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Bill Hillier, Christopher Alexander and the representation of urban complexity:

their concepts of 'pervasive centrality' and 'field of centres' brought into dialogue

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ABSTRACT

This paper draws attention to what we propose as a shared sensibility towards the life of cities in the work of Christopher Alexander and Bill Hillier. Specifically, it reflects on some similarities in their conceptions of urban centrality, while also acknowledging their very different intellectual trajectories. A consideration is how both men grounded their theoretical and analytical insights in their personal experience of cities. Alexander's emphasis on detailed multimodal observation and awareness as a source of design understanding is writ large throughout his many publications. The same could hardly be said of Hillier who consistently prioritized the configurational modelling of urban form. Yet those familiar with Hillier's teaching and design practice know how his analytical understanding drew on a deep knowledge of cities worldwide. For Hillier space syntax models were not simply outputs of a computational process but a stage in his ongoing dialogue with real places. Direct points of contact between Alexander and Hillier are few. Hillier's engagement with Alexander in *Space is the Machine* (1996) takes issue with the inductive epistemology in *Notes on the Synthesis of Form* (1964), while Hillier (2009) refers approvingly to Alexander's critique of the modernist city in 'A city is not a tree' (1965). Conversely, in *The Nature of Order,* Alexander makes brief but positive reference to Hillier and Hanson's analysis of 'G' in *The Social Logic of Space* (1984). This paper concludes by explaining why the connection of Alexander and Hillier, two of the great urban thinkers of last half-century, is worth developing further.

KEYWORDS

Bill Hillier, Christopher Alexander, urban centrality, pervasive centrality, field of centres

1 INTRODUCTION – CHRISTOPHER ALEXANDER AND BILL HILLIER

Christopher Alexander and Bill Hillier are both major figures in the development of applied urban and architectural design theory over the last fifty years. Along with Jane Jacobs, William Whyte, Stanford Anderson and others they were contributors to a view that saw post-war urban decline and the problems of urban modernism, not as a reason to abandon urban living but rather to understand more about how the urban built environment may support human life and society in a positive way. In this paper we propose the value of developing a dialogue between Alexander and Hillier that has not, as yet, progressed far in the existing literature. In *The Nature of Order* (2002-04) Alexander's notion of the 'field of centres' proposes urban centrality as a material and experiential phenomenon linked perceptually through relationships of scale. While Hillier's (2009) concept of 'pervasive centrality' is less conceptually developed it uses the analytical methods of space syntax to reveal centrality as an emergent property of urban spatial configuration, relative to the scale of analysis.

The focus of the paper then, is orientated around a discussion of Alexander and Hillier's concepts of centrality, rather than on choice of computational tools, urban data analytics or the philosophical dimensions associated with their work, other than when they arise in the context of urban centres. We start by exploring the different intellectual trajectories of these two thinkers, reviewing key points of contact in their published work, and reflecting on how their urban thinking combines both intuitive (experiential) and counter-intuitive (scientific) research epistemologies. In the second section we review Alexander's and Hillier's complementary approaches to the study of centres before reviewing these ideas through two worked examples. Finally we offer some guides to developing further dialogue between Alexander and Hillier's contributions to our understanding of urban centres.

2 INTERSECTING TRAJECTORIES

It is conventionally thought that while the humanities grapple with the intuitive, the 'hard' sciences explain the counter-intuitive. In this context it is instructive to think how Alexander moved from a background in physics into architecture, while Hillier made the journey in the other direction from literature and philosophy towards analytical social science and evidence-based design. It is telling in this respect that the site of the first major published engagement between Alexander and Hillier was the latter's critique of Alexander's best-selling early work, based on his PhD thesis, *Notes on the Synthesis of Form* (1965). Hillier took issue with its inductive epistemology, asserting that there was ultimately no rationale for mapping particular sets of human needs onto particular diagrams other than the leap of faith that essentially defined design knowledge.

For Hillier, drawing on Plato's idea of *intelligibilia* via Karl Popper's ideas of the hypothetico-deductive nature of scientific knowledge, architectural design was the 'rational deployment of intuition'. For Hillier and colleagues this intuitive design knowledge was essentially a knowledge of configuration. The theories and methods of space syntax were intended to raise architects' and designers' awareness of how to articulate, test and evaluate their configurational ideas – and to understand the configurational arrangements that could be found in the social world of buildings and cities.

Acknowledging their contrasting trajectories one might say that for Alexander design was the 'intuitive deployment of rationality'. Alexander's epistemology of architectural and urban design was grounded in a fundamental openness to the multiplicity of human contexts. In this sense Alexander's interest in formal and mathematical modes expanded after his early years to accommodate the experiential dimension in his overall conception of cities, without losing the rational and scientific. He wrote much about wanting to reunite what he saw as a growing split between science and human feeling since the onset of the Enlightenment.

Yet such characterizations as these, however neat, can be unhelpful if they emphasize contrast and opposition at the expense of highlighting how Alexander and Hillier were equally implicated in opening the fields of architecture and urban design to systematic research and enquiry in the post-war period. In large part this was driven by movements for social reconstruction and justice that were assertive in the politics of the western world during this period – but from the late 1960s a concern about the human consequences of modernist redevelopments of towns and cities was also a powerful motivating force.

