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A tribute to Bill Hillier

Keynote

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ABSTRACT

This opening session marks the legacy of Bill Hillier at this, the 25th year anniversary of the first space syntax symposium. Given the immeasurable range of influences Bill's ideas have had on the space syntax community, this session was designed around a small number of his past PhD students, each of whom spoke for up to 10 minutes on some aspect of their work with Bill, and how his ideas have guided them since then. The session was chaired by Margarita Greene, with short talks from: Frederico de Holanda, Sophia Psarra, Ruth Conroy Dalton, Vinicius M. Netto, Tao Yang. The session was organized by Laura Vaughan, John Peponis, and Ruth Conroy Dalton. The texts from all presenters from this opening session are presented in this paper.

Figure 1: Prof. Bill Hillier in front of UCL. © Elaine Perks

1 A TRIBUTE TO BILL HILLIER: INTRODUCTION

Margatita Greene

This session honors the legacy of Bill Hillier at this, the 25th year anniversary of the first Space Syntax Symposium in London. Given the enormous range of influence that Bill's ideas have had on the space syntax community and beyond, the session has been designed around a small number of his past PhD students, each of whom will speak on an aspect of their work with Bill, and how his ideas have guided them since then. I am honoured to chair the session, which was organized by Laura Vaughan, John Peponis, and Ruth Conroy Dalton.

I will start by shortly introducing myself in relation to my contact with Bill and the syntax community, and then I will do the same for each of the five presenters. I was one of Bill's PhD students. I arrived at The Bartlett at the end of the 80s as a qualified architect, having recently finished a master's degree in Sociology. I worked at the Unit and eventually did my PhD on the consolidation process of informal settlements. From there on I never lost contact with the syntax community while pursuing an academic career at Universidad Católica de Chile, where I am now Professor and Principal Researcher of CEDEUS (an interdisciplinary research centre dedicated to sustainable urban development). My main interests have been social housing and urban renewal.

Before I introduce the five selected PhDs supervised by Bill, I will take a few minutes to comment on the influence of Bill's ideas on my work. Since the time is impossibly short, I will restrict myself to only one but fundamental idea.

I learned about Bill while I was living in Leeds, in the north of England, and read one of his papers. I do not remember which one, but I was impressed to find what I had been searching through my architectural studies: an analytical approach that linked social phenomena with space.

I had studied in an architectural school strongly oriented to design with an emphasis on observation, description and representation. Yes, they taught us how to observe and detect and bring to the project a socio-spatial proposal, some called it the 'act', the 'situation', or … a bad translation would be 'the architectonic fact' (*el hecho arquitectónico*). It was always a discovery, highly valuated, although, as Bill would say, 'non-discursive'; that is, it was un-explainable through words. In fact, the idea was that at times we would identify a spatial quality or condition that the future inhabitant or user of that space or territory would not even know that s/he needed or wanted. We were always aspiring to a spatial innovation.

In my School, I learned much about designing buildings or neighbourhoods, giving them form and shape, so that they would respond to that which I had identified but could not put into words.
In search of a clarification of the social aspects, which I felt was somewhat missing I enrolled in an MA in sociology. I thoroughly enjoyed the experience, and when the time of my thesis arrived, I

chose as subject what had been my interest from the beginning: housing, and specifically self-built housing, where complex households were forced to live together due to lack of affordable dwellings. I was really proud about the research problem I was bringing to the group, but I was more surprised than disappointed when I realized that my sociology teachers were as un-interested in the spatial side of the phenomenon as my architectural teachers had previously been about its social aspects!

Now, I am sure you understand why I was fascinated when I read about Bill and Julienne's 'Social Logic of Space'. And then, pleasantly surprised when I met Bill and told him that I had recently completed a sociology thesis on this complex households' self-built processes. Contrary to my previous teachers, he invited me to present my thesis to his PhD students, and there started my involvement with this community until today.

On the same line, and to finish this introduction, I want to recall the opening of the first Space Syntax Symposium, in 1997 in London at UCL, where Norman Foster said, and I quote:
"… I love the world of analysis, observation, of research, but also passion, imprecision, the hunch. Space Syntax is the testing of the interaction of these opposing worlds." I still think this is a very good introduction to our subject and have often quoted these words when explaining what Space Syntax is.

Now, let me introduce some of Bill's former PhD students, who will give their testimonies regarding how Bill's ideas influenced their work.

Tao Yang arrived at the Bartlett in 2003 and was supervised by Bill on his PhD thesis, dealing with the spatial definition of urban areas. He worked with Bill at the Bartlett and Space Syntax Lab, developing the normalized choice measurement, called NACH. Later, he returned to China and at present he is Associate Professor at Tsinghua University. His interests focus on city information modelling, digital twin cities and future cities.

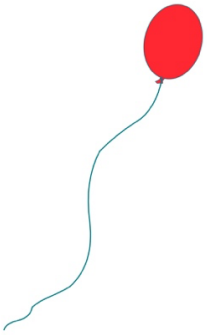
Vinicius M. Netto became Bill's student at the Bartlett at the turn of the new millennium. His PhD was about urban and architectural spaces and how we build societies as systems of action through semantic references and communication. Since then, Vini has looked into segregation beyond static residential territories, focusing upon the distinct daily trajectories of social groups in urban space. In short, he approaches cities as information, cooperation and segregation networks.

Ruth Conroy-Dalton qualified as a licensed architect before completing her PhD with Bill in 2001. Since then, she has worked on spatial cognition, carrying out research and developing crowdsourced navigation games and the application Sea Hero Quest, played by over 4 million people. She is currently Professor of Architecture at the Lancaster School of Architecture.

