

THE SPATIAL LOGIC OF ORGANIC CITIES IN IRAN AND THE UNITED KINGDOM

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0 Abstract

The issue of organic cities in urban studies has seldom penetrated beyond a fascination with aesthetic qualities and architectural attractiveness; whereas other fundamental characteristics of these cities have not yet been scrutinised. There are dilemmas in understanding whether the notions like architectural quality or memories of the past create the integrity of organic patterns, or whether the spatial organisation of the city itself conveys the rationale behind the behaviour of the city, independent from - or along with - other factors. Questions like: are there any specific rules for growth of organic systems?; what is the logic behind the spatial configuration of organic cities?; is there any differentiation between the global and partial organisation of the city?; how does the spatial structure of the city meets its functional and social requirements? and so on, seldom have been answered in an analytical approach. This paper will try to answer some of these questions by adopting the *space syntax* methodology in order to analyse and investigate six Iranian and six English organic cities. The selection of two groups of occidental and oriental cities not only expands the scope of the study towards a more global understanding of organic cities, but also provides a basis for the comparison between two major groups of organic cities: the Western mediaeval city, and the Islamic traditional city.

Keywords: configuration, organic, space, traditional, urban

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1 The enigma of the 'organic city'; a brief review of organic urbanism.

The notion of 'organic' has its roots in modern biology and the concept of living organisms. It can begin with an analogy between the visual characteristics of cities and natural organisms (Kostof 1991, p. 52). There is also another view which seeks the similarities between the human organs and elements of the urban form:

"The idea of a city as being composed of a 'heart' - the central business district, of 'arteries' and 'veins' in terms of the hierarchy of transport and communications routes, of 'lungs' in terms of green space and so on" (Batty and Longley, 1994, p. 31).

However, the more appropriate definition of organic cities has been envisaged as the opposite meaning to 'planned' or 'preconceived' cities. James Vance defines these two classes as:

"The preconceived city is laid out by an emperor, bishop, or other authority possessed of the power to start a settlement from scratch, still believing strongly that of city founding, and thus needful of an elaborate and inclusive plan. The organic city includes those settlements established at a geographical point but left to evolve in physical pattern as functions and fates determine" (Vance, 1977, p. 24).

The interpretation of organic cities as products of the natural evolution of built-form during a long period of time seems to offer a clear basis for the discussion. However, it is conceivable that all types of cities - even planned cities - at some stages of their

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lives are subjects to natural modifications. There are three determinants which help us to clarify the ambiguous boundaries of organic and planned cities: first, the initial layout of the city; second, the duration of the process of natural growth; and third, the scale of development. It can be noticed that the cities which have been laid out in a regular manner, at some period of time, show more tendency to preserve their initial structure in later periods, whereas the cities which had started from a more natural pattern of growth - such as villages - tend to fulfil more organic structures. However, if there is a considerable period of natural growth, and also if there is no imposing power to control the geometrical pattern of the city, even the artificially planned cities can adopt organic patterns. The scale of development and change is also a key distinction:

“Cities which grow naturally are formed from a myriad of individual decisions at a much smaller scale than those which lead to planned growth which embody the actions of somewhat larger agencies. Planned cities or their parts are usually more monumental, more focused and more regular, reflecting the will of one upon many, or at best, reflecting the will of the majority through their selected representatives” (Batty and Longley 1994, p. 8).”

It is difficult to say how many years or what situations provide the conditions necessary for natural growth, but the key point here lies between two modes of the dominant nature of urban structure: the city as a product of limited ideas based on a preconceived organisation, or the city as a product of numerous thoughts operating more randomly and over a long period of time.

Perhaps the primary concept which distinguishes organic cities from the other types is the notion of ‘irregularity’. Unlike regular patterns, organic forms do not follow geometrical orders. They cannot be easily measured, since they lack basic properties such as repetition, symmetry, parallel elements, alignment and so on. However, the notion of irregularity has not been conceived equal to ‘disorder’, ‘chaos’ or ‘disorganisation’ by recent urban theorists; on the contrary, the freedom from a predetermined urban grid, many urbanist believe, can create a highly flexible system of urban growth which intermingles the demands for various functions with the customary social conventions, and cannot be obtained in regular patterns (Papageorgiou, 1971, pp. 64-66).

If the city is considered as the physical manifestation of various determinants, it is apparent that the physical structure of the city is a complicated product which is unlikely to be easily tackled just by the superficial geometrical order. Geometry is the way of representing the physical organisation, but it is not the creator of urban life, nor the logic behind its behaviour. There are two ways of approaching this problem. It can be done either by employing a new form of geometry which seeks deeper patterns of order, or by adding new dimensions to the concept of order in the city. In recent years, there has been a vigorous effort to find deeper geometrical relations, hierarchies and networks to unravel the complexities of urban form,¹ instead of the *Euclidean* geometry, which is largely descriptive and unable to link the underlying processes of growth in organic formation.

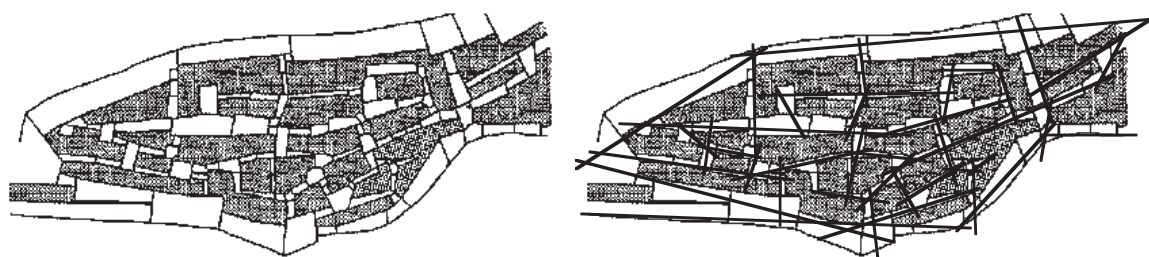
There is also a second way of dealing with the problem of irregularity and order by providing a new interpretation of order. Julienne Hanson introduces a new dimension by differentiating between 'order' and 'structure': "... order, in the sense of principles based on some generally accepted notion of sameness, repetition, geometry, grid, rhythm, symmetry, harmony and the like. ... structure, in the sense of making places intelligible through creating local differences which give both a sense of identity and a grasp of relation between the parts and whole, such we are able reliably to infer the global form from any position within it" (Hanson, 1989).

Therefore, an irregular layout may be able to create a powerful sense of perception for its inhabitants, whereas a highly-ordered pattern might be completely unreadable for the people who live in it. Bill Hillier also challenges the interpretation of organic as 'unplanned chaos' by changing the way of looking at irregularity:

"The spatial structure of the grid is the key element. 'Organic' towns which have grown over a long period seem to optimise certain key aspects of movement and land-use patterns by exploiting the structural properties of the urban grid. Many of the positive qualitative judgements we make about 'urbanity' are probably comments on this optimising functional logic of the organic city" (Hillier and Penn, 1992).

In this sense, structure creates a more complex understanding of order in cities, which is not conveyed by the simplistic geometry and is more about relation, configuration and use in urban patterns.