Although Hillier was a critic of what he regarded as the functionalism of the young Alexander he was not critical of Alexander's attempts to use scientific ideas in urban design. This was the case although Hillier's starting point was the relational pattern of space as a socializing agency, rather than the assertion of a particular set of criteria for creating the 'good social environment'. This position is testified to by the other main reference to Alexander to be found in Hillier's work, which is to the 1963 article 'A city is not a tree', an analysis with its clear resonances for the development of configurational theory. There are few explicit references but those that there are, are approving (for example, Hillier 2009). The parallel has been noted by colleagues in the space syntax field (Vaughan and Griffiths 2013, Figueirdo and Amorim 2007). Similarly, anyone who thinks the space syntax approach to configuration to be antithetical to the spirit of Alexander's enquiry has failed to notice his approbation of Hillier and Hanson's (1984) analysis of Gassin ('G') in first of his four-volume opus *The Nature of Order, The Phenomenon of Life* (416-17). Here Alexander certainly acknowledges the potential of configurational theory for representing the relationality of the built environment.

One of the few urban theorists who has extensively studied the work of both thinkers, the phenomenologist David Seamon, has described how both Alexander and Hillier conceptualized urban wholeness as a system of parts and wholes (Seamon 2004, 2015). Seamon sees these thinkers as complementary, essentially because Hillier provides the configurational basis for the parts-whole notion of urban wholeness articulated by Alexander. For Seamon a focus on the engagement with Alexander has the effect of concentrating attention on what he regards as the richest contribution of Hillier's work (parts-wholes) to our understanding of cities. Seamon, as a phenomenologist, naturally prioritizes the human and experiential. In this context Hillier's dialogue with Alexander offers a useful counterweight to the assimilation of space syntax into network science or spatial cognition (van Nes 2021). It is worth noting that the need for this epistemological balance did not go unacknowledged by Hillier who placed much value on Seamon's interpretation of space syntax theory (Hillier 2005).

Given the extensive effort Hillier put on developing space syntax analytics throughout his career one might legitimately ask why this should be the case. One important reason – and a useful point of connection with Alexander – is that for all his interest in and prioritization of formal analysis it was cities as good places for people to live, work and *be social* in that motivated Hillier first and foremost. The analytical models were means to this end. This is why Hillier's professional trajectory took him to the RIBA and the Bartlett School of Architecture – and led to the founding of the Space Syntax Laboratory at UCL and Space Syntax Limited. This is not a trivial point because it explains the strength – as well as some of the weaknesses highlighted by its critics – in the analytical model of space syntax. For all the emphasis on scientific epistemology there is a crucial inductive element in Hillier's teaching – in which generations of students have been told to use space syntax to critically explore their *hunch* about how a city or a building works to sustain or inhibit social life. *Design as the rational deployment of intuition*, in other words, is still premised on an imaginative engagement with the material reality of the city which Hillier and colleagues formalized in configurational terms.

Anyone who has been taught by or worked with Bill Hillier cannot fail to have been impressed by the seriousness of his engagement with cities – and how he made himself intimately connected with them. Identifying the generators of the 'life of cities', famously referred to as the 'urban buzz' (Hillier 1996, 169), was the main focus of his urban work – dovetailing with the concerns of Jacobs, Alexander and others during a period where the whole notion of urban living was widely under attack. The influential 'heuristic' analysis of urban centrality presented in Hillier (1999) shows how he deployed his intimate working knowledge of London's urban spaces in developing space syntax theory. This could be regarded as a source of weakness – space syntax as insufficiently transferrable from London's street network – but it was Hillier's determination to deploy these methods to understand the reality of particular cities in concrete terms that also defines the appeal of his methods to the architects and urban designers (rather than the network scientists *per se*) to whom it was intended to appeal.

Perhaps one of the most memorable manifestations of this research method, which was also a pedagogy for generations of students, was Hillier's City Walk – not a tour but (as he would emphasize) an itinerant *lecture* in which he sought to demonstrate the validity of the theoretical proposition of space syntax *in situ*. Among other things the City Walk set out the configurational principles that explained the under-occupation of large modernist public spaces compared to small historic ones (where on all but the rainiest days city workers could be found eating their sandwiches) in the City of London, while also giving an account of how the ultimate modernist building (the Barbican Centre, where he happened to live) worked well as a place to live in despite its 'anti-urban' (tree-like) qualities.

This heuristic is a crucial expression of the dialogic method of applied syntax: from the experience of the city –to the analytical model– and back to the city. It also explains why there is a residual incongruence between established methods in urban network science and their parallel emergence in space syntax theory, which have sometimes been a source of frustration. The current generation of space syntax scholars, many equally fluent in both epistemologies, are successfully ironing these out. The point in this context is that space syntax (a 'morphic language') developed empirically from the study of historical buildings, settlements and cities rather than from investigations into computer simulation or the universality of scaling laws *per se* – however important these would become. The research effort is primarily focussed on understanding actual built environments, past and present, realized and merely speculated. Yet there is also an irony that the breath-taking range of examples through which Alexander explores the nature of order, from carpets to cities, can be accessed through a highly abstract, computational lens. Even so, Hillier's sensitivity to what Penn (2003) called the 'shape of habitable space' ultimately brings us back to the concrete but messy nature of the many examples canvassed in Alexander's published work –that is to the problem of *description*, rather than the search for a neat mathematical formula of urban order.

