The Role of Spatial Design in Building a Resilient Community

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Abstract: The development of a scientific outlook on urban development must necessarily tackle the issue of community engagement. Here the history of the last thirty years in the UK brings lessons for those currently dealing with these issues in China. It is argued that autonomy is the primary requirement for an equitable and harmonious society, and that spatial planning has a very direct role in its provision. Three component theoretical strands are discussed and a method is described for bringing the tacit knowledge held by local communities together with explicit (scientific) knowledge through the use of evidence based processes. Evidence allows common ground to be agreed by different stakeholder groups and forms the basis of constructive dialogue.

Introduction

It is a truism that a harmonious society is free from conflict, however it is also commonly held that creativity and innovation depend upon competition, and that innovation itself often results from conflict. Since the ability to innovate will be crucial to the survival of future communities in a world of increasingly rapid social environmental and political change, how is it possible then to create a harmonious society which at the same time remains innovative and vital? This is the conundrum faced by architects and planners all over the world, but nowhere as urgently as today in China.

This paper investigates the role of spatial design in the processes of community building at scales ranging from the whole metropolitan area to the local neighbourhood and building, and proposes that it is a property of spatial design (when we get it right) to allow creative competition while minimising out and out conflict. In order to develop this proposition three separate lines of discussion are pursued: first, that fundamental to an equitable society is the provision of individual autonomy. Here the 'theory of human need' set out by Len Doyal and Ian Gough (1991) is used to argue the importance of the development of intelligible urban forms. Second, the theory of planning as that which unites administrative, legal and market systems in the management of spontaneous urban development, particularly through the processes by which property rights are asserted, as set out by Chris Webster and Wai-Chung Lai (2003); third, the theory of the independent and active role of spatial design first developed by Bill Hillier and Julienne Hanson in The Social Logic of Space (1984). More recent research results are described that suggest how these three lines of argument can be brought together to define a framework for active community engagement in evidence based planning processes.

Briefly, the proposition runs as follows: First, that the spatial structure of cities, in order to allow individual autonomy – the capacity to determine one's own future and to act with intention - must be intelligible. Intelligibility may be defined as the maintenance of a correlation between local and global spatial properties (Hillier et al, 1987); Second, that the spatial layout of the street grid, all other things being equal, determines a pattern of human movement flows (Hillier et al, 1993; Penn et al, 1998). These movement flows in turn bring people into contact with each other in space, as well as bringing moving people into contact with the static occupants of adjacent land parcels; Third, that markets in urban land are more or less sensitive to the opportunities to transact afforded by spatial structure, and that this process, in a free market, leads to an allocation of land uses in urban space (Hillier and Penn, 1992); Fourth, where there are lawful processes of this kind social meanings can be attributed through either their manifest operation, or through their denial. Denial of natural processes, such as those that result from the operation of free markets, specifically involve the assertion of power, however, so too do processes of social organisation such as those required to build geometrically ordered urban forms such as regular and radial grids, or other symmetric urban forms, and those required to keep large open spaces free from development.

These processes may be discussed though an analysis of the spatial structures of urban forms and a framework for making them apparent is developed. It is argued that transparency of intention is essential if local communities are to be empowered in planning their own future, and by doing so through evidence based planning methods both individual and community autonomy can be achieved. Finally, it is suggested that the spatial layouts that result from assertion of power through denial of natural processes tend to the reproduction of the social, economic and political power structures that make this denial possible, whilst those that allow novel social forms to emerge tend to operate through more probabilistic spatial and market processes, leading to social, cultural and economic innovation. The latter result in deep structures derived from bottom-up evolution, whilst the former result in a more obvious (and symbolic) surface order derived from their top-down origins. It is argued that where urban order is achieved through denial of bottom up processes conflict can result between the needs of the top down and bottom up. In order to reduce conflict at the same time as supporting innovation bottom-up processes must be used and managed.