The following sections of this paper will attempt to approach the issue of organic cities through both ways mentioned above, or more truly, through a combination of these two approaches. *Space syntax* methodology will provide a topological sense of geometry, based on spatial configuration and graph relations; at the same time, the new patterns of order will be pursued disregarding the pure geometrical principles. It will be demonstrated that the issues of 'space' and 'spatial configuration' in organic cities convey valuable meanings, which can be investigated by analytical tools.



2 Methodology of analysis and the selected case-studies

In this paper the main approach to the concept of the organic city is based on an analysis of the spatial structures which underpin the characteristics of the urban grid. The adopted methodology in this research, *space syntax*², investigates the configurational properties of urban structure by measuring the relationship between each component of the urban system and all other components. Meanwhile, it attempts to associate the spatial structures to social and behavioural features of architectural or urban systems. *Axial analysis* is among the analytical techniques which has gained a great creditability in syntactic study of urban systems. This technique models the architectural or urban systems by driving a network of axial lines through all convex spaces of the system (figure 1). These axes are the representative lines of sight - or

Figure 1: An example of axial modelling: convex map (left) and axial map (right) of a small settlement. Convex spaces are the largest and fattest spaces in that each point in the space is visible from all other points of the same space; and axial lines are the longest and fewest lines that pass through all convex spaces of the system. after: Bill Hillier, Julienne Hanson, and John Peponis, "Syntactic Analysis of Settlements", *Architecture and Behaviour* 3 (3 1987).

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visibility - and movement - or permeability. A computer-based analysis determines the relative depth value of each line with respect to all other lines in the system and creates an analysed map which shows the *integration* value of each element in the urban system. Simply speaking, *integration* is the relative mean depth of each component of space - defined by an axial line - from the entire system. Since this kind of relationship corresponds to all parts of the system, it is called *global integration*. Axial analysis is also able to give integration values at more local levels, which can be calculated with the same method, but this time the relative depth of each line is calculated from a sub-system of lines situated in a limited number of steps from that line.³

The case-studies in this paper are selected from two major groups of organic settlements before any modern transformations: the Iranian and the English traditional cities.⁴ Six representative cities from each category provide a satisfactory basis for the study of each urban type and also a comparative analysis of two different organic structures.

Table 1	Syntactic Values (Means)				Syntactic Values (others)				
	M. Con.	M.Int. R3	M.Int. Rr	M.Int. Rn	Max. depth	Max. con.	Max. Rn	Min. Rn	Rr
Old English Cities									
1. Norwich	3.3505	1.9327	1.1126	0.7531	27	17	1.1277	0.4528	7.99
2. Bristol	3.6716	2.1204	1.2506	0.775	29	20	1.2662	0.3787	7.27
3. York	3.4183	1.9844	1.2608	0.8277	19	11	1.3532	0.4621	6.14
4. Hereford	3.574	2.1739	1.7756	1.1998	14	17	2.1186	0.6936	4.28
5. Canterbury	3.1293	1.8957	1.578	1.0967	14	19	1.9718	0.6236	4.35
6. Winchester	3.6143	2.061	1.6628	1.1405	13	16	2.1055	0.6056	4.16
Mean (English)	3.4597	2.0280	1.4401	0.9655	19.3	16.7	1.6572	0.5361	5.70
Sta.Dev. (English)	0.2023	0.1090	0.2670	0.2016	7.1	3.1	.4557	0.1221	1.68
Old Iranian Cities									
1. Shiraz	2.6758	1.5588	0.7536	0.4870	47	10	0.7411	0.3007	13.28
2. Kerman	2.5731	1.4854	0.7110	0.4777	47	10	0.7742	0.2829	12.52
3. Qazvin	3.0070	1.7456	0.9071	0.6013	38	19	0.8662	0.3704	11.11
4. Hamedan	2.8437	1.6349	0.6938	0.3926	56	11	0.5511	0.2427	16.29
5. Kermanshah	2.8017	1.6226	0.6912	0.4489	38	7	0.6643	0.3177	12.94
6. Semnan	2.7304	1.5642	0.7629	0.4874	37	11.2	0.7481	0.3215	11.00
Mean (Iranian)	2.772	1.6020	0.753	0.482	43.8	11.3	0.7240	0.306	12.86
Sta.Dev.(Iranian)	0.1365	0.8060	0.0741	0.0624	6.8658	3.6799	0.0975	0.0389	1.7610

M. = mean; Con. = connectivity; Int. = integration; Max. = maximum; Min. = minimum

3 Syntactic measures; an initial way of pursuing organic laws

The investigation of spatial patterns of organic order can be started by using the measures obtained from the *axial analysis*. In this connection, two types of measures are used (table 1): the mean values of syntactic variables (the first four columns) and some complementary measures (the last five columns).

The syntactic mean values of both categories vary closely within their own range of variation. Two notions can be mentioned here: firstly, the values for Iranian old cities are considerably lower than English cities; secondly, the differences between the syntactic values increase from the more local factors (such as connectivity) to more global values (such as Rn integration). The first result contributes to the idea that different types of organic cities hold various degrees of syntactic structure, although they share common spatial characteristics. The second result, however,

Table 1: A comparison of syntactic values resulted from the axial analysis in six English and Iranian old cities.

reveals this aspect of organic order: that cities of the same urban genotype share more common characteristics at local levels, whereas when they grow to larger scales they tend to show more global variations, still within their specific range of variation. A similar understanding can be obtained for other syntactic values (the last five columns). English cities are shallower and more connected structures, whereas Iranian cities are deeper and less connected; but in both cases there are consistencies in producing similar syntactic values (for instance, Iranian cities, regardless of their size, maintain a maximum connectivity close to 11.3 and a maximum depth close to 43.8). This proposes that organic cities of each genotype tend to create different spatial properties, but they also preserve a degree of consistency among themselves. This consistency of spatial values can be regarded as one of urban growth laws, but for completion of the idea of 'organic order' there are other important characteristics yet to be considered.

4 Spatial configuration and the cores of urban grid

For conducting this discussion we have to review the global integration maps of Iranian (figure 2) and English cities (figure 3). In summary, the integration cores of Iranian old cities form a compact, dense and continuous sub-structure in the centre of the city. The centre of integration - or the 'syntactic centre' of the city - usually matches the geographical centre. The physical shape of the core can vary from city to city, but two forms are more common: linear extensions and deformed grids. Regardless of its shape, the core, which is always the final destination of all major routes, matches the location of the central bazaar. The integration core in English cities is not as dense as Iranian cities, but it is still a relatively compact structure in the centre of the city. The shape of the integration core in English cities is mostly linear and is often dominated by a long and significant line, the 'high street'. Similar to Iranian cities, the major routes of the city always terminate at the integration core or become part of it in the centre.