Sophia Psarra arrived in London from Greece and completed her PhD at UCL supervised by Bill and Julienne Hanson. Today she is Professor at the Bartlett, so probably many of you know her. Her

research interests are on the cultural, political and cognitive aspects of architecture and urbanism. She is currently completing a co-edited book: Parliament Buildings: The architecture of politics in Europe.

Frederico de Holanda arrived in London as a qualified Brazilian architect. He carried out his MSc and PhD in Architecture at the Bartlett, both supervised by Bill. He is now Emeritus Professor and Senior Research Fellow, at the University of Brasília. He investigates relations between configuration of buildings and cities, and social stratification. He has published several books – among them one dedicated to Bill and another to Julienne.



2 LEARNING TO IDENTIFY, REPRESENT AND MEASURE MORPHOLOGICAL PHENOMENA: MY STUDIES AND WORK WITH PROFESSOR BILL HILLIER

Tao Yang

I owe a lot to Professor Bill Hillier for guiding me to discover an academic path and to explore urban morphology creatively and constructively. When applying to the Bartlett in 2003, I had just graduated with a MArch from Tsinghua University, and was still utterly ignorant of space syntax. But Bill selected me as his doctorate student and the offer and scholarship came to me right after a brief telephone interview, marking my first step into the world of space syntax. All the details of first meeting with Bill 19 years ago remain fresh in my memory. It was 24th September, a lovely autumn day at Torrington Place. Sitting before a square coffee table full of academic books and journals, Bill told me that I needed to prepare to climb an academic mountain and that I needed to 'warm up' by reading The Social Logic of Space. Then he emphasized that I should forget much of what I had read before. At that moment, I felt that this was like the course in which a Kong-fu master teaches the pupils to forget what they learnt and to start fresh with meditation.

The first few years of studying and working with Bill were years of bittersweet symphonies. After several years of day-to-day discussions with Bill, I fully understood the meaning of forgetting what I had read. He addressed the critical method of seeking regularities/laws or anomalies in empirical studies and experiments and scrupulously developing potential theories from scratch and from first

principles, by studying both how real cities and buildings function and the way we perceive and behave in spaces. In fact, Bill originally proposed that an analytic paradigm had to be developed in architecture. Critical to this was the idea, borrowed from Ian Hacking, that we sometimes should not be contended to study evident phenomena but should also strive to 'create' them using our own instruments and methods, for example our own ways of representing spatial relationships or morphologies of space occupancy and use. The philosophical intellectual foundation and the pioneering spirit of Bill have inspired me each day during our work together and since.

As for the cities as complex systems, Bill clarified the spatial mechanism of emergence by introducing the concept of *configuration* – relationships taking account of other relationships, ranging from the local to the global – with an aim of investigating how urban parts interact with each other at various scales to generate the city as a whole (Hillier 1996). He showed me how to identify urban patterns or regularities by focusing on configurational or syntactic variables at different scales. He also showed me how morphological regularities arise according to socio-morphological generators and have socio-economic implications. For example, simple discoveries, such as the correlation of movement density and integration, were creatively linked to the refinement of descriptive variables – e.g. angular integration - and that of the analysis methods. The creation of phenomena can be interpreted as new ways of representing, measuring, and even intervening. Along the way we kept discovering new ways of describing phenomena and bringing them under the purview of systematic analysis.

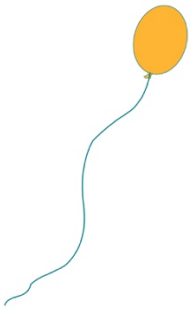
Bill also taught me how to conduct a rigorous empirical study. When I showed the patchwork patterns, meaning that groups of neighbouring lines tend to have similar values and colouring, and surrounded by discontinuities where values and so colours significantly change, made evident by the changing rate of node count (Yang and Hillier 2007), Bill asked me to test other variables, such as metric mean depth and entropy, and to ensure whether the patchwork patterns were a consistent phenomenon. In fact, the discovery of such patchwork patterns was also related to the methodology of neighborhood detection as conducted by Sheep, according to the variables of point intelligibility or synergy (Dalton 2007). Bill became convinced that a new and significant phenomenon – a kind of discontinuity in the urban network – had been identified. This provided a syntactic framework for explaining the morphological generation of distinct urban areas, such as districts, neighbourhoods and communities. We drove in his Jaguar to visit the City and London Docklands to observe the expressways, the canals, the green boundaries of communities, and historic named areas, in order to empirically verify the morphology of the theoretically generated patches on the ground, and to understand its implications. All of this, especially the Jaguar rides, definitely helped me understand the significance of field study in the quantitative research on cities.

In addition, Bill suggested that anomalies found in the analysis might act as a starting-point for developing theory and/or method further. When we found that some segregated spaces had the highest choice values in the design project of the Arundel area, we realized that choice, based on segment map, needed to be normalised to make those segments comparable by incorporating the effect of size

in the analysis. We investigated different behaviours of integration (the reciprocal of total depth/closeness centrality) and choice/betweenness centrality, as sub-networks within the city grow in size. One day Bill suggested me rethinking the morphological meaning of the D-values. I suddenly figured out that betweenness centrality can be treated as a benefit and closeness centrality (or its reduction) as a cost. The benefit-cost ratio could then be defined and used as a dimensionless variable. This variable, which later came to be called NACH, solves the problem of normalising choice. With integration also normalized (NAIN), we could identify the foreground and the background of urban network with greater ease and assurance. This had been abstracted as a star model (Hillier, Yang & Turner 2012). Meanwhile, we identified the two-parametrized Weibull distribution as a function of describing the growth of urban grids, in which one parameter is denoted as the catchment area defined by the sub-grids at a certain stage of the growth, and another as the closeness of each segment to the others at that stage. We thus characterized urban growth and cast light on the automat generation and diversification of urban networks.