One of the most important features of Alexander's work is that it was not primarily intended to be analytical (even if analysis needs to precede design) but directly applicable to design and the creation of cities. Beginning with *The Timeless Way of Building*, the first work in the trilogy that includes *A Pattern Language*, every book written by Alexander has a statement at the beginning that reads *'[title of book] is the first in a series of books which describe an entirely new attitude to architecture and planning. The books are intended to provide a complete working alternative to our present ideas about architecture, building and planning—an alternative which will, we hope, gradually replace current ideas and practices.'* Indeed, at the beginning of *The Nature of Order*, Alexander wrote 'I wanted to be able to do the real thing—and for that I had to know what the real thing is. The reason was not intellectual curiosity—but only the practical reason that I wanted to be able to it myself.' (Alexander 2001-04, vol 1, 2).

Alexander was explicit in his understanding of the city as the result of a generative process—or more precisely, multiple, nested generative processes—and so the patterns, pattern languages, and the centres and fields of centres to be described later in this paper are all presented in ways that give the theories themselves human agency. Alexander's theories are not analytical tools that test the results of design processes that happen in a different realm of thought or a different kind of professional activity—they are themselves the basis for action, design and building. This is partly a product of its time—after all, the 1960s, when much of Alexander's formative work took place, were years of political dissent, and many of the reactions against post-war planning and architecture were intertwined with other reactions against the domination of large institutions. But it was also connected to emerging, scientific understandings of complex adaptive systems and the idea that processes of formation and emergence play a large role in the shape and function of the result.

This was also understood by people like Jane Jacobs, and certainly Hillier and Alexander alike followed Jane Jacobs in her famous last chapter (22) of *Death and Life…* in recognizing cities as problems of 'organized complexity' – the sidewalk as a 'complex order' (Jacobs 1993 {1961}). Indeed Hillier characterized space syntax as a method that enabled architects to 'access complexity', even if that access did not result in procedural changes to the way they carried out the activity of design (BSGSSG 2010). If their careers, backgrounds and pre-occupations meant their work took different trajectories for Alexander this meant a more catholic outlook and collaborative approach whereas Hillier was engaged in the more directed task of developing space syntax theory, methods and applications – an analytical focus that can appear at odds with the life of the city but really it was an attempt to understand and describe the nature of (urban) structure.

The following section of this paper brings into dialogue two important notions in Alexander and Hillier's thought: the 'field of centres' and 'pervasive centrality.' (Alexander 2001; Hillier 2009, 2016a). It is typical of Hillier that this important idea—itself increasingly pervasive in research and teaching in the space syntax field—arrives relatively late and almost casually in Hillier's own *corpus*. Yet our proposition is that it expresses many of the same ideas about the relational and scaled notion of urban centres that were a preoccupation of Alexander in *The Nature of Order*. In taking this approach we deliberately eschew comparing different modes of urban modelling derived from the theoretical traditions represented by Hillier and Alexander. Instead we follow David Seamon in emphasizing the richness of the syntactical concept of configuration while recognizing that this necessitates, far less precludes, an engagement of space syntax scholars with Alexander.

3 CENTRES AND CENTRALITY IN ALEXANDER AND HILLIER - DEFINITIONS

3.1 Alexander's Field of Centres

The idea of the centre, and how centres are related to each other, is central to the work that Christopher Alexander carried out for the last several decades of his career. Although most people are more familiar with his early work, including the 1965 article 'A city is not a tree', speaking toward the idea of a city as a complex network of streets, and the 'pattern language', dealing with entities that combine spatial relationships and human activity, the later work involving centres is more powerful, even as it incorporates the earlier work.

In very simplified terms, a ***centre*** is a place of increased intensity or focus relative to the space around it, and ***fields of centres*** are formed when centres cooperate to form and support each other. A centre may be a solid or a void. In the city, centres may be streets, squares, buildings, parts of buildings, or any perceived entity. But the complexity arises because centres are not independent of each other, and are defined in terms of other centres. This is analogous to the space syntax property that streets in an urban network can be understood only within the entire network as they take on their numerical values in relation to that network. Centres are perceivable by themselves but are in fact defined by other centres. Smaller centres help to form larger ones, so that the built environment is in fact made up of a field of centres—many small ones, a few large ones, and centres of intermediate sizes in between.