The rest of the Iranian old city is mainly connected to the centre through the main routes or 'thoroughfares'. These lines start from the gates or entrances to the city and elongate organically through the residential quarters and finally reach the core. Some secondary routes grow like branches from the main routes and penetrate inside the quarters or connect them to neighbouring quarters. On thoroughfares, the segments of lines are longer and the angles between the intersecting lines are smoother. There is a similar principle for the major routes in English old cities, except the fact that the lines are generally longer and more straight than Iranian cities. There are secondary routes in English cities as well, but they do not penetrate too much inside the 'flesh' of the city. The length and angles between lines in English cities also vary from the thoroughfares to minor streets, but this variation is not as extreme as Iranian cities. The edge areas, which surround the centre and are connected to it through major routes, are the most segregated areas in Iranian cities. The degree of segregation increases by approaching the edges; however, the distribution of segregated areas around the core remains homogenous. The ending point of urban structure inside the city occurs at the end of dead-ends which are highly segregated in the global organisation of the city. The areas of lower integration in English old cities are also located on the areas defused from the city centre. Although the appearance of residential areas in an Iranian traditional city is different from an English old city - in

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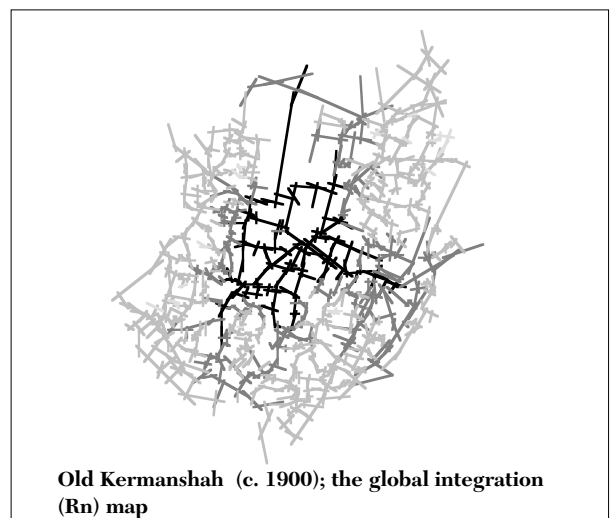
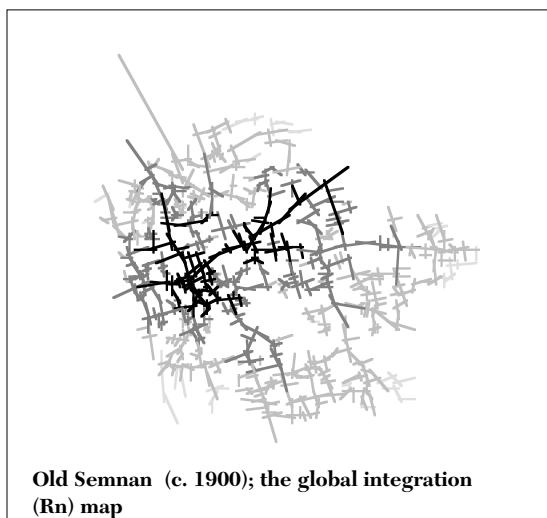
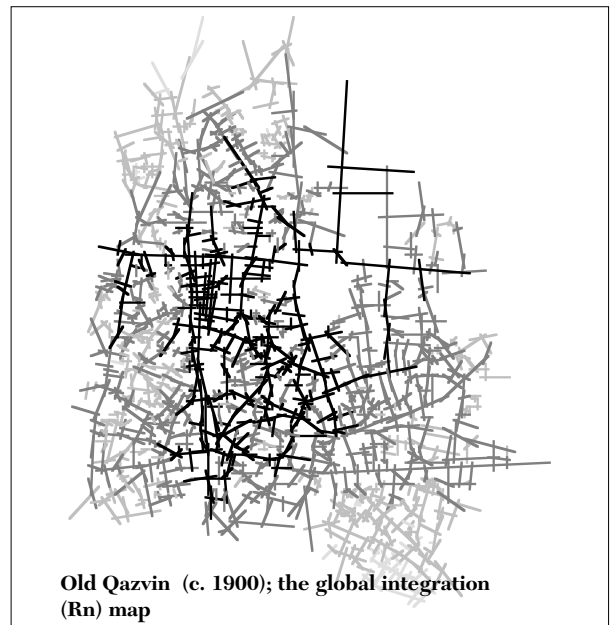
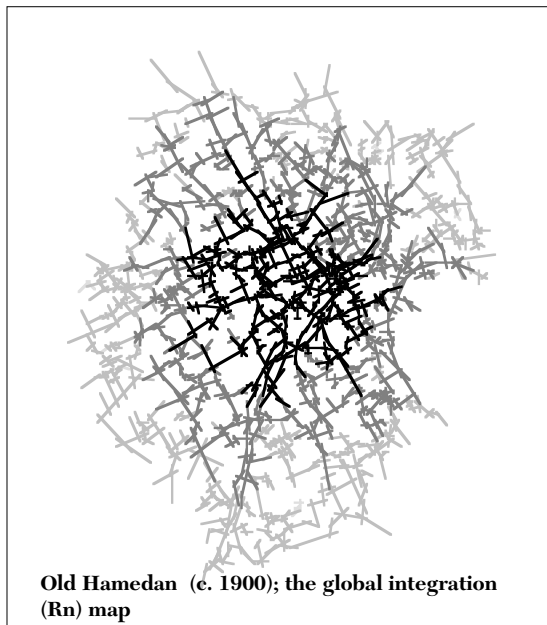
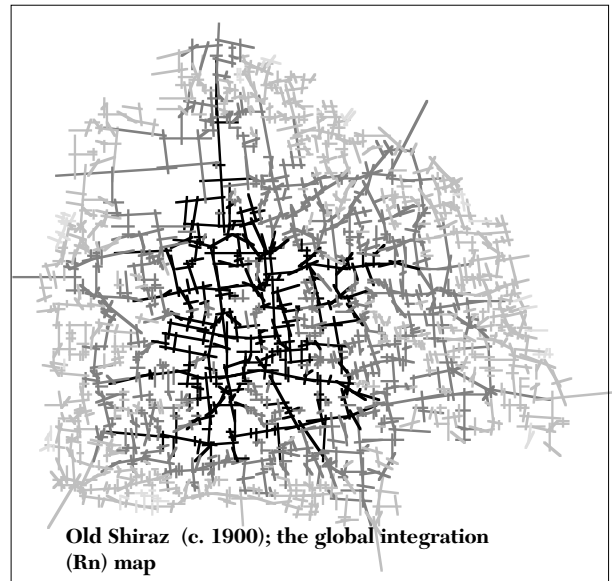
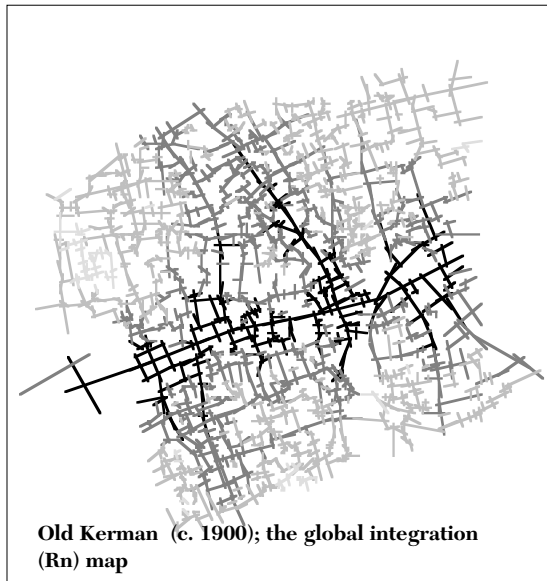