The idea of the emerging structures was of course fundamental to Bill's thinking from the very early development of the foundations of space syntax. In April 2019, he invited me to the Barbican. I had to follow the yellow lines drawn on the ground to help visitors find their way, to meet him at his apartment home, with the elaborate and delicate balcony garden created by Sheila, Bill's wife. Not surprisingly, he was still busy with working on the symposium paper about the different types of structures implicit in graph-theoretic representations of networks, exploring a new direction for the development of space syntax analysis. After discussing about the stability and reproduction of the global spatio-temporal structure in terms of the organisation of the structure itself, Bill asked me to compile all the different ideas together to a final version. Unfortunately, this was our last face-to-face meeting, although we had exchanged many emails on the publication of Chinese version of the Social Logic of Space on the 30th July, 2019. During this period, Bill continued to think about the theoretical challenges and specifically the way in which quantitative analysis might capture the different types of structure that characterize different parts of spatial networks. For him, 'we have no means of assessing the effect of the strong differences in the form of the structure and its functional correlates on, for example, the economic or social performance of the city as a whole. We can analyse the city to bring to light 'structures'. But we cannot describe those structures in such a way as to make them comparable, and detect relations to global performance. More simply, we have no theory of structure. This is the problem at the urban level'. This paper was presented in the last symposium in Beijing.

In my name and in the name of space syntax scholars and practitioners in China, I express our deepest appreciation to Bill.



3 IDEAS AS LEGACY:

TRACES OF BILL HILLIER IN THEORY (AND MEMORY)

Vinicius M. Netto

When I learned about this session for Bill, I told Laura, John and Ruth that I had never received an invitation that made me happier. And I meant it. I feel that the best way to thank them for this privilege is to respond to this special occasion by talking about Bill's role and influence on our trajectories as researchers and as a research field. Although there are other ways to do this, I'm afraid I can only do so personally on this particular occasion, in the presence of his colleagues, students and friends.

Of course, this occasion — our being here — is a celebration. So let me start by sharing some of my impressions of him as his student some 20 years ago. A lasting impression was of his thought when he was speaking with you. I think I haven't met another person with a mind as clear as Bill's. If, for me, the world was — and still seems — a bit opaque, a challenge to understanding, the world for Bill appeared to have no mysteries, so confident was he in explaining things around him. It was an absolute joy to hear him think aloud. He seemed able to understand anything using a thought imbued with endless relationality, constant materiality and sociality. Now, how do you think with all these layers and materials like they were always already there, simultaneously at work within the thing you want to understand? As much as these 'substances' surround us, they seem to constitute and shape Bill's thoughts.

And there was this tireless, recursive way of thinking, like the search for ideas was his playground. Was it Bill who said that once we learn a new idea, we will never think without it? I also remember him saying things like, "We are not afraid of throwing good ideas away", or "I went to this academic event, I talked to this group of people, and I threw this idea; I tested the idea on them" — perhaps not precisely in these words, distorted by "the labyrinth of memory".[1] Nevertheless, one could see how his enthusiasm for ideas was enormous. It was authentic. We could watch throughout the years him engaging again and again with the most significant subjects — society, space, cognition and so on.

[1] I borrow these words from Argentinian poet Jorge Luis Borges.

Relentless. Always looking at the same thing, taking a different angle, finding new things, new versions of sets of relationships, or new forms of description — finding excitement in those new versions and discoveries.

This is perhaps the most admirable thing about him: how do you keep looking at the world with a sense of surprise? Looking at the world with fresh eyes. That takes an ability, a disposition. Of course, children and students have that disposition. We are likely to lose that as we mature and naturalise the world to ourselves. It seems to me that Bill never quite did that. He didn't seem to grow used to this thing we are a part of. Back in those years, I wrote that "Bill always seems like a student, seeing the world with fresh eyes". Those words are in my thesis and a book I later dedicated to him. That's perhaps his biggest lesson to me. The key and most challenging thing to do is to take a step back and stop taking the way things around you work for granted. You constantly need fresh eyes.

A feeling I have after these years about those interactions with Bill on research, which I'm sure many of you feel, is a wish to reenact those conversations. When you were forbidden to show up in his office in the morning. When you had the privilege of having a person at the peak of his intellectual powers, give you regularly a part of his time and thoughts, the most precious things. I wish I had recorded those talks. I wish I could get back to them, now more prepared. I wish I could emulate them today with other people. Today, I surprise myself trying to reenact those situations with my students — when I unconsciously attempt to repeat that way of dialoguing. I pick myself trying to reach his clarity in my teaching and writing.

Now, a word about Bill's theoretical work. Sociologist Robert Merton called the effect of the cognitive environment on the creation of sequences of ideas between different authors "multiple discoveries". As far as I can decode it and trace its possible inspirations, Bill and his co-authors composed their theory creatively from the knowledge of many different disciplines and fields. We see the linguistic idea of a primacy of syntax over semantics and the 'restrictions on random processes' in urban morphogenesis, reflecting the emphasis on signs rather than meanings in the view of information as the amount of freedom of choices governed by probabilities, a measure of the degree of randomness in Claude Shannon's information theory; the topological thinking in 'cities as networks', as in Christopher Alexander; the use of graph theory to detect relational properties, as in Linton Freeman's social network analysis. But Bill went so much farther than any graph theorist in exploring those ideas spatially — like in the idea that each space contains in its configurational nature a global relationality — and in the context of society, the concept of the individual and the social system as a single whole seen from different prisms. He could theorise society up there with the best: the attention to co-presence as an elementary condition of social awareness, as in Goffman; the anthropological reading of codes of social cohesion via Durkheim's solidarities and Turner's communitas as inherently spatial; the view of societies as encounter systems and the focus on co-presence as fundamental to social reproduction. That was society seen in the "here and now", like Giddens' new

structuration theory. The social logic of space was theorised simultaneously but with much more material depth.

