A reflection on ‘Order and structure in urban design’

Kayvan Karimi
The Bartlett School of Graduate Studies
University College London (UCL)

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This article introduces Julienne Hanson’s seminal ‘Order and structure in urban design: The plans for the rebuilding of London after the Great Fire of 1666’ and discusses how its fundamental contributions to the field of space syntax could be appropriated to further enhance the understanding of urban form and urban design. The article focuses on the key points of the original research, leaving Hanson’s work to speak for itself.

This article argues that one of the most influential aspects of Hanson’s work is her demonstration that the degree to which a city combines both structure and geometrical order has a profound impact on its essential character. Not only has Hanson’s work been a vital contribution to the study of urban form, but the understanding of how configuration interplays with a city’s ordering principles means that for designers, an essential bridge has been built between the quantifiable methods of space syntax analysis and the intuitive process of design. The article concludes that Hanson’s work on urban structure could be used as a foundation for designing sustainable urban systems based on a synchrony of layers of urban function with spatial structure.

1. City of shapes and city of actions: order and structure

Julienne Hanson’s study of the plans for the rebuilding of London after the Great Fire of 1666, ‘Order and structure in urban design’ (Hanson, 1989b), was published in Ekistics in 1989 and was drawn from Hanson’s doctoral thesis, A Morphological History of the City of London (Hanson, 1989a). London’s organic evolution over centuries means it constitutes an ideal laboratory to study urban change, particularly at this juncture of its history when the city suffered extensive devastation. Hanson’s work demonstrates that a focus simply on order, on the geometrical properties of plans, makes organic cities appear as disordered, chaotic systems. Arguably the most important aspect of Hanson’s article is her argument that, whereas architects commonly focus on visual order by ‘raising structure to a level of conscious investigation alongside order’, a well-structured and liveable urban realm can be created. This argument is based on the extensive work developed in her doctoral research (Hanson, 1989a), in which she used the oldest part of London, the City, as a case to explore hundreds of years of urban change and spatial transformation.

Hanson begins her argument with a relatively general definition of order: ‘… order, in the sense of principles based on some generally accepted notion of sameness, repetition, geometry, grid, rhythm, symmetry, harmony and the like’ (Hanson, 1989a, p. 117). Hanson argues that these notions have historically influenced the design of buildings. Irregularities of form are commonly measured in architecture within the framework of formal regularities, and a pre-conceived sense of order is used to comprehend disorder. For instance, symmetry, which is about sharing specific geometric properties in a reference to a geometrical entity (a point, axis or plane), implies a strong presence of order; whereas the lack of symmetry is commonly seen as a lack of order. The notion of order is less evident in urban design and is generally limited to observa-
tions regarding the geometrical sameness or the presence of repetitions observed either through the plan view of an urban area or the architectural treatment of its buildings. A gridiron urban network, or a geometrically designed town, for instance, is normally considered as an ordered system. However, this type of order is only captured in drawings or bird’s-eye views of the city, rather than by navigating through the spatial system. This is where Hanson detects the problem: ‘There is a tendency to assume that order yields structure in the experiential reality of the buildings and places we create through architectural means’ (Hanson, 1989b, p. 22). Despite the common elision between order and structure, Hanson asserts that they are demonstrably two different things: order does not necessarily create structure and structure does not always imply order. The former is visible in plan, the latter only intuitively understood without analytical tools for analysing configuration, such as space syntax.

One reason that cities are rarely studied as structures perhaps lies in the fact that structure is one of the most challenging concepts to define, despite having been used for a long time. Almost as old as philosophy and science, the concept of structure is used widely and indiscriminately across disparate disciplines (Pullan and Bhadeshia, 2000). There are various definitions of structure spanning from philosophy and linguistics to physics and mathematics, which make the provision of an all-encompassing definition for the term almost impossible. However, skipping through the multiple interpretations available, two notions commonly appear: firstly, structures are formed by deeply constructed ‘relations’ and ‘patterns’ rather than those that can be found on the surface level of visual relations; secondly, structure is something that if altered excessively as an entity, will completely change or even become something else entirely.

It is true that deeply-rooted patterns can sometimes be created by ordered patterns. If we take Cerda’s plan for the extension of Barcelona as an example (Aibar and Bijker, 1997), it can be argued that the repetitious geometrical order imposed by the new grid has restructured the entire urban system. However, this is not the only way that structure is shaped. The structure of a crystal, for instance, is based on a rigid order of its particles, but that of a liquid is formed by a totally random interaction between its particles governed by some general rules, such as intermolecular gravitation. Even in Cerda’s plan it is apparent that the formal order is deliberately broken by placing two new major boulevards, Diagonal and Parallel, at an odd angle with the rectilinear grid, resulting in widespread irregularities and some degree of apparent disorder; but the outcome is actually an enhancement of city-wide movement and wayfinding (Karimi and Mavridou, 2004). Being an integral part of an entity, structure is deep, hidden and difficult to detect, but if identified it can offer a powerful insight into the understanding of that entity.