Individual autonomy and the intelligible neighbourhood

In considering the rights and duties of members of civilised society to one another, Doyal and Gough (1991) make a strong assertion: that ultimately all individuals in an equitable society have an absolute right to autonomy, and a duty not to curtail the autonomy of others. Autonomy is the ability to make intentional decisions about one's own future. There are many ways for the ability to make intentional decisions to be curtailed: lack of economic means, lack of education or lack of access to information and poor health can all inhibit ones freedom to decide one's own future, as can social and political power structures and the sanction of inequitable laws. In order to be intentional a decision must be informed, and here both knowledge and information

come into play, since without either one or the other any decision one makes is effectively arbitrary.

It will be argued here that knowledge and information provide the link between individual and communal autonomy and urban planning, both in terms of the planning process and in terms of its product – the built environment. Whilst the former may seem obvious, that the ability to act autonomously in planning processes depends on access to knowledge and information, it is perhaps less clear how the built environment itself relates to autonomy. In order to explain this we must first show how the built environment can be considered as a configuration of space, and how configured space gives an individual information about where they might move and what opportunities this affords them. We must then show that different ways of configuring space – of designing urban layout – can increase or reduce an individual's access to information.

It is clear that a layout of buildings in space creates a pattern of visible and hidden space and building surfaces from a specific point of view (Figure 1a). As the viewpoint moves so the visual field changes. Building surfaces and open space carry two distinct types of information. The former gives information on land uses, where the latter give information on where one can move next. In anything but the simplest environment one must move in order to see all of the space and all building surfaces.

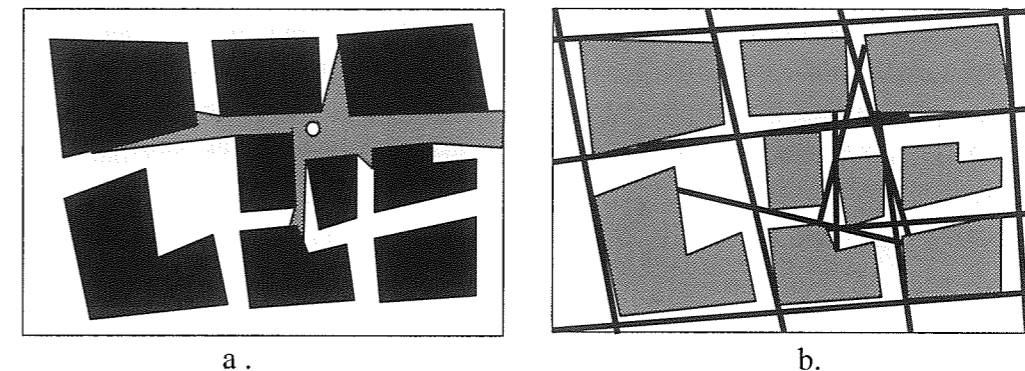a .   b.

Figure 1a. A visual field from a viewpoint gives partial (local) information about the adjacent land uses and opportunities for movement. Figure 1b. An axial map simplifies the space pattern into potential lines of sight and access.

