developments after 1949 are in a sparse grid, it cannot satisfy the precondition of generating a live centre. Whilst the ‘dual centre’ is still the most intensified parts in the city. On the other hand, the result showed by axial analysis suggests that the change of integration core after 1930 is not ‘shift’ but “expanded” to the west direction. Consequently, the “spatial pressure”\(^9\) caused by massive urban expansion is not strong enough to generate a new centre. the rationality of the “absence of centre shift” is now exposed.

*Fig. D1:* urban tissues from Old Town (Left)

*Fig. D2:* urban tissues from the new developed areas after 1985 (Right)

(Blue colour indicates the Canal, black is the street, grey is the semi-private area within the gated community.)

**Discussion:**

The puzzle of “absence of centre shift” is brought to light by explicitly explanation. In parallel, , Hillier’s proposal about key spatial factors of centrality is verified in a different grid condition by

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\(^6\) The gated community is a dominated way of spatial organization in the post-1949 development, which reinforces the large scale of grid in the new development and made the interface between people and street really unfriendly. The function of these gated communities could be dwelling, office, hotel, school or factory.

\(^9\) Hillier argued that ‘As settlements grow, the pattern of global integration is likely to change, and this will create spatial pressure for a shift in the focus of centrality’. (1999 p. 108)
this case study. Here, it would relate this case study with the current debate of applicability of Space syntax in regular grid. Ratti holds the idea that in a regular grid, integration values would be exactly the same in all streets, therefore which is the situation space syntax is not able to respond. However, Hillier and Penn argue that in practice such grids just not occur (2004). As old Town of Suzhou has been always be considered as a tessellate grid (Suzhou Shizi, 1995), this paper could reinforce Hillier and Penn’s argument by a regular city in real world. From the old maps or axial graphs, it is clear that the formal grid of 1229 became much more differentiated and interrupted as time goes by - longer axes were extended even longer to form a super network, much more short back lanes were generated within the blocks. Therefore, although Suzhou is an ideal regular grid conceptually, in practice, it is a well-structured and differentiated grid, depicting by axial analysis as a whole range of integrated and segregated lines.

A further effort is made to explore some distinctive characters of orthogonal grid from this case study. Firstly, the axial analysis shows that even after a massive urban expansion, the integration core mainly remains in the old position except a westward expansion. It is argued that this is not to happen by chance, but under an intrinsic property of orthogonal grid. Since the orthogonal and deformed grid have different rules of growth, by and large, in the former, the old integrator is being extended to the new developments linearly, but in the latter, there is always a new line attaching to old integrator in a highly obtuse angle of incidence. Therefore, it is expected to see that the change of integration core in orthogonal grid is a kind of expansion of the old core, but the one in deformed grid is to shift from one set of lines to another. Whether this implied that the historical core of orthogonal grid is more stable than other kinds of grids would be a subject of further study.

Secondly, this paper tries to propose that for orthogonal grid, the criterion of grid intensification for live centre is more important than deformed grid. A conjecture made here is that this is because the total length proportion of the higher integrated streets of Orthogonal grid is much bigger than deformed grid. As the proportion of total line length is much higher, there are many more options of functional centre if we just consider the global integration value. This feature raises the importance of local grid condition, and that is exemplified by the phenomenon observed by Author. There are two secondary shopping centres in Suzhou raised in recent two years, and the positions of which is very clear the two sites with relatively small-scaled grid outside Old Town (Figure A). This conjecture needs further case studies to exemplify.
Bibliography


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