The main question is: in the absence of concepts that imply order, what else could be used to define the urban logic of cities? Hanson recognises that the reason for this shortage lies in the fact that the concept of structure has been commonly confused with order. Instead, she bases her definition of urban structure on the patterns of human movement and exploration in the city: ‘Order depends essentially on recognisable similarity of parts in similar relations to each other, to yield an immediately available gestalt, whereas structure is the underlying pattern which is picked up by moving about and which depends on an arrangement of differences’ (Hanson, 1989b, p. 22). A major distinction between order and structure is made here by Hanson: whereas order is about similarities and differences of forms, structure is about how we, as human beings, read urban systems and their relational patterns linking parts and the whole together. This shifts the concept of structure in cities from an abstract perception of
formal entities to a physical experience of the city as it is explored and navigated by people. A principal implication of this argument is that if we find a means of analysing the structure of a city, we are in fact dealing directly with its people and their interaction with the physical environment.

Hanson’s nuanced distinction between order and structure helps resolve a long-standing problem of why some urban systems work efficiently without any apparent geometrical order, while others apparently fail despite possessing a highly ordered geometrical plan. An example of these can be seen in a highlight of twentieth century planning – the British New Town. Like Newcourt’s plan for the rebuilding of the City of London (ibid., p.37), space syntax analysis of the New Towns shows these commonly followed a formal order in plan, whilst occasionally mimicking organic form by deforming the grid. A common pattern was to create neighbourhood units and repeat them recursively, but an essential feature of these plans was the lack of connection between local street networks and the main network of roads providing connections between neighbourhoods and the city centre (Figure 1). The result was to create a plan where parts are shaped by formal regularities, but the structure of the city lacks correspondence between the local parts and global whole (Karimi, 2009).

Figure 1:
Part of the route from the railway station to the city centre in the New Town of Harlow in Essex, UK. The highly ordered design of Harlow’s plan is perceived by users in a totally different way: the system is very difficult to navigate; the understanding of the local area does not give any clues that can help the understanding of the bigger system; finally, there is confusion in terms of the location and arrangement of urban elements, such as the Market Square and the City hall.
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The notion that space is not a container or a mere a background to human activities, but intrinsic to them has been the backbone of syntax thinking in the past three decades (Hillier and Leaman, 1973; Hanson, 1989b; Hillier, 1996; Hillier, 2001; Hillier and Vaughan, 2007). For this reason Hanson uses the syntactic approach to explore the issues of structure and order:

‘A syntactic explanation of a plan requires sets of principles to be brought into play, not one; that is, both structure and order. These may work together to reinforce each other in a design or they may be in opposition to each other, with structure differentiating space in the interests of intelligibility for the user (internal observer) and order tidying it up again in the interests of the planner or critic (external observer)’ (Hanson, 1989a, p.17).

2. Order and structure in design and planning

Hanson’s works responds to another critical question in urbanism: how is the structure of city perceived by designers and planners? Despite it being customary to assume that urban designers use morphological order to shape the structure of their design, it has not been sufficiently established if this really is the case in practice, or indeed how its use is employed by different designers. Hanson’s study articulates how ideas of order represent different design and planning approaches. The five extant plans studied by Hanson range from highly geometrical urban grids to schemes that retain some irregularities of the urban grid that had existed before the Great Fire. With the exception of Wren, who uses long thoroughfares linking the geometrically distinct parts of the city together, offsetting the public buildings so as not to obscure the direct views (the most syntactic of the five, according to Hanson, 1989b, p.37), the remaining proposals use diverse ordering properties, such as similarity, symmetry, geometrical shapes and repetition to form their main designs. For instance, Hooke and Newcourt use a regular orthogonal grid and regularly shaped urban blocks and public spaces, Knight a series of streets running parallel to the river, and Wren partial geometries which are orthogonal in the middle but become octagonal at the extreme sides of his design.

Whilst, as Hanson argues, there are similar geometrical motifs amongst the five studied cases, it is only through the subsequent space syntax analysis of the City of London, that the structure is revealed. The syntactic analysis reveals hierarchies and relationships that cannot be easily seen by the naked eye and shows how the various proposals utilise the integration core differently to shape primary city activities. This primary network of the top 10%, which normally houses prime activities such as retail and commerce, is compared with a background network of the bottom 50% least integrated lines, which are normally associated with less important activities and residential areas. The analysis shows that some design proposals are more successful than others in placing core urban activities at the integration (and hence the movement) heart of the city. The integration cores are formed in locations that do not match the importance of prominent public buildings and squares. More importantly, the parts and wholes of the design schemes do not create the interrelationships that had existed in the highly irregular urban grid of the City before the Great Fire. Apart from partial and perhaps unconscious attempts of one or two schemes (such as Christopher Wren’s design) to address issues of parts and whole, in most cases the more ordered the proposal, the weaker the spatial structure and the less there is an intelligible correspondence between parts and whole.