There is a relationship between knowledge derived from moving around a whole environment, and the information on space that tells you where you can move to immediately from a particular location. One way to investigate this relationship is to represent the patterns of space in the environment as a simplified axial map (Figure 1b). An axial map can be redrawn as a graph in which lines of sight and access are represented as nodes and intersections between lines – where changes of direction take place as we move – are represented as links (Figure 2).
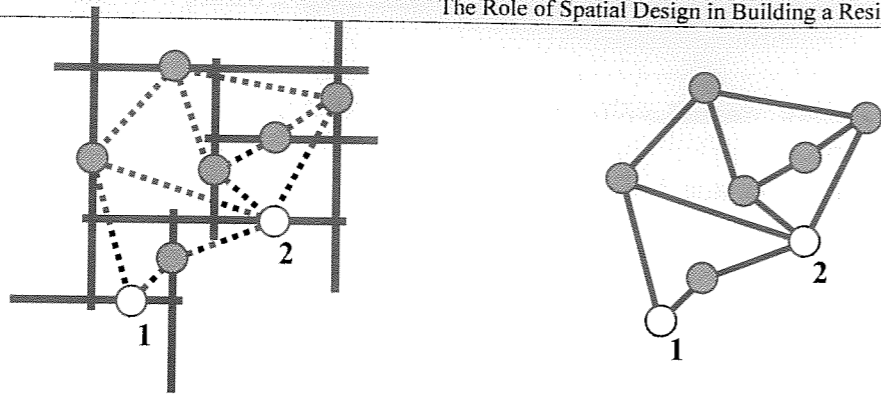
Figure 2. An axial map simplifies the open space configuration of an urban area into the linear structure which defines movement potential. This can be represented in turn as a graph.

The graph representation of urban space allows a range of graph theoretic measures to be used to quantify its properties. For example, Figure 3 shows the graphs redrawn from the point of view of the two lines marked 1 and 2 in Figure 2 above. The redrawing shows how the street system differs when viewed from two different locations. From line 1 the rest of the system is distanced, one must make on average 2.29 turnings to reach any other line, while from line 2 only 1.43 turnings are required on average. The measure of mean depth in the graph (the average number of turnings) is a global measure of the graph in that one needs to traverse the whole system in order to calculate it. It is important to this argument that turning a corner in the urban grid involves a substantial change in visual field and in information available to the viewer. In contrast, the connectivity of a node (simply the number of other lines a given line intersects) is purely local and can be thought of as information one can gain from a single visual field without moving.

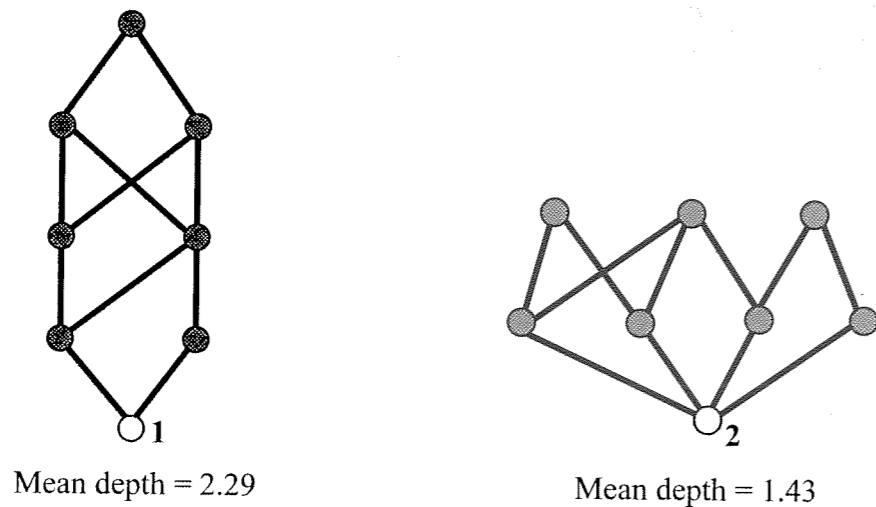Mean depth = 2.29   Mean depth = 1.43

Figure 3. The graph from figure 2 considered from two different points of view in terms of fewest change of direction routes from an origin node to all other nodes.

Hillier et al (1987) use local and global measures of the graph representation to define a measure of the 'intelligibility' of a spatial configuration as the correlation between connectivity in the axial map and a normalised measure of mean depth (called integration). Since a statistical correlation can be thought of as a predictive tool: "from information on variable X how well can I predict variable Y?", it can also be treated in terms of how well local information present in the immediate visual field gives a good

guide to one's global position with relation to the whole spatial system. They found that many traditional forms of settlement around the world correlate local and global measures much more systematically than one would expect by chance. In contrast they found that in many modern UK examples of social housing projects the relationship between local and global graph properties seems to be systematically absent. These housing projects were often criticised as being 'maze like' or 'labyrinthine' by their residents.