Figure 2. *The global integration (Rn) maps of six Iranian old cities.*

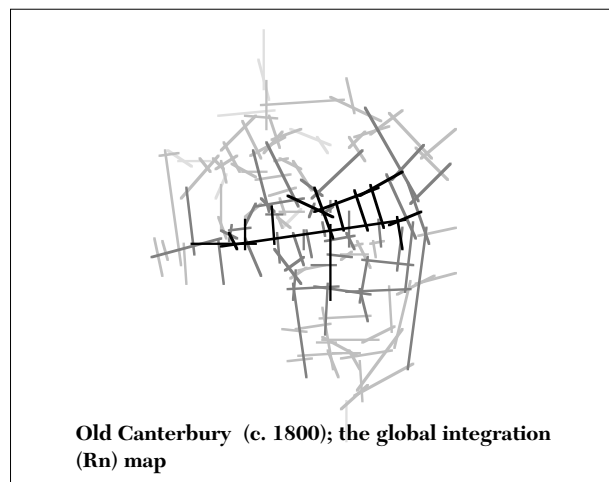
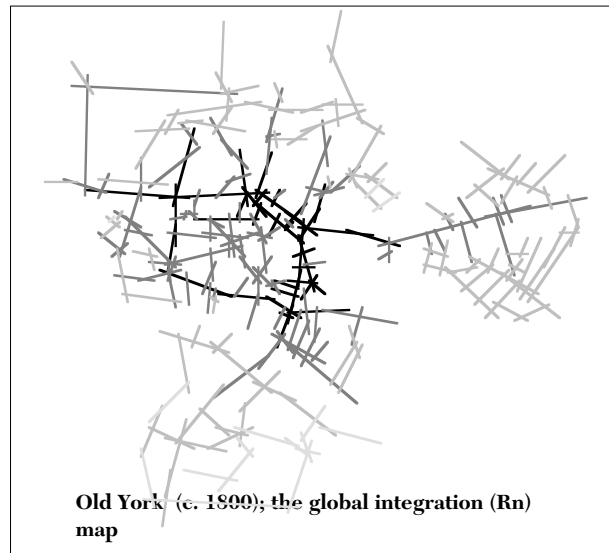
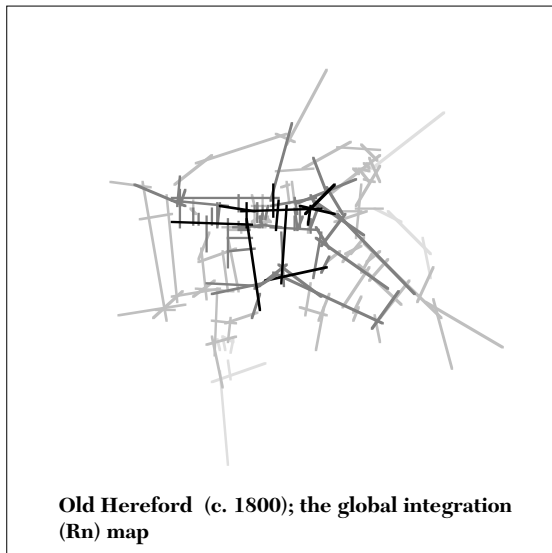
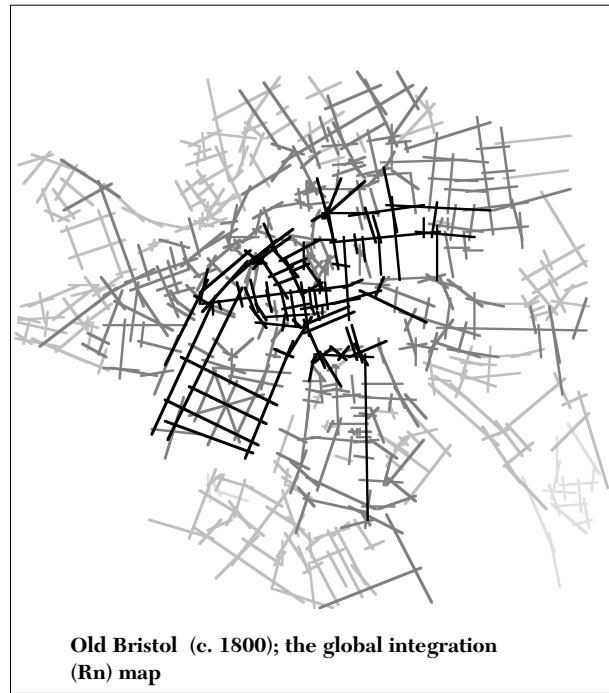


Figure 3. The global integration (Rn) maps of six English old cities.

terms of depth, density and shape - still they share a similar logic of urban structure by structuring the residential quarters around the main centre and keeping them at a lower degree of integration in the whole city.

5 Part-whole relationship and the spatial structure

According to the syntax theory, not only the local and global characteristics of urban systems are important issues, but also the interaction between them, i.e. the correspondence between the local and global configuration of space, is rather significant. This significance arises from the definition of ‘structure’ in syntax literature (Hanson, 1989), and extends to other aspects of spatial systems, such as optimisation of movement at local and global scale by following the spatial configurations of space at different levels (Hillier, 1996, p. 170). Similar to other factors, the pattern of part-whole relationship differs from English to Iranian cities, but again there are some common characteristics which can contribute to a common spatial theory of organic cities.

A quantitative picture of the part-whole argument can be represented by the measures of correlation coefficient between local and global syntactic values (table 2). The value of correlation between *connectivity* and *global integration* for the Iranian and also for larger English cities seems relatively poor. Where the correlation between the *local integration (R3)* and *global integration (Rn)* rises significantly for English cities (0.4279 as mean value), the result is still poor for Iranian cities (0.1600 as mean value).⁵ It can be shown that higher values for integration radii (specifically R5) can detect the local structures of the Iranian old cities more successfully.⁶ In this case, the correlation between *integration R5* and *global integration* makes more sensible values (mean 0.2860), though they are still lower than the same values for English cities. Finally, the correlation between *integration Rr* and *integration Rn* shows closer values in both categories, remarking the fact that there is a similar relationship between the integration core and the rest of the city in each category.