Such a wide and diverse range of ideas informed by apparently incompatible fields, shaped into a single fabric of a theory.

Think about that for a second — what it takes to navigate so freely in the realm of ideas.

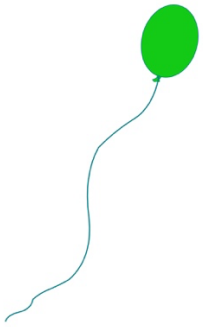
If my description is correct, the trajectory of these conceptions shows how, beyond combinatorics, a *configurational* logic is critical to new theories — also at the moments of learning from different approaches to reach something greater than the sum of its parts.

Now, look around in the discipline of urban studies. The emphasis on movement and co-presence and the topological view of cities are everywhere. This collective effort has brought new scientific standards to empirical work, which were not usual in the discipline apart from works in urban economics. The emphasis on objectively identifiable social and urban entities like pedestrians and co-presence and the deep view into spatial structures in cities and buildings allowed for study cases with large samples — urban areas or whole cities — in extensive fieldwork, finally offering empirical robustness. This collective effort seems to have changed the discipline — and fields of practice along with it.

And, of course, it changed my view of cities and societies.

I sought Bill because he was an original thinker, and he inspired me to be a theorist. As his student, I tried to somehow extend or work outside the borders of his ideas. What else was out there to be discovered? What phenomenal areas were not explored? I felt stimulated by him to go in other directions. Before I even met him in 1999, I used Bill's focus on the elusive spatiality of movement and the temporality of the "here and now" to think of social segregation beyond static residential territories, operating instead in subtle but pervasive ways in the distinct daily trajectories of social groups in urban space. With him, I explored the idea of meaning in urban and architectural spaces as part of how we build systems of social action through communication. Since then, my colleagues and I have looked into the effects of buildings on the social life of streets and neighbourhoods. And more recently, we've been exploring information theory to analyse morphogenetic paths and frequencies of cellular configurations in different spatial cultures — what Bill called 'distinctive ways of ordering space' — and explain the role of cities in how humans battle entropy by coordinating their actions and producing societies as large-scale cooperation systems. As you can see, even though I've tried to find alternative and complementary ways, I've kept drawn to Bill's ideas and the developments in space syntax. Even considering how paths might unfold so differently, I feel that I grew in connection with colleagues and friends in this community, and I learned that it is good to be part of a community.

Let me finish these thoughts by reminding something that sociologist Niklas Luhmann said — something that would perhaps align with Bill's view that ideas are in things:[2] Luhmann noted that the mode of existence of consciousness is the meanings it creates. If he is correct, we are alive whenever our ideas circulate. So Bill keeps present. He's certainly present to me and, I'm sure, to many of us. The fact that we are gathered in Bergen and connected across so many regions of the world is a testament to the beauty and power of his ideas.



4 HILLIER'S IDEAS ON CONFIGURABLE SPACE, SPATIAL MEANING AND THE SITUATED OBSERVER

Ruth Conroy Dalton

For me, a key, early memory of Bill took place when I was a masters' student: I recall sitting in a lecture room at UCL listening to Bill present a research observational study (I cannot now remember where, other than it was an urban study in London) and he had a slide of junction gate counts showing the split between one direction and another. Bill was describing how, say, 15% of people entering the junction chose to go left and, I am making this up now, 85% of people chose to go right. This was predictable by the space syntax measures calculated. I vividly recall sitting there thinking, *"yes, but why would I choose to go right and not left? I have free will, would I do what everyone else is doing, or would I be one of the 15% turning the other way? And why? Is this even testable?"* For me, this precise problem of how to bridge between individual decision-making and the aggregate, observations of collective movement, as typical in space syntax studies, became the focus of my interest and has sustained me now for many years. How do small-scale, individual spatial decisions aggregate to produce the collective patterns of movement that correlate with space syntax measures?

Naturally, it is clear, thanks to Bill, that a large proportion of pedestrian movement naturally arises from the probabilistic effects of the urban spatial structure. As he identified, *"All other things being equal, movement-flows in different parts of a street network [are] systematically influenced by the spatial configuration of the network itself."* (Hillier, 1999 p. 108). Indeed, in a

[2] I thank John Peponis for his comments and insightful suggestions.

later paper of 2005 he elaborates, "*because… results are about aggregate human behaviour, it has always been unclear how far they depended on individual spatial decisions, and how far they are simply mathematically probable network effects (*Hilllier 2005, pX*).* So, how do we start to detangle these two entirely separate phenomena, the effect of spatial configurations set against our role as individuals making localised, spatially-embedded decisions? And why consider these separately? Because in doing so, we are able to reveal something about how we, humans, make meaning of the external world (in other words the process of cognition). Bill spent a lot of time talking and writing about the concept of *meaning* and for me this is precisely what the study of cognition (and particularly spatial cognition) is about: the process of how we make the information in the world around us meaningful. As Bill said, *"Our mental interaction with the spatial world engages abstract relational ideas as well as concrete elements"* (Hillier, 2012, p. 29). And therefore, it could easily be stated that Bill's lifelong pursuit of meaning in space syntax is perfectly synonymous with the field of study that I have more recently termed *architectural cognition.*

For me there have been three key ideas, influenced by Bill, that have continually acted as the foundation for my pursuit of these kinds of questions. First, the idea that space should be an object of study, in its own right; it is representable, measurable, describable, and quantifiable. For space syntax researchers, space is contained/bounded, limited (not an infinite void), and configurable (it is subject to, and forms, spatial relationships) and particularly through this last characteristic, space becomes meaningful. This leads directly to the second idea that has been important to me: this being that space is a morphic language. Bill made the distinction between meaning arising from signification and significance. Significance, arguably being the more important of the two, whereby a spatial configuration acquires meaning through the act of comparing it to a sort of 'back catalogue' (that we have amassed through a lifetime of direct experience) of all instances of similar spatial configurations that we have previously encountered. Significance is about meaning acquired by comparison to sets of other similar things, it is about meaning communicated via patterns of arrangement. Finally, the third concept that I would bring into this trilogy of ideas is that of the situated observer and, in particular, the idea that any spatial system appears different depending on where a situated observed is located. (i.e., the rest of the spatial system may be close/far depending upon the structure of the system and the location of the observer: space looks different depending where you are.)