Hanson’s work contains important implications for urban design. Whilst the application of geometric order is relatively straightforward for the design process, it is evident that in the absence of a synthesis with structure, such an approach is likely to lead to a
lack of congruence between urban form, distribution of activities, patterns of wayfinding, and the many other essential constituents of the liveable city. What happened to the City in reality after the Great Fire is quite intriguing. The re-birth of the original grid, or the ‘rise of the Phoenix’, as Hanson puts it, illustrates the tendency of some cities to follow patterns formed and shaped over hundreds of years. There is no doubt that there are socio-economic and political reasons, as well as ownership or legal issues which lead urban restructuring to follow the grain of the past. However, in the case of London, where the Great Fire created a relatively blank canvas in 1666, the power of the spatial structure seems to have overtaken all other issues in the historic continuity of the City’s grid.

Hanson concludes that ‘raising of structure to a level of conscious investigation alongside order may lead to a situation where claims made at the drawing board are capable of translation into well-structured and therefore liveable urban places’ (Hanson, 1989a, p.40). It could be argued that the implicit argument is that analysis of the relationships between parts and whole should be an essential part of the urban design process. By using space syntax methods, Hanson not only employs an analytical method that is highly relevant to how space is configured, but also demonstrates that this specific type of analysis provides a very efficient method of reviewing urban design outcomes, comparing them and making an intelligent judgement about their likely implications.

Despite its limitations in being used in the very special context of the City of London, this approach is capable of being utilised in any urban design process which includes idea generation and option...
testing. It is important to emphasise that the generic approach offered by the analysis of spatial structure does not mean that designs or design options should abandon the features that are specific to their particular context. A successful design is still the one that coherently links the generic functionalities that are expected from the design with particularities that distinguish design ideas from each other. However, the use of syntactic methods can provide the framework to separate these issues from each other and make sure the particularities of design do not undermine the overall functionality that is expected from the spatial structure.

3. Urban elements and spatial structure: lessons for urban design

Hanson’s theory of order and structure provides an essential approach to how cities should be understood. This understanding can be complemented further by investigating how the spatial structure of the city links with the important elements of the city: the buildings and public spaces which accommodate the principal activities of the city, and manifest themselves in its spatial structure. The importance of urban elements is fundamental, as was suggested above in the case of the City’s churches and squares: through their physical manifestation, they accommodate prominent functions and land- uses, generate and attract movement, symbolise social and cultural values, and characterise the architectural character of the city.

The importance of urban elements in understanding cities is acknowledged by some influential urban theoreticians such as Camillo Sitte (Sitte, 1945), Aldo Rossi (Rossi, 1985) and Rob Krier (Krier, 1993). Urban elements are shown by these authors to play a significant role, since throughout time they accumulate the values which make them
the points of recognition and identity for the city. These are places that correspond to the way the city functions and to the means by which urban history and the ‘collective memory’ of the society are crystallised (Rossi, 1985). Whilst highly influential, the authors’ theories tend to focus more on the localities of places and urban elements (as suggested by Peponis, 1989). Hanson’s work highlights the need for a general theoretical framework to capture the complexity of the city as a process.

Inspired by Hanson’s work, a method of investigating urban elements and spatial structure was developed by the author of this article in the 1990s to underpin the dynamics of urban transformation in the historic cores and its implications for urban conservation (Karimi, 1998). The study took a sample of organic cities in Iran and England to establish their local and global spatial patterns and how they correlate in different places of the city. Visual inspection of the urban grids did not reveal any aspect of order, but space syntax analysis revealed a pattern of spatial hierarchy appearing at both local and global scales (Figure 3). The analysis identified where the cores of activity, main thoroughfares, local centres and residential quarters were located and how these different localities were linked in the bigger context of the city. This spatial interpretation was found to be highly consistent with what is known about the social and economic characteristics of these settlements (Karimi, 1998; 2000; 2002).

The concept of intelligibility, used by Hanson to describe local to global spatial relationships can be quantified using regression analysis. The analysis showed that the degree of association between the local and global patterns varied in different parts of the city (Figure 4). In the centre of city, where maximum interaction between all groups of people - insiders and outsiders - is expected, this correlation...
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is the highest, but when someone penetrates deep inside the residential areas, these correlations get weaker. It seems that the organic grid has created a mechanism through which certain parts of the grid, which need to be perceived and navigated more easily, become more intelligible. In contrast, in certain parts of the grid the level of intelligibility is reduced to make it harder for non-residents to find their way through the system, and thus discourages them to proceed farther. This hierarchy of the grid manifests itself in the size, shape and architectural articulation of different spaces as well. There is a clear change of all these factors when someone moves through the urban grid and explores places that are meant to play a local, an intermediate, or a city-wide role (Figure 5).