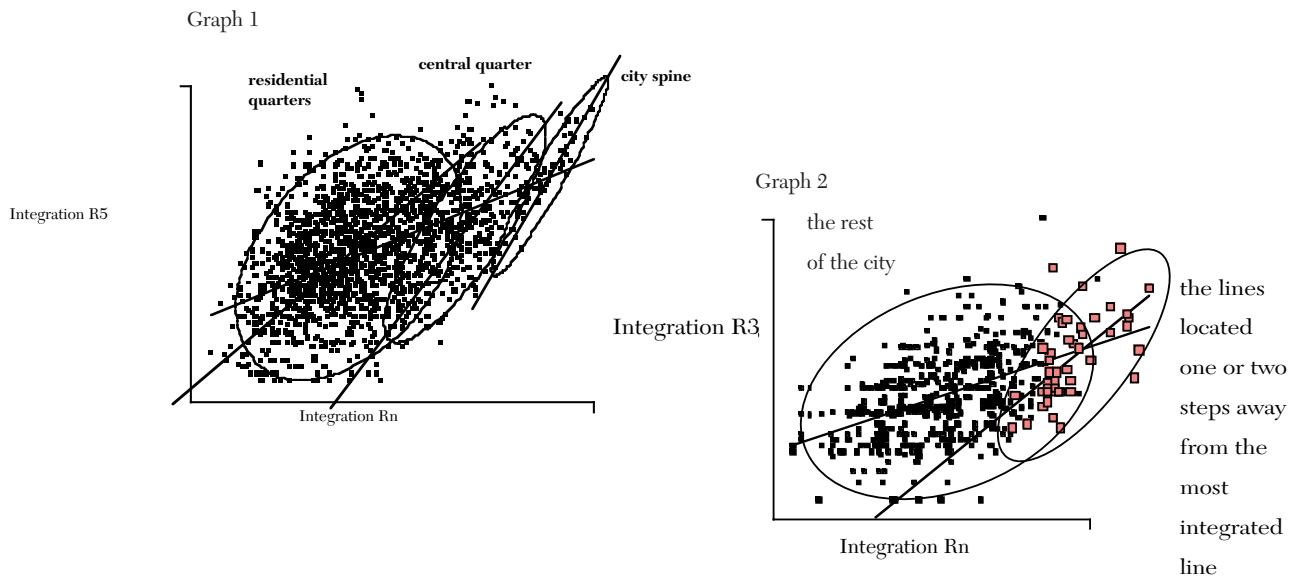
Table 2

<i>Correlation coefficients (r squared)</i>	<i>Int. Rn v. v. Con.</i>	<i>Int. Rn v. Int. R3</i>	<i>Int. Rn v. Int. R5</i>	<i>Int. Rn v. Int. Rr</i>
Old English Cities				
1. Norwich	0.2018	0.3207		0.6521
2. Bristol	0.1542	0.2681		0.6971
3. York	0.2166	0.2851		0.621
4. Hereford	0.3031	0.552		0.7171
5. Canterbury	0.2513	0.5172		0.7238
6. Winchester	0.4578	0.6245		0.826
Mean (English cities)	0.2641	0.4279		0.7062
Old Iranian Cities				
1. Shiraz	0.0946	0.1370	0.2784	0.6549
2. Kerman	0.0964	0.1275	0.2466	0.6942
3. Qazvin	0.1297	0.1838	0.3037	0.4993
4. Hamedan	0.1137	0.1700	0.3120	0.6301
5. Kermanshah	0.0910	0.1257	0.2261	0.4412
6. Semnan	0.1698	0.2171	0.3470	0.5991
Mean (Iranian cities)	0.1160	0.1600	0.2860	0.5860

Table 2. The ‘second order’ measures of syntactic analysis for six English and six Iranian old city; the correlation coefficients (r squared) of global integration against other measures.

Another notion which improves the understanding of urban structure in organic cities is the variation of local-global correspondence in different areas of the city. According to the general shape of local/global scattergrams, three distinct areas can be

recognised in an Iranian old city (graph 1): firstly, the central spine, including the bazaar complex, which makes a fairly tight scatter and gains a high correlation value; secondly, the central quarter which embraces the city spine and is still well correlated; thirdly, the residential quarters around the central area which do not show a strong correlation between the local and global integration. Therefore, in Iranian old cities the spatial behaviour of different areas is different; where a great deal of legibility is needed, such as the bazaar complex, the local structure coincides the whole structure of the city, but where privacy and tranquillity is demanded - such as residential quarters - the local structure develops a different pattern from the global structure.



The differentiation among different areas in English cities is not as structured as Iranian cities. Although the whole scattergram looks tighter, there is no strong grouping or splitting effect; but it can be shown that the local-global correlation for the integration core is higher than the rest of the city. If we select the lines which are directly connected to the most integrated line in smaller cities (or located two steps away from it in case of larger cities) on the scattergram, they will make a sub-scatter which is tighter and more correlated than the whole city (graph 2). Therefore, even in small systems like English old cities, the centre gains more readability and stronger local/global orientation than the rest of the city.

6 Spatial structure and the 'urban elements'

The constitution of the 'city' is manifested by different disciplines which interact into the physical framework of urban life. The function, movement, culture, land-use, architectural quality, monumentality, and many other determinants in a city are conveyed by the entity which creates interaction among them and the environment: the 'space'. By analysing the space we are able to learn about the rules of structuring the urban space and consequently urban life, but it is also a crucial issue to find how the non-spatial attributes of the society correlate to the spatial structure. However, correlating the social data to the spatial structure of old cities is not always a simple task, since any type of direct observation cannot be operated in the old times, and any set of comprehensive data for this purpose is unlikely to be easily obtained. Nonetheless, there is an efficient way of overcoming this difficulty by using more appropriate sources, such as the principal 'elements' of cities - i.e. the major buildings or urban spaces which accommodate the main activities in the city.

Graph 1. A typical scattergram of global integration (R_n) against local integration (R_5) for Iranian old cities. Three distinct areas exhibit different correlations. The scatter is extremely tight and correlated for the city spine; the tightness and the correlation coefficient decreases from the centre to surrounding residential quarters.

Graph 2. The typical scattergram of global integration (R_n) against local integration (R_3) for English old cities; the lines which are one step (for smaller cities) or two steps (for larger cities) away from the most integrated line make a tighter and more correlated scatter at the end of the scattergram.