In the context of this paper, it is important to note several things about centres:

1. They are perceivable as real things in the world, and named as such—the street, the doorway, the fireplace, the sitting circle next to the fireplace, the front porch, the dining-room table, the group of people sitting together at dinner, the window, the rosebush, the rose, etc. They may be formed by any spatial or architectural type.
2. They are strengthened and completed by other centres that are smaller, and help strengthen and complete other centres that are larger. So the street is strengthened by the buildings on either side of it, and those buildings strengthened as centres by their facades, and their facades strengthened by their doors.
3. They thereby exist as a part of a field of centres in which they are all supporting each other.
4. An effective design process consists of the formation of centres at different scales, a process in which one of the roles of the formation of a centre is the strengthening another centre of which it is a part.
5. When this happens, and the centres are strongly formed, other geometric properties appear, including: LEVELS OF SCALE, CONTRAST, LOCAL SYMMETRIES, THICK BOUNDARIES, ALTERNATING REPETITION, GOOD SHAPE, DEEP INTERLOCK,

GRADIENTS, INNER CALM, NOT SEPARATENESS, THE VOID, ECHOES, POSITIVE SPACE, AND ROUGHNESS. (Alexander 2001-04, vol 1, 143-242)

6. Finally, there is often ambiguity in the definition of their boundaries. This is consistent with the idea that the boundary itself is not necessarily only a line with infinitesimal width, but is in fact 'thick', and this is true of all its parts and subparts and sub-boundaries.

The field of centres combines entities that have a perceivable and commonly recognizable reality with the idea of a complex whole that may not be perceivable, or perceivable all at once; the entire city, for example. Indeed, the combination of the perception of familiar entities with what may be a highly complex network-like array is one of the characteristics of Alexander's formulations.

What about the field of centres?

1. In traditional cities and vernacular settlements, the field of centres is often composed of centres of different sizes—many small ones, a smaller number of medium sized centres, a relatively small number of large-scale centres.
2. Physical entities may be part of two or more centres at the same time. A building façade, for example, is the outer wall of a building and the inner wall of a street. This characteristic is one of the attributes that joins the centres together into one single entity that is in fact the field of centres.
3. The strength of a particular centre depends on the centres that are adjacent to it, and therefore on the entire field of centres. In this way it is analogous to an urban network made of street segments, in which the properties of integration and choice, for example, are based on the overall configuration.
4. It is often the case that the interactions of adjacent entities are the strongest, and ambiguities they share are the most evident.

3.2 Hillier's Pervasive Centrality

So how does Bill Hillier's analytic proposition of the 'pervasive centrality' of urban spatial configurations compare to Alexander's more inductively derived notions of centre and field of centres? Certainly both are concerned with the scaling qualities of urban centres and their wide urban embedding. Hillier had an ability to assign memorable terminology to describe the qualities he identified in the spatial configuration of cities. From 'axial' and 'convex' space and 'integration and segregation' to 'foreground' and 'background' networks space syntax has developed its own lexicon of spatial-morphological analysis.[1] To critics of analytical techniques such terminology constitutes the opaque technological jargon of an essentially reductionist epistemology of built environments. In a network science context there was some concern about

[1] https://www.spacesyntax.online/glossary/ accessed 30th November 2021

the robustness of syntactic descriptions such as axial mapping that had developed in relative isolation from the mainstream (Batty 2013; Ratti 2004; addressed by Hillier and Penn 2004). An indicative, if trivial, example of the latter is Hillier's preference for 'integration' and 'choice' over the standard network science terminology of 'closeness' and 'betweenness' to describe largely equivalent measures in configurational analysis.

'Pervasive centrality' is a relatively late arrival in the space syntax lexicon, emerging only in the context of Hillier's (2009) work on the 'spatial sustainability' of small centres. It expresses the idea that:

> the function of centrality in cities pervades the urban grid in a more intricate way than has been thought, and that multi-scale centrality should be seen as a pervasive function in cities, with clear spatial correlates, and not simply as a hierarchy of locations. (Hillier 2009, K0:3)

As this passage suggests pervasive centrality was anticipated by earlier notions of urban centrality defined as the *topological* centrality that Hillier and Hanson (1984, 115) identified with the 'axial integration core'. This refers to an emergent property of the urban grid characterized by a linear structure through which localized areas were made accessible globally, the r-squared of local and global integration measures, later referred to as 'synergy' (Hillier 1996, 134-35). Within the axial paradigm of space syntax urban modelling in fact, the adjective 'pervasive' was applied typically to the obliquely intersecting pattern of centre-to-edge longer lines that Hillier identifies as key to the local-global structure of the urban system (Hillier 1996, 360-68; 1999b). This sense was associated with the terminology of 'spik[e]y potato' and 'deformed wheel' (Hillier 1999a; 1999b) in expressing the important idea that local centres were not bounded but – to use the terminology of the 2009 paper – characterized by 'fuzzy boundaries' embedded in the larger urban structure. This is a similar concept to that of Alexander, described above. It is key to the relationship of structure and function that expresses the 'spatial cultures' of contemporary cities (Hillier 1989).

Characteristic of the axial paradigm was the prioritization of the global scale of analysis established by the analyst and often equivalent to the study area extended to natural boundaries. This method was complicated by increasing interpretative awareness of how centres of different sizes were mutually embedded in the larger system, as set out in Hillier (1999a). Yet the analytical basis for pervasive centrality had to wait for the development of segment analysis in *Depthmap* for large-scale urban systems (Turner 2009, Hillier, Turner et al 2010). This was because its precise empirical definition depended on the ability of angular segment analysis to differentiate network centrality at different scales (for example, 400m, 800m, 2000m etc.). Hillier (1999) by contrast, relied on a more 'heuristic' analysis of axial configurations to identify how

different kinds of centre were embedded in the urban grid. In Hillier *et al* (2012a) the latter concept is dropped and the relation to *Depthmap* made explicit.