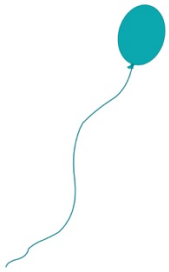
For me, the combination of these three ideas are foundational to the study of 'spatial cognition' or even 'architectural cognition'. Let us briefly return to the situated observer. In this next quote, Bill is talking about cities but his comments could just as easily be applied to complex buildings, *"Space in cities is about seeing and moving. We interact with space in cities both through our bodies and through our minds. Our bodies interact with the space network by moving about in it... Our minds interact with the city through seeing. By seeing the city we learn to understand it. We also see space, and the city comes to exist for us also as a visually more or less complex*

object, with more or less visual steps required to see all parts from all others, and so as a system of visual distances" (Hillier 2012, p. 15). This is the idea that we visually experience any spatial configuration serially, since we can only be occupying one space at a time, and that we need to move from one space to another in order to experience more, and build up a picture, of the larger the spatial system. It is clear that in this process, we both remember the spaces *we have already occupied* whilst also making continual inferences about the spaces that we are yet to explore, but always based on what we have already experienced. This process of continually integrating our memories, attending to different visual cues in the environment whilst reasoning and forming judgements about the spaces around us is critical to the process of spatial cognition.

This is the point I feel it would be useful to briefly talk about spatial cognition and architectural cognition: cognition refers to any of the 'higher-level' brain functions that begin to organize and structure the raw sense data, which represents our 'input' about our surroundings. Spatial cognition research, in particular, is concerned with the acquisition, organization, utilization, and constant revision of knowledge about spatial environments. One way for a lay-person to understand what spatial cognition is about is that it is concerned with how "that stuff out there" (external to us), "gets in here" (is internalized in some manner). Again, this resonates with much of Bill's writing about how we understand the city, for example, when he observed how *"We cannot easily grasp [the] patterns [of organic cities] when we see them `all at once' from above. But, curiously, when we walk about in them, and so see them a bit at a time, the very differentiation of their parts can make them easier to navigate than patterns in which parts tend to be similar and in similar relations. From inside, we often find the organic easier to understand, from outside the geometric."* (Hillier, 2012).

If we ask the question, what exactly is the connection between the immediate, visual cues available from any one, single location in the city, and that city's larger spatial structure, we must, of course, make reference to the measure of *intelligibility*. Intelligibility is an astonishing concept; at face value, it seems almost a ludicrous proposition that there could be a meaningful connection between global spatial measures and local visual information, but the data (the correlations between intelligibility and connectivity and how this relates to people's experiences of and behaviour in more or less intelligible environments) do suggest that this is a plausible mechanism. We are only now beginning to test what might be the most salient local visual cues, for example work by Wiener and Hölscher (2012) on the spatial attention and gaze behaviour of people navigating a virtual world. They showed how people tend to visually fixate on, not only, long lines of sight but also on parts of the scene that suggested imminent changes to the spatial geometry with occluding edges and openings being particularly noteworthy. Also work from Emo on the degree to which we pay particular attention to long lines of sight, or axial lines, at street junctions (Emo et al, 2012). All of this work, is beginning to provide compelling evidence for how intelligibility might function.

So, thanks to Bill we are now far closer to understanding how that how "that stuff out there, gets in here". And we are also closer to understanding how individual decisions made in spatially complex environments can emerge to form patterns of behaviour that correlate with spatial measures, over and above, mere probabilistic effects of the spatial network. But the journey still continues and it is a journey that has very much been built upon the foundations originally laid by Bill. There is still so much more work to be done.



5 HILLIER'S MACHINE: THREE CONCEPTS AND TWO PROPOSITIONS ON A THEORY OF DESIGN

Sophia Psarra

My contribution focuses on two periods underlying my own interactions with Bill Hillier: my first encounter with him as an AAS MSc/PhD student at the Unit of Advanced Architectural Studies (AAS, 1985-1997), and second as his colleague at the Bartlett, UCL since 2011.

In the time between the two periods and the two 'versions' of Bill, space syntax evolved to an approach that has exercised great influence in architectural/urban research and practice and in the disciplines addressing the relation of space and society. Bill presaged by some forty years the contemporary interactions of architectural and urban advances with the sciences of complexity. And yet there are important differences between the two approaches. I would like to bring out these differences by looking at these two phases of Bill, first as teacher at the AAS MSc and second, as a contributor to the Journal of Space Syntax (JOSS), which I edited from 2011 to 2015. More specifically I will refer to his theory lectures in the AAS course and his three papers we published in JOSS (2011; 2012; 2016).

A science of cities versus societies as spatial systems

Writing about the change of the subtitle of the Journal Environment and Planning B from 'Planning and Design' to 'Urban Analytics and City Science' (Batty 2019, p. 403), Michael Batty explains that 'urban analytics is fast emerging as the core set of tools employed to deal with problems of big data, urban simulation, and geodemographics'. Existing in parallel to urban analytics, the science of cities is a better focus, 'going back to social physics as reflected in notions about scaling, rank-size, allometry and so on, and its analytical focus through fractal geometry, chaos theory and complexity' (Batty

2019, p. 404). As Batty explains, there are hundreds of books on data analytics but few that bridge the gap between big data and the sorts of data we need to think of cities more strategically.