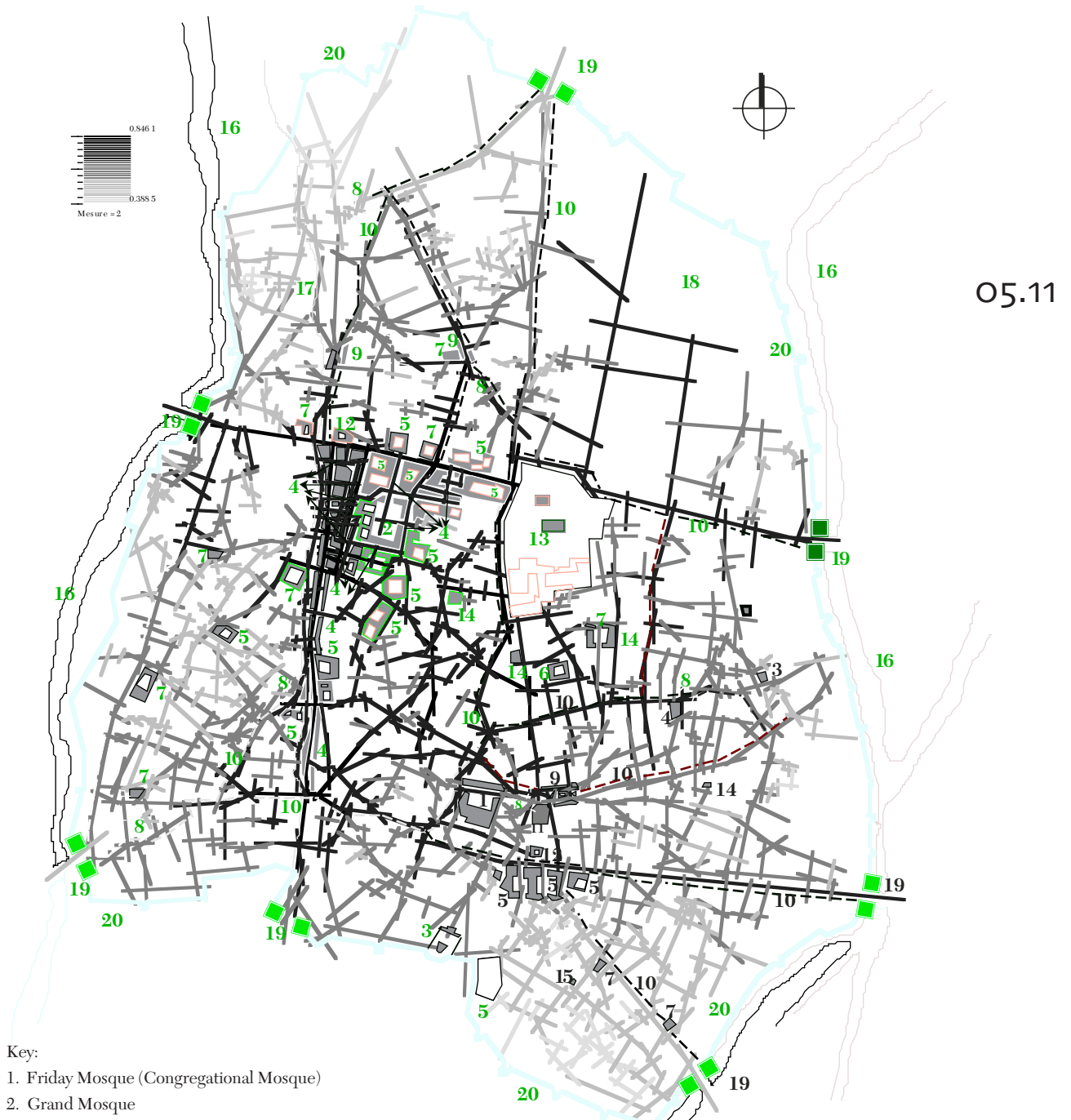
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Although elements of the cities are themselves spatial entities, they also convey other types of information from other layers of activity in the city: they are the main generators or attractors of movement in the city; they are the containers of major functions; and are also the manifestations of cultural and artistic representations in the city. The role of urban elements in organic cities seems even more crucial, since there is no pre-determined condition for the incorporation of urban elements inside the city structure. The location, size and shape of urban elements, as well as their relationships to each other and to the whole city, seem to be an evolutionary product of a gradual selection, instead of an instant decision at a particular period of time. Here, it should be mentioned that the elements of the city are respected by some influential urban theorists, such as Camillo Sitte (Sitte, 1945), Rob Krier (Krier, 1975) and especially Aldo Rossi (Rossi, 1982), as the focal point of their urban theory. The study of urban elements not only fills an empty space in our particular approach, but also reinforces the theoretical understanding of cities inspired by some prominent urban theories.

In order to demonstrate the relationship between the results of spatial analysis and the occupation of urban elements, the urban elements of Iranian and English organic cities are superimposed onto the axial analysis of the urban grid (the global integration). The result is a series of maps for Iranian and English old cities which can produce a lot of implications and interpretations. From each set of maps, one representative example is shown in figures 4 and 5.

Without exception, in all Iranian cities the most integrated line of the city passes through the 'bazaar'. In English cities there is not such an equivalent for the bazaar, but instead the central streets, especially the 'high street' - if it exists - play a similar role. The commercial elements in both city types gain the highest spatial significance, yet an important difference exists between them: in Iranian cities the street and market place amalgamate into a single entity, but in English cities the main streets take over the market place as the dominant part of the urban structure. Other major elements of Iranian cities find a close location either inside or attached to the bazaar complex, composing a powerful urban complex in the heart of the city, virtually named as the 'city spine'. The location of major elements around the central streets in English cities creates a similar effect, though this organisation does not construct a solid aggregation of physical components as the 'city spine' does in an Iranian city. The central structure in both city types is connected to other parts of the city through the major routes which extend from the city gates to the centre. These routes provide the interaction between residential quarters and the rest of the city, but more importantly, they accommodate the main locations for the local elements of the city: the local bazaars or local squares in Iranian cities, and parish churches in English cities.

The quantitative attributes of space syntax analysis enable us to extend the argument of urban element in organic cities to a more precise extent. By using this property the degree of incorporation of each urban element can be measured, creating a 'rank order' or 'class order' which shows the hierarchy of urban elements inside the grid. By determining the values of each element, the table of global-integration ranking for urban elements can be introduced (table 3).⁷ For finding the overall rank order we have to sort the tables, which could be done for each city separately, but it is more meaningful if we do this for all the cities together.⁸



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Key:

1. Friday Mosque (Congregational Mosque)
2. Grand Mosque
3. Religious Shrines or Historical Tombs
4. Bazaar
5. Carvansaraye
6. Madrasedh (College)
7. Mosques
8. Local Squares or open spaces
9. Local Bazaars
10. Main Thoroughfares
11. Adlieh (Court House)
12. Government Offices (like Post, Police, etc.)
13. The Palace and Garden of the Governor
14. Hammam (Bathhouse)
15. Ab-Anbar (Reservoir)
16. River
17. Stream
18. Mud Fort
19. City Gates
20. City Walls

Figure 4. The old city of Qazvin; the main elements of the traditional city (before 1900) are superimposed on the global integration (Rn) map of the old.