> Depthmap is a remarkable piece of software. The parts we use to analyse cities – segment analysis – were based on a theory of the city, and quickly led to a better one. The concept of *pervasive centrality* (Hillier, 2009), a key idea in the syntactic perspective on the sustainable city, came from the power of Depthmap to detect delicate local structures which hardly seem to be present (Figure 1), as in the spatial detection of London's 'urban village' structure through low metric radius angular choice. (Hillier, Yang and Turner 2012, 155)

Pervasive centrality expresses a more powerful concept than was possible to demonstrate empirically before the development of segment analysis in *Depthmap*. It proposes that centrality is *everywhere* in the spatial morphology of cities, producing multiple interfaces between localized intensities of movement and social interaction, and the extended urban fabric. This is a profound change because it reveals the established binary local-global relation of the axial paradigm as constituted by any number of potentially overlapping scales of intermediate centrality. It redefines the task of analysis from applying specific measures of local (typically r2 *Depthmap*) and global-r*n* analysis to a kind of syntactic or configurational *archaeology* in which the provenance, relevance and meaning of different scales of analysis, and the research rationale for their deployment, are brought under the critical spotlight (for example, Hillier, Serra, Karimi 2015).

Pervasive centrality is not simply the syntactic renaming of the polycentric city. In fact this abstract representation of centres as bounded, hierarchical nodes in a planned urban system is antithetical to Hillier's definition. For example, in the statement:

> A key outcome of the process [space syntax theory] describes is a pattern of centres we call pervasive centrality, by which we mean that centrality functions such as retail pervade the urban grid at all scales, creating a far richer and complex pattern of centralities even than envisaged in concepts of polycentricity (Hillier 2016a, 78)

In rejecting the binary polarities of centre and periphery and the simplified hierarchies of polycentricity the space syntax concept of pervasive centrality marks an important step to realizing the implications of centrality as an *historical* process. Descriptions of centrality are always relative to the scale of analysis and the historical complexity of contemporary built environments means many such scales might be thought to have relevance. Exactly what relevance and how it manifests in contemporary contexts now becomes the object of research.

Yet although it is an attractive concept that has rapidly been assimilated into published work (van Nes 2021; Psarra 2018; Griffiths 2014) it is has never formed the explicit focus of a paper despite, or perhaps because, its implications for the de-centring the single, dominant observer viewpoint of the analyst are quite radical. One issue is the extent to which pervasive centrality (a relative concept) is equivalent to the 'foreground network'. Hillier (2016b) appears to assert that it is:

> The *foreground network*, through what I have called the 'city making process', acquires the form of a *pervasive network of linked centres at all scales*, and is driven by *microeconomic* activity, which in its nature seeks to concentrate and maximise movement and co-presence, and so optimise the potential of spaces to create this. (Hillier 2016b, 200)

Yet there is a tension between expressing the idea of pervasive centrality (as relative to all scales of urban space) through the lens of the foreground (i.e. social-economically generative)/ background (i.e. residential and culturally conservative) binary that appears rather static by comparison. One of the implications of pervasive centrality is that what appears as background 'residential space' from a 'global' analytical viewpoint, is likely to reveal its own localized pattern of foregrounded activity, embedded within the larger grid. This relativity implies different potentials for urban *affect* as well as socio-economic effects as differentiation in the configurational description of centres within, between and in relation to other centres becomes apparent. This is because the overlaying of differently scaled descriptions of centrality in analytical terms is likely to have something to do with the particular patterning of historical growth and the material qualities of everyday life which are implicated in the social construction of more intangible qualities such as a 'locality' and 'sense of place'.

Although the concrete definitions of Alexander's centres are very different to the formal definition of Hillier's, they both touch on the importance of understanding one centre in relation to others. In this respect Alexander's field of centres expresses, at least in part, the configurational idea of relation – that a centre is not a thing in itself but intelligible only through the emergent properties of the larger entity. We also conjecture that Hillier's idea of pervasive centrality that emerged along with the finer-grained precision of segment analysis, is very close to Alexander's idea that centres exist at multiple scales in the city. Indeed, the concepts of foreground network and background network are not intrinsically fixed at any particular scale of urban space but rather help to express the complex scalar configurations of pervasive centrality in urban systems from the most local of centres to the geography of the urban region and beyond.

4 WORKED EXAMPLES OF CENTRES AND CENTRALITY IN ALEXANDER AND HILLIER

4.1 Alexander's Field of Centres – a worked example

Here we give two examples that illustrate Alexander's fields of centres: the first in Rome and the second in Venice. In Rome, the Campo de' Fiori is a large convex urban space that is formed mostly by five and six storey buildings that have shops at their ground floor and apartments above. That building typology has been present in Rome for at least two thousand years. It changes function over a typical day. In the morning it is a market; at around 2pm the market is cleared and cleaned; and subsequently the cafés and restaurants at its edge arrange their tables and chairs in arrays that penetrate the space. It is the place for celebrations including the noisy celebrations of football victories; and for political demonstrations –the campo marks a neighbourhood that has leftist roots. Those roots are marked by a statue of Giordano Bruno facing toward the Vatican, in the middle of the space; Bruno was burned at the stake in that place in the year 1600 for challenging the authority of the church. Several streets feed into the space, including the Via dei Giubbonari, that used to be lined with furniture shops, housed the offices of the Communist newspaper l'Unita, and leads toward the Jewish ghetto; and the Via dei Baullari which cuts through the square at its western end and ends at the Piazza Farnese, with the Palazzo Farnese, now the French Embassy, anchoring it. The Embassy's celebration of Bastille Day takes place partly in the Campo de' Fiori as well. The building that is probably the most notable in the square itself is the Palazzo Pio, which is in the position of the ancient Temple of Pompeii—but its end rather than its principal façade is facing the square. The principal façade faces a minor square, the Piazza Biscione.