Furthermore, the major elements of the city were superimposed onto its syntactic analysis to examine the relationship between how the city is structured spatially and how this structure is complemented by urban elements which represent the interaction between inhabitants, architecture, movement network and space. The results, even if examined visually, are striking (Figure 6a). There is a strong synchrony between the levels of spatial integration and the importance of the urban element in terms of attracting people or accommodating activities. For instance, the location of the most important commercial activities - the Iranian bazaar or the English High Street - is consistently found to be the most integrated lines. There is a similar logic in the syntactic value of the other elements of the city, which is explained in detail elsewhere (Karimi, 1998; 2000; 2002).

In order to quantify the relationship between the urban elements and spatial structure, the syntactic value of all urban elements were calculated by averaging the values of the lines that are parts of these elements or adjacent to them. These values were put in a table and then ranked according to the syntactic value of each urban element (Figure 7). The rank order of urban elements created by this method is quite revealing. The spatial position of almost all elements of the organically evolved city could be clearly explained by its social, economic and cultural characteristics (Karimi, 1998; 2000; 2002). This means that the hierarchy of the space has shaped the hierarchy of the urban elements to optimise the efficiency of the urban system.

Figure 5:
A typical scattergram of global integration (Rn) against local integration (R5) for Iranian old cities. Three distinct areas exhibit different correlations (Karimi, 1998).
Figure 6a:
Left, the elements of the city (in white) are superimposed onto the syntactic analysis (global integration) of the old city of Shiraz, c.1800.

Figure 6b:
Right, the historic core of modern Shiraz is analysed, using the same technique. The old elements of the city (such as the Friday mosque, the old colleges, the bazaar and caravanserais) are shown in white and the modern elements (such as the new shopping places, administrative buildings, educational buildings and modern public spaces) are shown in pink (Karimi, 1998).

Figure 7:
The rank order of urban elements in Iranian and English historic cities.
The same techniques were used to explore how the transformation of the spatial structure has had an impact on historic centres by superimposing both historic and modern urban elements onto the spatial analysis layer. In the case of English historic cities, which have maintained their original spatial structure, the historic elements of the city are as active and well used as the modern urban elements (Figure 6b). This has created relatively easy conditions for regeneration of their historic centres (Karimi, 2000). In contrast, the drastic shift of the spatial structure after modernisation in Iranian cities has created a mismatch between the original character of each historic urban element and its position within the modern spatial structure. For instance, the bazaar, which used to be the backbone of the spatial structure in the historic city, is now a fragmented and segregated entity. The result is a disparity between the historic elements of the city, which have lost their logic and the modern urban elements, and which have followed the transformed spatial structure closely. Arguably, this is one of the reasons for the subsequent decline of the historic centres and the difficulties found in attempts to regenerate them (Karimi, 2000). Such analysis of the spatial requirements of urban elements allows for a generic understanding of their disposition within the urban grid.

4. Foreword: the structure of urban harmony
Hanson’s seminal conception of order and structure in urban design has undoubted influence. Her major contribution is in demonstrating how an analytical and thorough understanding of the spatial structure can enhance the generic understanding of how the interplay between order and structure is essential to shaping the character of individual places. Beyond the understanding of the generic structure of cities, Hanson’s work highlights the importance of studying the specificities of each context historically and morphologically, so that design approaches and options can link back to what makes a particular city the kind of city it is. This is arguably the foundation of achieving sustainable, contextual and harmonious urban design.

An urban system is composed of various physical or functional layers that overlap across the foundations of its spatial structure. The distribution of flows, infrastructures, land uses, densities, social interactions and the many other layers of the city are in constant interaction with each other, and indeed with the spatial structure. The urban system will become increasingly more efficient as these layers correspond to a greater degree. From an analysis of how these layers interact with spatial structure, more complex models of the city could emerge to address fundamental urban problems and provide more advanced tools for urban design.
References


Karimi, K. (1998), Continuity and change in old cities: an analytical investigation of the spatial structure in Iranian and English historic cities before and after modernisation, University College London (UCL).


About the author:

Dr Kayvan Karimi is a Senior Lecturer within the Space Research Group at the Bartlett, UCL, and a Director of Space Syntax Limited, a UCL spin-off company that utilises Bartlett’s research in professional consultancy. His academic and professional experience spans from the East, where he originates, to the West, where he has spent most of his professional life. He has worked extensively on a wide range of research and consultancy projects, including strategic city planning, urban regeneration, large-scale urban master planning, urban conservation, revitalisation of historic centres, regeneration of informal settlements and public realm design.