The implication of these findings is that the spatial design of urban neighbourhoods forms an important component in the cognitive equipment we use to understand and navigate our environment. If an area is designed in such a way that local and global are uncorrelated we effectively disable the user's ability to navigate and to locate themselves. In other words, we reduce their autonomy in their interactions with the urban realm by removing access to spatial information. Where the reduction in autonomy is systematically imposed by one class on another, as in the UK's post-war housing programme, whether or not these actions were intentional or consciously planned, it is hard not to see it in a political context.

Natural movement, predictable social contact and the movement economy

By representing and quantifying the configurational properties of street systems as described above, it becomes possible to search statistically for determinants of observed human movement flows. In this way the question "is there a spatial design determinant of human occupancy and co-presence in space?" can be answered. The results are striking. In urban systems that have been studied to date spatial configuration (in particular measures of depth in the axial graph) has been found to be strongly and consistently related to variations in movement flows from location to location (Figure 4).
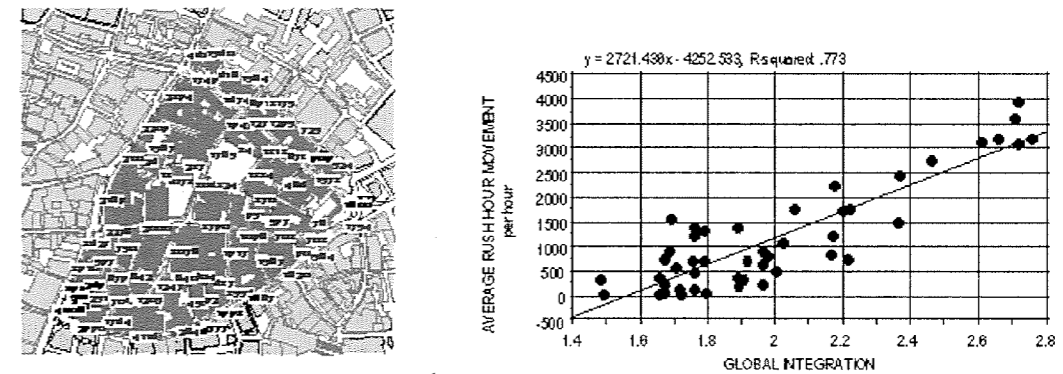

a.   b.

Figure 4 a. Baltic House Area; Rush Hour Average (Adults/ ph); b. Correlation between Global Integration and Rush Hour Movement

There is now considerable evidence that the spatial configuration of the street grid is the primary determinant of human movement flows, whether these are pedestrian or vehicular (Hillier et al, 1993; Penn et al, 1998; Peponis, J., 1989; Read, S., 1997). The implications of this regular association between patterns of spatial configuration and human movement flows are important. In just the same way that one can predict from local spatial information something about one's global position within the urban

structure, the correlations with movement mean that from the same information on space contained in the local visual field, one can predict human presence and occupancy. It is this that allows one to behave intentionally with respect to others and which gives one autonomy in social and economic relations that depend on being able to decide on the degree to which one wants to engage in face to face contact with others.

It is important also to note that where intelligibility in the spatial structure is reduced, so too is the predictability from space of human movement. In this way, designing urban space to be unintelligible at once removes the user's autonomy in defining their own route through the environment, and at the same time removes their freedom to choose the time and place in which to meet and interact with others. The converse, that in an intelligible urban area the presence of others is essentially predictable, has important social and economic consequences. Socially, the spatial layout of the city can be seen as constructing a 'virtual community' through patterning the potential presence of others in a more or less predictable way. In this way we can take advantage of the predictability of movement patterns to seek out (or to avoid) human contact.