This is all the manifestation of a complex field of centres. The entire space itself is the principal centre; contributing centres that help give it life are the Piazza Biscione and the other streets; more minor centres are the apartment buildings, which themselves are intensified by their ground floors at which public and private centres overlap. The Bruno statue is a small yet powerful centre that people informally sit on, but that is always present as a memory of its namesake and his sacrifice. The entering streets are centres that support the life and centrality of the main space. The Piazza Farnese is a centre that is itself given its strength by the Palazzo Farnese on axis with Via dei Baullari, and the façade of the palazzo is a smaller centre that belongs both to the palazzo and the piazza.

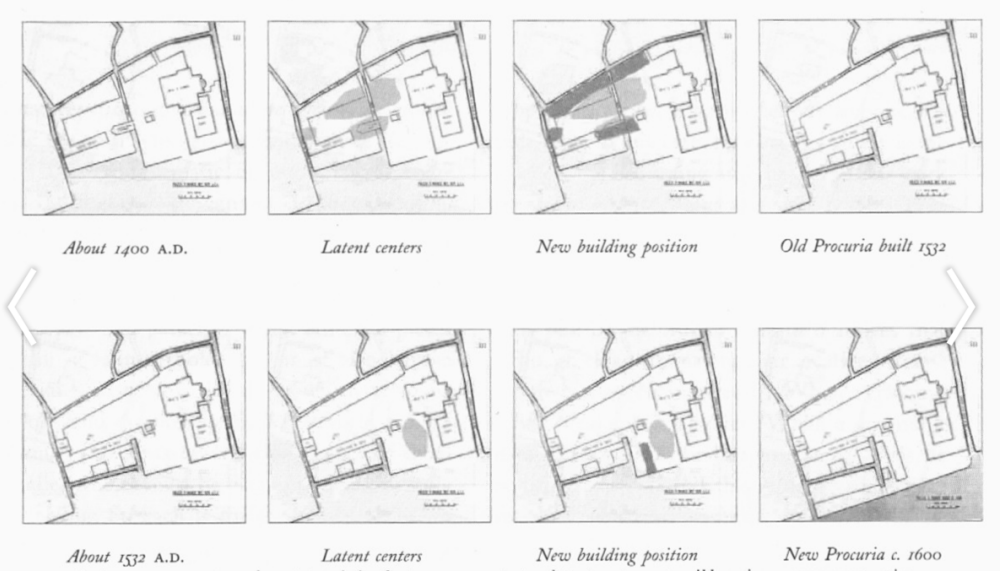

Figure 1: Images from Christopher Alexander, *The Nature of Order*, *Book 2, The Process of Creating Life*, 253

The second example, the emergence of the Piazza San Marco in Venice over about twelve hundred years (Figure 1), has to do not only with the structure of centres, but with their formation and intensification over time. Alexander asserts that the complexity and unity of the traditional built environment itself comes from the formation of centres at different levels of scale. And here we want to introduce another of Alexander's concepts, the idea of **structure-preserving transformations**, as we explain this. What the structure-preserving transformation does is introduce more detailed structure, often at a smaller scale, that enhances and strengthens the structure that is already there. In the case of the Piazza San Marco, the main existing centres of the church, the Piazzetta facing the Grand Canal, and the long piazza on axis with the church, emerged very early in their existence as well as their relationships to each other. And subsequent additions and transformations made the whole place grander but in a way that maintained that original spatial structure. Look for example at the addition of Sansovino's library. It reinforced the axis leading perpendicular to the water through the Piazzetta to the front of the church; the long piazza was enhanced as a centre when it was renovated and extended in the sixteenth century; the same was true for additions to the church itself as well as additions to the Palazzo Ducale.

In *The Venice Variations*, Sophia Psarra (2018) makes clear that the evolution of *campi* that were at the heart of Venetian neighbourhoods furthered and strengthened their role as local centres with a few common typological features, over the hundreds of years of their evolution. She points out the development and strengthening of the street network and the measure of choice within this evolution (30), and the persistence of the relationship between the individual campi to the foreground network of connection among the dozens of islands/neighbourhoods from very early times. With respect to the Piazza San Marco, Psarra focuses on the strengthening of the square near the end of the Renaissance, partly through the work of Sansovino whose Libreria helped

give the piazza a classical unity, and she points out, and illustrates with visual integration maps, several ways in which smaller centres including the library helped strengthen the large centre that is the entire piazza complex, including the Piazzetta and the Porta da Mar. This provides a detailed explanation of the formation of the square, sequentially illustrated in the second volume of *The Nature of Order* (Figure 1), during one or two centuries of its long evolution. What is also significant in Psarra's work regarding this issue are the visual integration maps that show the strengthening of the connections between the Piazza San Marco and adjacent islands (Psarra 2018, 108). This is a phenomenon that is consistent with Alexander's ideas about the relationships among adjacent centres.