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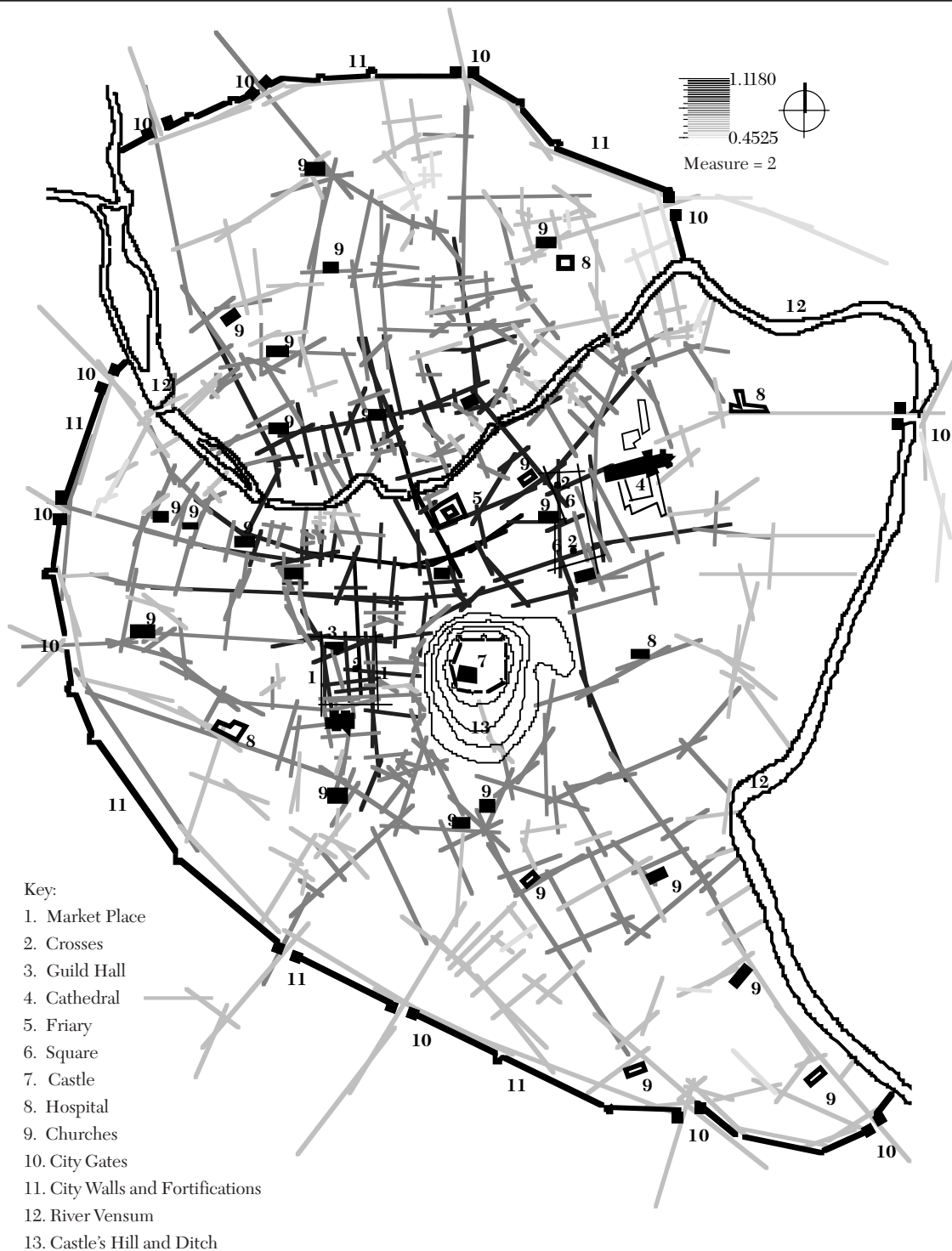


Figure 5. The old city of Norwich; the major elements of the traditional city (before 1800) are superimposed on the global integration (Rn) map.

The global-integration ranking of urban elements presents a sensible order of urban elements in both city types. In Iranian cities, the bazaar, city square and carvansaraye, are the top elements. These are places which accommodate the most intensive part of urban activities in the traditional city and provide the interface between residents of the city and outsiders. In English cities, the high street, crosses and guildhalls are found at the top. Different in appearance, but conceptually similar to Iranian cities, the prime elements in English cities are the elements which represent the most important functional and symbolic activities in the city. The absence of market square in the first band suggest the idea that in English cities the urban square is not the dominant feature and is always overshadowed by the streets.

Table 3

<i>Iranian Old Cities</i>			<i>English Old Cities</i>		
	<i>average</i>	<i>average</i>		<i>average</i>	<i>average</i>
	<i>Int. Rn</i>	<i>*int. Rn</i>	<i>/mean intg.^</i>	<i>Int. Rn</i>	<i>°</i>
<i>City Elements</i>				<i>Int. Rn</i>	<i>°</i>
1. <i>Bazaar</i>	0.6674	1.3837		1.8655	1.7609
2. <i>City Square</i>	0.6497	1.3670		1.5227	1.6015
3. <i>Carvansaraye</i>	0.6532	1.3546		1.5811	1.6003
4. <i>Grand Mosque</i>	0.6527	1.2696		1.4977	1.5371
5. <i>Friday mosque</i>	0.6106	1.2679		1.3885	1.4144
6. <i>Colleges</i>	0.6416	1.2588		1.1551	1.1879
7. <i>Govern. Place</i>	0.5739	1.1970		1.1125	1.1438
8. <i>Ruler's Palace</i>	0.5431	1.1647		0.9842	1.0659
9. <i>Local Squares</i>	0.5450	1.1095		1.0167	1.0254
10. <i>Mosques</i>	0.5293	1.0939			
11. <i>Local Bazaars</i>	0.5214	1.0773			
12. <i>Shrines</i>	0.5145	1.0619			
13. <i>Castle, Citadel</i>	0.5119	1.0358			
Mean Integration	0.4825	1.000		0.9655	1
				10. <i>Castles</i>	0.9414
				11. <i>Gates</i>	0.9433
14. <i>Gates or Ent.</i>	0.4710	0.9723		Min. Integration	0.5361
Min. Integration	0.3060	0.6352			0.5543

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° *average Int. Rn* : the mean value of global integration (Rn) for each urban element among the selected cities.

^ *average int. Rn /mean intg.* : the mean value of integration Rn for each urban element divided by the mean integration of the city which the element belongs to.

The elements which follow the top elements in Iranian cities are the grand mosques, Friday mosques and colleges, whereas the second band in English cities consists of markets and cathedral squares. In both city types the second group of elements adjoin the central spatial core and strengthen it; but the nature of the relationship between these elements and the top elements is different: in Iranian cities, the central mosques - and the main colleges which join them - are the places of both worship and social interaction; therefore, they become fairly intimate to the city spine. In English cities, the market square and cathedral square provide the complementary spaces for the central core, leaving the worship functions to less integrated areas.

Table 3. A comparison of mean integration (Rn) values of urban elements in Iranian (1) and English (2) old cities. The table is sorted by the average value of integration Rn divided by mean integration of each city (the last column).

The local elements in Iranian cities are relatively integrated in the urban system, which is quite adaptable with their functional and social role in traditional life. These are the interrelating elements between the centre and the rest of the city. In English cities, the cathedral and parish churches make the third group of urban elements. This is comparable to the situation of local elements in Iranian cities. Although the cathedral seems to function quite globally in old cities, its function is more regional rather than civic, and therefore, it does not appear among the most integrated elements. Parish churches are pure local elements which mainly dominate the local public functions. The location of local elements in the global integration ranking table is similar in both Iranian and English cities: after the superior central elements, but before the elements which are not intensively used by people.

There are similarities between our two city types also at the bottom of the ranking table. As the most diffused elements from the centre, the city gates are the most segregated urban elements in both tables; however, their values are quite close to the

mean integration and are larger than the minimum integration. The castles and citadels have the same situation, stressing the tendency of creating relatively segregated places in all cities, but still close to the average integration values. Before castles and gates, there are some elements - such as shrines in Iranian cities and hospitals or colleges in English cities - which are globally important, but are not intensively used in the daily life of inhabitants. These values are fairly close to the mean integration values.

05.14

The comparative study of the ranking of urban elements in Iranian and English cities reveals a fundamental result in understanding of organic cities: urban elements endeavour to locate themselves in the most appropriate occupations which suit their functional, social and symbolic character inside the spatial structure of the city; simultaneously, the spatial structure evolves in response to the formation of urban elements, creating the most appropriate spatial configuration for the established urban entities. In this sense, organic cities develop some general similarities, which are created by the common logic of traditional cities, as well as some differences, which are created by the diversity of socio-economic and environmental factors.