'In short, we have all the tools to deal with data generated routinely in real time but we have none of the requisite theory, other than the most pragmatic where we have bits and pieces of a science. The real challenge of urban analytics is to make sure we invent this science as well as working with ways of using it to plan cities better' (Batty 2019, p. 404).

My purpose is not to compare Bill's theories to these fields in any systematic way, but to guard against Bill's work as being associated with these areas. I will attempt however, a broad comparison. 'City science and urban analytics describe systems as emergent bottom-up processes with only occasional top-down centralised action' (Batty 2012, p. 9). In contrast, Bill saw that space is the sine qua non of society defined as spatio-temporal encounter systems made up of fully separated mobile individuals, but surviving any individual.

'Society arises, initially through devices for overcoming the spatial discretness of individuals, first by creating some kind of spatial patterning, and second by transpatial integration, but this time not as a cognitive device for understanding the world from a point in it, but as a means of constituting categoric differences among collections of individuals' (Hillier 1989).

There cannot be a theory of the city - or architecture - that is not at the same time a theory of the social. My proposition is and there cannot be a theory of the social without a theory of 'description retrieval' and 're-embodiment' (Hillier and Hanson 1984, Hillier 1989), that is, how human minds retrieve descriptions of shared forms and experience, and either re-embed them or creatively alter them into new realities. The notions of 'morphic language', long/short models, and 'structure'/'order' are central to these ideas. I argue that it is these notions that establish the difference between Bill's work and city science. It is these concepts I will discuss, also seeking to understand the relationship of Bill's theory to design.

Bill Hillier's theory lectures

Bill taught a theory course that introduced students to scientific concepts and theories of knowledge. He developed the content year-after-year, by working over material in the handout notes he gave to students. Even a quick look at his notes from 1988-89 shows that he used a consistent schema of organisation. Each text consists of six paragraphs, each numbered and headed by a topic sentence indicating what idea or thesis the paragraph deals with. What is interesting thus, is not simply the content of his talks, but also their structure, the classifications of concepts, the overlaps of ideas in subsequent lectures that though temporally separated were conceptually connected.

Was the six-part rule a constraint he practiced to order his arguments, or a desire to orchestrate his reasoning through a repeated structure which students would unconsciously absorb week-after-week,

like an hexameter, or both? Bill had a unique way to grasp things as being logically structured and conceptually organised. Logical structure in language maps specific meanings into reality to see if they apply. The six-part rule on the other hand, used natural language as morphic language, both to specify meanings and to enrich our awareness of the multi-coded complexity of ideas, exploring possible meanings in their interrelationships. So my belief is that he aimed for both.

Three concepts

Morphic languages (Hillier and Hanson 1984; Hillier, 1989) are systems where meaning arises out of syntax resulting from the simultaneous presence of relations rather than extraneous associations - what Bill defined as the difference between 'significance' and 'signification' (1985; 2011) respectively, two terms he borrowed from Vitruvius (1996).

Deriving from the theory of probability, long and short models are defined by the length of descriptions necessary to describe syntaxes of morphic language (Hillier and Hanson 1984; Hillier 1989). A highly ordered process will have a long model (e.g. Bororro village), and a less ordered one a short model (e.g. beady-ring). In buildings this idea evolved into 'strong' and 'weak programme' buildings (Hillier 1996). In relation to cities, they evolved into the notion of the 'dual grid' defining the generic city as the foreground economic network of retail and markets, and the background socio-cultural network of residential areas (Hillier 2012; 2016).

The notions of structure and order distinguish between how things are intelligible to us through spatial patterns we grasp by living in them, and how they are logically organised as rational concepts, which can be grasped all at once.[3] 'The simplest forms of order are the classifications – the binary distinction between what is and what is not a member of a class of things – which the mind… imposes on the chaos of our experience to give it spatial and transpatial order' (Hillier 1989). So for Hillier, order is associated with the organisation of society into spatial and transpatial groups on the one hand, and the logical patterning of spatial arrangements on the other.[4]

How do these concepts inform or open up the imagination in architectural design?

One particular answer is given by Phil Steadman based on a morphological theory proper (Steadman 2014). Enumerating possible forms, Steadman asks why certain possibilities are pursued as built forms while others are not. Two pathways open here as a response: one is Steadman's return to the model adding constraints, because these possibilities are contrary to some generic functional requirement. The other pathway is Hillier's idea that 'the built forms that actually exist are not simply subsets of the possible but variable expressions of the laws that govern the transition from the possible to the real' (Hillier 1996, p. 254). Both pathways eventually converge, seeing built forms as being

[3] For Hillier, order is not geometrically defined, as Julienne Hanson described order (1989), but mostly logically defined.

[4] Through two fundamental notions: 'gluing' and 'binding' (Hillier 1989; Hillier and Hanson 1984).

about constraints to possibility imposed by generic functions. So Steadman's and Hillier's definitions of possibility refer to how it is mapped into the realm of necessity and the real.

However, architecture does not simply satisfy generic functions and does not develop out of the enumeration of possibilities. So if we do not go through universes of possibilities, how are we informing the design imagination? One possible answer lies in the ideas of morphic language, short and long models, order and structure.

Two propositions

Proposing the theory of morphic language out of syntax, Bill extended into the area of the aesthetic related to architecture and design (Hillier1989; 2011). The aesthetic works by mapping onto reality to find not truth or solutions but possibilities which give it significance. Architecture – like poetry - is about mapping into a genotypical family of architectural forms, both those which exist and those which are possible. We have therefore, to set Steadman's model aside and follow Bill's idea of the construction of complex possibilities of meanings in the realm of architectural freedom (Hillier 1989). However, the two approaches are not opposed, as architectural freedom is about possibilities of meanings rather than freedom from constraints.