In economic terms the passing trade provided by through movement is a major driver of exchange and transaction (Hillier and Penn, 1992). Retail land uses aggregate on spatially integrated streets in greater numbers than in more segregated locations. There appear also to be scale sensitivities in these aggregations. Where particular classes of retail derive their trade from an essentially local market area, for example convenience grocery stores, they will tend to seek out locally more strategic sites. The more that a retail function depends on a larger market area, the more globally accessible the site it will select. This process leads to patterns of aggregation of different retail functions.

Spontaneous urban development and spatial structure

I have argued elsewhere that the patterning of land uses that characterise long evolved urban areas also provides efficiencies in searching for specific classes of goods and services by shoppers (Penn and Turner, 2004), but the argument proposed here is more fundamental. It is that urban spatial configuration plays a direct role in the process Webster and Lai call catallaxis:

> "The creative order that emerges as individuals interact to discover, test and exchange new knowledge has been termed *catallaxis*. Catallaxis involves innovation. It happens when resource owners, however meagre their assets, find others who want something they possess and discover how to process their assets to supply that need in return for remuneration. Catallaxis as an economic model contrasts to the traditional neo-classical maximisation model by being open ended and relatively unconstrained. In the comparative static neo-classical world, profit and utility maximisation is limited by endowment constraints including production technology. In the catallactic world, knowledge evolution, innovation and adaptation guarantees a constant supply of new wealth-enhancing opportunities for those willing and able to use their resources productively in exchange or in combination."
>
> (Webster and Lai, 2004, p35)

The main proposition here is that catallaxis both depends on, and consists of, making manifest the information required for individuals and communities to act autonomously, since it is only through autonomy that either cooperation or competition are possible. Urban spatial configuration, at all scales from the street segment and neighbourhood to the whole metropolitan region, gives people immediate access to the information on which to base their decisions on how to behave and how to interact with others. It is the overt and open nature of the built environment, of the disposition of property rights and land uses with respect to space patterns that carry information on opportunities for social and economic interaction and exchange, and of spatial configuration in defining how one moves through and is brought in contact with that information, that defines the basis for an emergent and spontaneous urban realm as a social and economic entity. More importantly, when spatial configuration and land use patterns result from long term evolution, these patterns, and especially the correlations between different aspects of spatialisation, carry information on history and process dimensions of society.

Symbolic and instrumental space: meaning and power structures

The sketch given above relates mainly to what might be considered as the bottom-up product of long evolution and market processes. In this spatial structures have evolved to give a correlation between local and global properties. The land parcels adjoining space have been allocated through market processes such that there is a correlation between market catchments and spatial location. Given long enough for a system to evolve and sufficient flexibility in the redesign of space or the re-allocation of land uses to plots, one could imagine that a relatively efficient urban form would result. One might imagine that this form would look like one of the many organic and unplanned settlements that we are familiar with. And yet, there are a whole class of settlements that show few or none of these properties. Modern Capital cites such as Brasilia or Canberra consist more of symbolic axial spaces than axes that are to do with movement.

Here there is a simple proposition to be made: that power structures in society can demonstrate their power by means of three processes: first, through coordination and investment in coordinated action; second, through a process of 'building big'; and third, through denial of the outcomes of bottom-up processes. The results in terms of urban planning are of two kinds: first, coordination is most often seen in the geometric and often symmetric plan forms of urban areas or whole cities that result from centralised planning, and the obvious investment and coordination required in order to construct large and monumental buildings and infrastructure. Second, the investment in unused or ceremonial space (that which gains use mainly through organised human activity), or unused space which results from rule systems that exclude natural movement or occupation of locations which otherwise would be well used. All of these can be seen as manifestations of conspicuous consumption, either of human organisation, space and resources, or through the denial of access and so conspicuous lack of use of space, and so a denial of efficiency. In any event these processes make use of the natural 'bottom-up' properties of urban space and economic markets to construct meaning in the urban landscape through organisation or denial.