7 Discussion

The major objective of this paper has been an analytical interpretation of an obscure urban issue: the 'organic cities'. This obscurity, discussed in the beginning of this paper, has occurred either because the issues of 'space' and 'spatial structure' have not been appropriately evaluated in urban studies, or because the analytical methods needed for this kind of approach have not sufficiently evolved. It was explained that organic patterns do not share too many characteristics with biological systems, and the better understanding of organic growth comes in contrast to the planned or pre-conceived settlements. It was also discussed that the notion of irregularity in spatial formation is a major characteristic of organic cities, however, irregularity is not equal to 'disorder' or 'disorganisation' in urban systems.

At the first stage of our analytical approach, the syntactic measures were scrutinised. As an important finding, it became apparent that the syntactic measures in each category maintain an agreeable relationship: under similar conditions, the syntactic measures - such as mean connectivity or mean integration - remain close to each other. This is something like a concealed order which controls the pattern of the irregular grid. The study of urban configuration, created by axial analysis, provided some common characteristics for both city types, in spite of their differences: the urban grid tends to form a compact core in the centre; some major routes, which tend to be more linear and less winding, link the central core to the outside as well as the rest of city; and, the rest of the urban grid develops around the core and thoroughfares, providing more local sub-structures. This finding verifies the laws of urban emergence, proposed by Bill Hillier, in resolving the two paradoxes of urban growth: the paradox of 'centrality' and the paradox of 'visibility' (Hillier, 1996, p. 340). In this sense, organic cities maximise the integration of the centre for accepting the potential of accommodating the prime urban activities; at the same time, they try to reduce the segregation of the city from outside and the rest of the city from the centre through expansion of major routes.

Another major discussion was the issue of 'part and whole' in organic cities. It was experienced in both genotypes that the configuration of the urban grid in a local context is not exactly similar to the global pattern, but there are some logical degrees of overall part-whole agreement. But more importantly, it became clear that the extent of this agreement varies in different areas; it is highly correlated in the centre, where the maximum legibility is needed, but it becomes less significant in approaching the edges, where privacy and retirement is expected. This characteristic, in syntactic terms, can be regarded as a 'near invariant' which can be pursued in all types of organic structures; whereas, the differences between the two groups of English and Iranian cities, i.e. topological differences, originate from the cultural, social and economic differences.⁹ Therefore, the logic of spatial structure in organic cities can be revealed by the differentiation of urban spaces through the local or global configuration of the urban grid, and also through the differentiation of part-whole correlation among major urban areas.

The last part of this chapter attempted to substantiate the results of pure spatial analysis by investigating the relationship between the spatial structure and the actual activities in cities through the analysis of 'urban elements'. It was demonstrated in both Iranian and English cities that there is a powerful link between the socio-functional role of urban elements and the position they obtain in the urban structure. The hierarchy of the corporation of urban elements inside the urban grid makes a sensible 'order'. Again, although both of the two studied city types developed their own specific characteristics, common principles were also exposed. The most important elements of the city, socially and functionally, find the most integrated parts of the grid and locate themselves inside the integration core in a way which maximises the efficiency of each element; whereas the elements which have lower significance, in local or global context, occupy the less integrated positions. Thus, there is always a sensible coincidence between the non-spatial significance of an urban element and its degree of integration in the hierarchy of spatial configuration, as well as a remarkable agreement between the degree of part-whole interaction and the socio-functional role of urban elements.

8 Conclusion

Although the findings of this paper have resulted from only two species of organic cities, they are able to provide evidence for the claim that organic cities produce their own kind of order, in spite of their apparent irregularity. Any deep analysis of organic structures can reveal the principles and laws of urban growth which are based on an evolutionary fulfilment of the inhabitants' needs during the process of spatial formation. The genuine character of organic cities, which is widely admired everywhere, seems to be created by the harmony between what the city is and what the city is needed to be. Talents of artists, achievements of engineers and sophistication of civic life can accomplish the appearance of an organic city, however, the fundamental concepts of its structure still lie within the creation and incorporation of urban spaces and the rules which tie them together.

Notes

¹ Among the most significant approaches of this kind are: the hierarchical ideas, pioneered by *Christopher Alexander* (Alexander, 1966); ideas of shape grammar based on mathematical linguistics (March and Stiny, 1985); *space syntax*, or configurational analysis of spatial systems and behavioural patterns (Hillier and Hanson, 1984); and more recently, the application of *fractal geometry* into urban theory (Batty and Longley, 1994, pp. 54-6).

² *Space syntax* is the set of theories and techniques, developed in the Unit for Architectural Studies, The Bartlett School of Graduate Studies, University College London, by Bill Hillier, Julienne Hanson and their colleagues and students. Space syntax uses spatial methods and techniques to analyse the urban and architectural spaces and correlates them with social and behavioural concepts.

³ *Integration* could be defined as: the relativised mean depth of each component of space - a convex space or an axial line - from the entire components of the system which have the maximum depth of 'm' from that component. This is integration with radius m or R_m . If the number of 'm' is equal to the total number of elements in the system (n) it is called *global integration* or R_n . If the number of 'm' is limited to a lower radius (usually radius 3), it is called *local integration* or R_3 ; if the value of 'm' is one it is called *connectivity*; and if the number of 'm' is equal to the mean depth of the system from the most globally integrated line it is called *radius radius integration* or R_r .

⁴ The traditional form of English cities can be found in the periods before the 18th century, but in the case of Iranian cities the periods before the 19th century can be considered as traditional.

⁵ These measures can be compared to similar measures for seven modern American cities (mean R_n v. $R_3=0.3016$) and seven modern European cities (mean R_n v. $R_3=0.2690$), reported by: Mark David Major (Major, 1996).

⁶ This difference between the traditional Iranian cities and Western grids arises from the inherent morphological character of Iranian old cities in producing shorter and more broken lines. Based on this reasoning, through an analytical process it can be investigated that by increasing the radius of local integration from 3 to 5, a more sensible picture of local structures can be obtained. The details of the method of obtaining the appropriate radius for Iranian old cities is outside the scopes of this paper, but briefly, it can be determined by calculating the mean depth of the whole system from the super-grid of the system, assuming the fact that the super-grid is the place that all local structures overlap.

⁷ In order to create a rank order from the integration measures, the following rules are followed:
 - for each element the most integrated line of the global or local integration map, which either passes through the elements or the element has a direct access to it, is considered as the determinant line.
 - if there is more than one element of each kind in the city, each element is calculated separately and then the average value will be obtained.
 - if an element corresponds to more than one line, the average value of all lines corresponded to that particular element will be used.

⁸ This could be done by using the mean values of global integration for each element (the second column), or even more sensibly, the average of integration values of each element divided by the mean integration of the city they belonged to (the third column). It should be explained that this new measure will reduce the effect of relative integration of different cities, and hence, provide more coherent results; however, practically there is no major difference between these two methods of sorting.

⁹ Hillier defines 'near invariants' as "the configurational properties we find fall within a narrow band of combinatorial possibility. Without the knowledge of these 'near invariants' we cannot easily understand what cities are in principle, before we consider them as types or as individuals." He believes that the deep invariant structure of the urban grid is created by the 'near invariants', while the typological differences arise from cultural and socio-economic differences; and individualities from topography and historical conditions (Hillier, 1996).

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