This description relates the structure of the built environment with the formation of that structure. From the point of view of Alexander, a built environment that is emergent like this has the capability of being highly connected, of having a complex field of centres, and of being amenable to bottom-up decision-making in planning and design. Because centres have an everyday reality to people, decisions about their formation can be participatory and generally public and available. But perhaps most important, as Psarra points out with respect to Venice, and affirmed by these maps in Alexander's book, the formation of centres at a small scale can be done to strengthen centres that are larger.

4.2 Pervasive Centrality – a worked example

Consider three places of commercial concentration that appear on Bill Hillier's map of the northwest part of the London Borough of Camden. These were looked at via Google Street Views, (and there is clearly more to learn about all of them). These are all places that Alexander would identify as centres, but they are quite different from each other, and indeed have different spatial-configurational descriptions. The first (1) is Haverstock Hill, near the Belsize Park underground station. This is obvious. The station has been there since 1907; it is on a street that is clearly what Hillier would call a foreground street, and with their commercial uses the buildings around that place are clearly expressing this identity and helping to make a major centre in the neighbourhood.

The second centre (2) is not as strong in terms of its foreground characteristics, but the intersection of Mansfield Road, Agincourt Road and Fleet Road has attracted a few businesses that were built as conversions to residential buildings. The third example is perhaps the most interesting. It is a street called Lambolle Place, that is a couple of minutes' walk from Haverstock Hill and linking together the ends of three long residential streets. There are two interesting things about this. One is that the businesses are largely houses in conversions of the ground floor of houses. The second is that a long building on Lambolle Place seems as if it might be the conversion of a railway viaduct. Obviously, this demands more investigation.

Figure 2: Intensity of retail in the Camden Town area of London c.2000 from Bill Hillier 'Centrality as a Process' (1999, 115); photographs of selected streets © Google Street View

In analysing a place like this, which might happen in connection with some kind of urban design project, Alexander would try to correlate his observations about the possible centres that exist here with what people say about the use and importance of them. But what then? How did this observation enter into Alexander's idea of analysis being integrally tied to action? To give a possible answer to this question, we turn to a project of Alexander's, done with Howard Davis, in the American city of Omaha, Nebraska. It involved the development of a planning process for the improvement of a Black neighbourhood that had experienced disinvestment and consequent decay. It was a complex project, but in a nutshell, its purpose was to figure out how neighbourhoods could have control over money made available for urban investment and improvement by the Federal government. The approach was to require that each neighbourhood identify centres of different scales—some large, like the area around the Belsize Park station and that would be connected to other large-scale centres in a kind of foreground network, and others small, like the ones on Fleet Road and Lambolle Place—and then put the money into projects that intensify existing and incipient centres, and the paths between them. This is a recognition of the reality of the network of centres, and the need to support and strengthen it. The diagrams in Figure 3 show how, if that is done year after year, what emerges is a strong network of centres and connections.

Each of the places on the map represents an existing centre, some strong and some weak, identified by people in the neighbourhoods who feel connected enough to them that they feel they

are deserving of the limited funds available for physical improvements. And this shows the kernel of a dynamic process, analogous to that of the development of St Mark's Square, that takes the theoretical idea of centres within a network of centres, or what Alexander would call a 'field of centres', and turns it into something that is operational in urban development. In both cases the actual process is a piecemeal one rather than involving the development of a detailed master plan, but guided by a common understanding of centres in different stages of formation, and the need to reinforce them and strengthen the links amongst them.