Evidence and informed dialogue in community engagement

During the later part of the 1980's planning processes in the UK went through a period of radical change. This was driven partly by the out and out failure of recent large scale urban interventions: traffic schemes that divided communities, social housing projects that had declined into malaise, city centre regeneration projects that had decimated the live centres of our market towns, destroying their economy; partly by news of more community minded approaches such as 'Planning for Real' taking place in the USA; and partly by the rise of highly vocal community and conservation groups surrounding almost every site scheduled for redevelopment. In any event, the result was that a significant lobby was formed in favour of community engagement in planning and architectural design processes. The space syntax analysis methods described above were developed from academic theory to live application during this period. Amongst the first live applications of these methods were projects carried out on behalf of local community groups and tenant associations faced with radical redevelopment plans in their neighbourhoods. A series of projects (Mozart Estate, Maiden Lane Estate, Coin Street, Kings Cross Railway Lands, The South Bank Centre, all in London) pitted the new scientific methodology against both local government and private developer led schemes in public planning inquiries. In every case the planning inspectors found in favour of the evidence based approach, however, perhaps more interesting than this is the light these projects shone on the nature of planning processes and the knowledge entailed in these.

Specifically, there appear to be two kinds of knowledge involved in planning decision making: knowledge of principles and previous cases – the domain of professionals; and local knowledge of the specific site concerned, the local community, its people and their history. The latter is the domain of the local community and its residents. Both types of knowledge are not without their problems. The knowledge held by professionals had been shown in the UK to be flawed. Poor theories, such as those of territoriality that gave rise to 'defensible space' and enclosure concepts of community, had also shaped a series of socially dysfunctional mass housing areas. Meanwhile, for the most part local community knowledge is tacit rather than explicit. This makes it particularly hard to bring to bear in a planning process. How can one extract knowledge of this kind from the community members? The role of space syntax analysis in this was to help generate an evidence based dialogue between the different professional and local community groups concerned. Because space syntax represents the spatial environment directly and visually, and because it makes use of observations of human occupation and movement patterns with which the local community are very familiar, it brings to the surface of the discussion the knowledge that locals hold about their area, whilst exposing the theories that the professional planners, designers and consultants hold up to the light of direct evidence. This creates the basis for positive dialogue. So long as different groups can agree on the facts of the case (and evidence based methods put these in plain view), then discussion can move rapidly to consideration of different options for solving problems. And so long as theories can be tested on the basis of local evidence then local non professional people are more likely to understand and to accept their implications.

The process becomes one of learning, where the professionals learn from the local community, and both learn from the analysis of the local evidence. At the same time the community are empowered since their local knowledge becomes influential in the process of planning. This gives a new degree of autonomy to the community in determining the future of their neighbourhood, however it does require the professionals concerned to concede some of their power. As locals are enabled the professional no longer exercises the same degree of control over decisions, but instead gains kudos by enabling and empowering the community. This requires an open mind on the part of the designer or planner.

The principles outlined above suggest that it might now be possible to adopt a basis for planning firmly grounded in evidence. What might such a scientific outlook on urban development look like and what implications might this hold for planning processes founded on equity rather than historic authority? One factor seems clear, the processes of scientific understanding only progress in one direction: once something has been discovered and becomes a part of explicit scientific knowledge there is no going back. Once we understand the processes through which cities become intelligible, and how this allows autonomy, it becomes impossible to design an unintelligible urban area without the accusation of either incompetence or the will to remove autonomy from those that must live there. The same holds for the great symbolic gestures of planned cities. Now that our understanding encompasses the distributed processes of spontaneous development it becomes impossible to claim that a symbolic space designed to be empty is unintentionally so. This is all to the good. Scientific knowledge and evidence based planning requires honesty and transparency on the part of all those concerned, however it also carries implications for more equitable sharing of power in the planning process by balancing local (tacit) and scientific (explicit) knowledge.

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