Two pathways of meaning

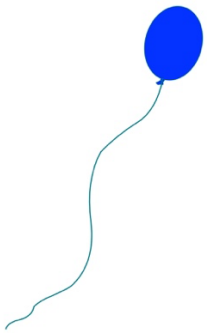
In my work I have defined buildings and cities as dual systems consisting of a configurational structure of spatial properties and relationships of logical-conceptual order specifying identity or membership of elements into classes (Psarra et al 2018). In a comparison between Mario Botta's and Le Corbusier's houses we see two pathways by which possibilities of meanings are achieved (Psarra 1997; 2017). The first one is where possibilities are used in such a way as the configurational structure and the logical order of elements support and affirm each other (a long model - Botta). The second is where configurational structure and conceptual order do not correspond but point into different directions, creating ambiguities and more complex possibilities of meanings (a short model - Le Corbusier) (Psara et al 2018; Psarra, 2018; 2022).

Architecture as multi-coded morphic language.

The correspondences between configurational structure and conceptual order reinforce a single coded system. Aiding description retrieval by a single multi-layered code, through repetition over space and time these schemata become normative ideas – ideas we think of - the architectural imagination seeks to alter. The imagination is thus, informed by a combinatorial syntax where the relation between significance and signification is not precise, but strives for openness in the realm of architectural possibility and freedom. We recognise this in other domains of creative activity as in Calvino's Invisible Cities where real life phenomena enter a combinatorial game of mathematical and linguistic transformations that disturb their conventional meanings, training the imagination (Psarra 2018). It is here that combinatorics enters the theory of architecture, not as possibility informed either by

randomness or constraint, but as an experimental approach that loosens the correspondences between the layered aspects of morphic language.

This is, I believe, is a potential extension of Hillier's ideas necessary for a theory of design, and of space syntax from a theory of architectural necessity to one of architectural freedom.



6 BILL HILLIER

Frederico de Holanda

I rank among those who had the privilege to meet Bill Hillier decades ago, when the expression "space syntax" first appeared in print form: that was the year of 1976, and the place was the fascinating intellectual environment formed by him, Julienne Hanson, Adrian Leaman, Alan Beattie, and other colleagues at the Bartlett.

I have since been greatly stimulated by his seminal ideas, first as his MSc student, then when he supervised my MSc thesis, and then my doctoral dissertation. For my great joy, our relationship did not end here, for we met often again – in Brasília, London, Atlanta, Stockholm, Istanbul, Santiago. I have considered a list of adjectives, adverbs, and metaphors to try and convey how important he was to me, both academically and personally. Found none, either because they were too shallow, or too pompous, or perhaps because I think he hated the three species: his theory is built upon verbs and substantives.

Bill's contribution raises the bar of the social importance of architecture, and in doing so he establishes new levels of ethical responsibility in design. Surely architecture is made of brick and mortar, it is an inanimate phenomenon; surely people are made of flesh and bones, they are living organisms; physical properties of building materials affect the comfort of our bodies as biological entities, and the contribution of natural sciences to architectural performance legitimately defines lines of research in academia.

However, Bill does not approach architecture through the lenses of natural or biological sciences. Rather, he does this through the lenses of social sciences. For him, not only architecture but society

itself is an artifact, configured through recognisable patterns of bodies deployed in space and time. True enough, societies as encounter systems are not new in the literature – remember Pierre Bourdieu's social capital: we are positioned in society according to cultural, economic, and political resources we can mobilize, but also through the networks of social contacts to which we belong (Bourdieu 1984). This is Bill's system of encounters and avoidances, as Daniel Koch has emphasised more recently (Koch 2015), but now through analytical categories which allow for their fine-tunning approach as arrangements: large, small, hierarchically defined, horizontally structured, in daily life, in exceptional circumstances, actual, virtual, all qualified by social labels superimposed on people. Notwithstanding the virtual mode of relationships, encounters happen in actual places, the order of which modulates our movement in space (through barriers and permeabilities) and our awareness of others (through transparencies and opacities); this happens at all scales, from small buildings through settlements to the natural landscape, as Lucy Donegan shows, concerning the social choreography in urban beaches (Donegan 2019; Donegan & Trigueiro 2016).

The possibilities and restrictions instituted by architecture go far beyond appearances and matters of style – the hegemonic approach in architectural literature. Against the mainstream, the focus is now directed toward the ordering of space, which is "really about the ordering of relations between people" (opening paragraphs of The social logic of space) (Hillier and Hanson 1984, p. 2). Not an easy task. As Michael Benedikt notes, it takes years of training for architectural students to be instilled with an ocular-centric, solipsist experience of places, so that they can draw their projects without people, or wait for a shot of an existing building until… nobody is around (Benedikt 2020, p. 44). The images of any publication on the "architecture of power and taste", in Garry Stevens words (Stevens 1998), illustrate the point.

When Bill and Julienne put people back in, they stress the importance of the couplet architecture-body arrangements as one of the most telling instances by which society's identity is constituted, recognised, and reproduced. The obvious corollary is the addition of a type of capital that has not deserved a place of pride in Bourdieu's oeuvre: architectural capital. Inspired by another master of mine, the Brazilian philosopher Evaldo Coutinho (Coutinho 1970), I suggest architectural capital is two-fold: 1) there are end-elements: ordered space in which we are, through which we move, and in which we are aware of other people; ordered space is the ultimate aim of architecture, and the forte of Space Syntax Theory; I call this spatial capital; and 2) there are mean-elements: volumetric features which, by practical necessity, define the voids; I call this building capital.