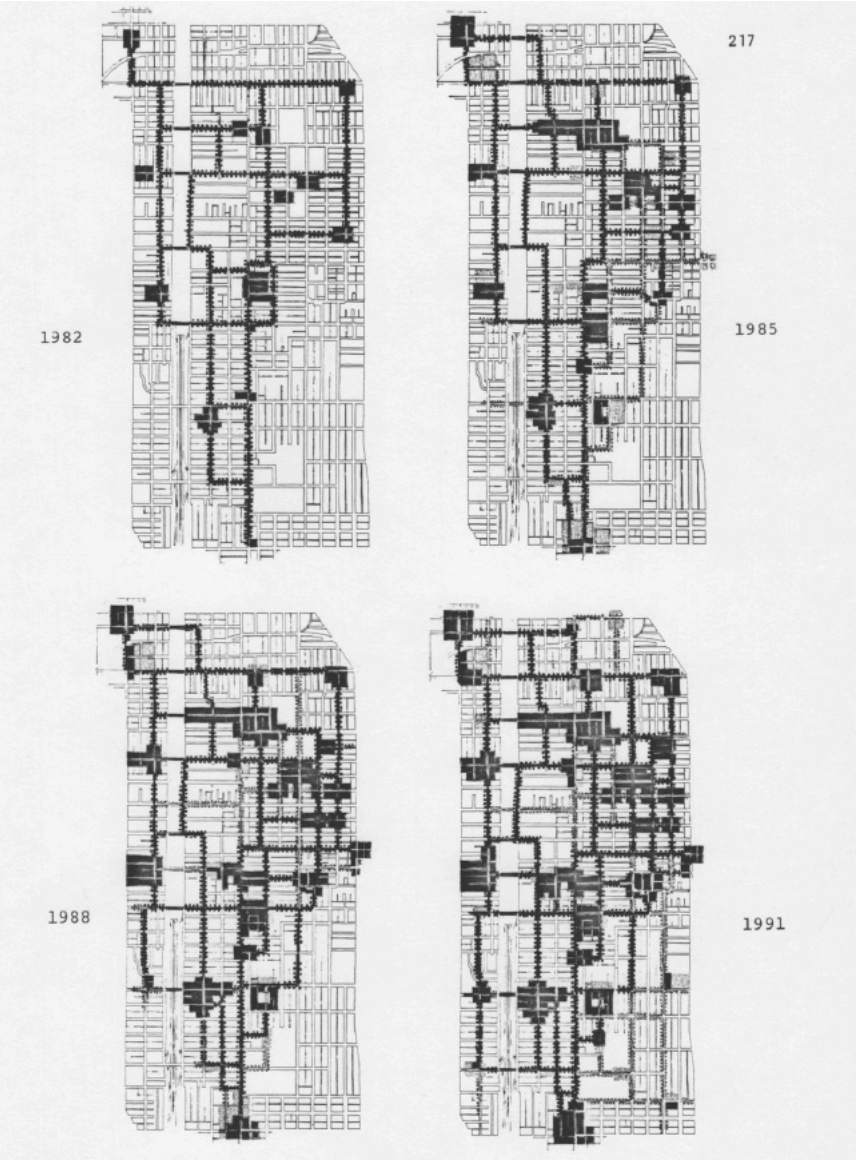

Figure 3: Diagrams from Christopher Alexander and Howard Davis, *Rebirth of the Inner City: The North Omaha Plan*, unpublished report, 1981.

The link between Alexander and Hillier that we are making is explicitly described by Alexander himself on pages 416-417 of Book One of *The Nature of Order*, *The Phenomenon of Life*. Alexander uses the example of the French village of 'G' in *The Social Logic of Space* to help

support his views of the unity of social and spatial structure. He concludes this section with a summary statement:

> It is highly significant, in my eyes, that throughout their careful analysis, Hillier and Hanson reach conclusions similar to those I am presenting in this chapter about the unity of space and function. As they say: "Society must be described in terms of its intrinsic spatiality. Space must be described in terms of its intrinsic sociality". In my language, they are saying—as I am also saying—that it is not really possible to keep function and space separate. Rather, what is needed is an integrated view of function and structure, in which the living character of space is visible as a characteristic of the integrated whole. (Alexander 2001-04, vol 1, 417)

5 CONCLUSIONS

Whereas in the *Nature of Order*, Alexander overwhelmingly draws his examples from patterns which can be taken in from a single viewpoint, Hillier prioritizes the analysis of spatial configurations at the scale of whole urban systems. As other commentators such as Seamon has noted, it is this ability to identify the structure beyond the perceptual field that gives space syntax much of its theoretical and applied contribution. At the same time we should not make an overly rigid contrast between the multi-modal perceptual basis of Alexander's and Hillier's analytical approach. This is because, as we have previously discussed in Section 1, for Hillier spatial configuration was precisely a way of exploring design intuitions about how cities work 'the kind of problem a city is' – to quote Jane Jacobs – that extend beyond what can be seen, while not being separate from this. This required the development of a 'non-discursive technique' of description (configurational analysis) in order that such intangible (perceptual) qualities as 'centredness, urban buzz' etc. could reveal themselves as a 'spirit of place' distinct from the semantic or aesthetic languages that might be thought to express locality (Hillier, 1996, 65 *passim*). So it is likely that Hillier would have agreed with much of the thinking informing Alexander's comment that:

> ... words, concepts, and knowledge all interfere with our ability to see wholeness as it is. To see wholeness accurately, we must not pick out those artificially highlighted centers which happen to have words as names, since these are often not the most salient wholes in the real wholeness. What we must do instead is to watch, quietly, receptively, and in an unfocused state, for those centers which are most salient in the real configuration as it is. (Alexander 2001-04, vol 1, 456)

Hillier differentiates between 'knowledge' arising from external contexts that can be deleterious in architectural contexts (for example the assumption that community maps onto localized enclosure) and configurational knowledge of the kind space syntax advances. This latter knowledge is precisely the kind of intuitive knowledge of pattern and centres that Alexander is

concerned with in *The Nature of Order*: the emphasis on urban space as social agency rather than as a container or derivation of particular social function. If Alexander prioritizes the material description of myriad actual centres, Hillier focuses on the formal description of the networks in which centres are embedded. Both sought to express through their work the complex qualities of urban built environments that are implicated in bringing some areas of cities to life while leaving others feeling lifeless. In viewing the trajectories of their long careers in developing post-war architectural and urban theory it is perhaps time to allow that as much ties as divides their views of the city, that Hillier's work transcends the dedicated field of space syntax and that, within that field, Alexander's work needs to be approached comprehensively, rather than through the lens of Hillier's relatively limited engagement with him.

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