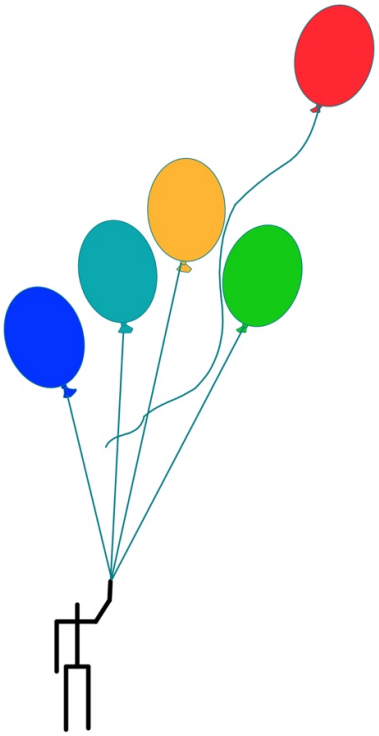
However, if such physical elements have a supporting role in architecture, their materials, finishings, colour, texture, size, form (Holanda 2007) are also constitutive of power and taste, that is, of the habitus, the overarching Bourdieu's concept that encompasses modes of having, acting, thinking, and feeling, which distinguish subjects and locate them in social space.

The above reasoning implies we should avoid a “moaning-mode”, which laments a situation without considering that places are social constructs. It is as if simply bad professionals or bad knowledge were the source of bad environments. There certainly is incompetence around us, but this is not the crux of the matter. When it comes to the habitus, both “pedigree” architecture and the anonymous social production of buildings and settlements may constitute one and the same architectural paradigm – for example, gated communities in Brazil cut across class status.

Now, if we are to leave the moaning-mode and embark on a “critical-mode”, we must for a moment zoom-out from the environment and not focus on the environment per se, but rather on the habitus to which the environment belongs as one of its constitutive elements: what paradigm is being embraced by the social subjects in question? In the critical-mode, we are not simply analysts of an environment, we are critics of society, but focussing in one of the forms it materialises – architecture and social arrangements. We must act as the social subjects we are, struggling in a social milieu, fighting for a certain habitus, identifying our allies as much as our adversaries – and confront them. Otherwise, we run the risk of picking the (ineffective) wrong battles. In the worst scenario, of adopting a naïve stance and preaching in the desert.

Concrete reality, artifactual phenomena – these are perhaps good catchwords to convey Bill’s vision of architecture and society. Sociological or historical literature often register “society” as power struggles among social classes, or ways of expressing ideas, or modes of producing material goods. But none of such processes happen in a void: they do not occur in some sort of insubstantial ether, but are deployed in space and time, and qualified by them – as Julienne, Bill and Hillaire Graham once put it, “ideas are in things” (Hanson et.al 1998, p. 80-108).

Notwithstanding specific theories or interpretations, praiseworthy as they are, what I cherish most from Bill’s teaching is this: I have re-learned to think about Architecture, and, by the same token, about human society. His influence in my thinking was rather in the field of Epistemology, rather as knowledge about knowledge, than knowledge about the world: Philosophy, rather than Science.
In my name and in the name of Bill’s academic children, grandchildren (and great-grandchildren!) who constitute research groups in Brazil – in Brasília, Goiânia, Recife, Natal, João Pessoa, Rio de Janeiro, Niterói, Fortaleza, Florianópolis, Porto Alegre, Curitiba, Pelotas, Belém, and possibly other cities – I say we are for ever grateful.



7 CLOSING REMARKS

Margarita Greene

We have seen the many ways in which Bill's ideas marked his former PhD students. Each of the five presentations highlighted a number of concepts that opened a particular avenue of inquiry:

Tao emphasized the morphological aspects, how to identify urban patterns and regularities focusing on configurations, and their social and economic implications. The referred to approaches to empirical data, the search of new and rigorous methods of describing phenomena.

Vini pointed to Bill's constant generation of new ideas, ranging from the description of structure in terms of restrictions on a random process, to co-presence as the first step to social awareness.

On the other hand, **Ruth**, intrigued by what Bill described as 'natural movement' was taken to spatial and later architectural cognition. She talks about 'how we make sense of the world' and asks how we make individual decisions, and how these lead to aggregate observable patterns of movement which correlate with space syntax measures.

Sophia also started from the question of how discrete mobile individuals organize space to become a society, but centred on the 'description retrieval' necessary for this process.

Description retrieval applies equally to the city and buildings and to social relationships as they are arranged in space over time.

Lastly, **Fred** went back to the original paradigm shift, that led to our common understanding that architecture is "really about the ordering of relations between people".

This brief and incomplete review of the five testimonies, demonstrates at least two rather surprising aspects: the first, is that in spite of their richness of individual perspectives, ideas and observations, there is almost no overlap between them, nor contradiction. Each one seems to have been inspired by an amazingly complete theoretical and methodological framework initiated by Bill and Julienne, and a very special group of researchers, who formed the basis of the syntax community. Some of them are present here today.

The second is that I am sure that if we had time to hear from more of Bill's PhD students, we would get an even richer account of concepts, morphological phenomena and trajectories of research. In fact, we have here a very special PhD student, John Peponis, Bill's first doctoral graduate, whose testimony is missing today, but is pending for some future date.
But let me recall some of Bill's ideas that were not mentioned today: the *beady ring*, the *deformed wheel*, the distinction between *inhabitants* and *visitors* which I have always found extremely interesting when analysing residential areas. The differentiation between *generative* and *conservative* buildings, the *inverted genotype*, the *visible colleges*, and the *virtual community*, among others. Of course, I can see that many of facets of Bill's work highlighted today are closely related to this list. What I am trying to say is that if you were intrigued today there is so much more for you to discover!

And this brings me to my impressions from my first encounters with Bill's ideas. I remember going to the theory lectures that Sophia mentioned. They finished late, or at least many times it was already dark when I started a one-hour trip back home. Nevertheless, the 60 min seemed to pass so quickly, because I was re-thinking what Bill had presented to us, but now from my own experience. My feeling was that with each one of these lectures Bill opened new ways of looking at my own memories, new windows in my mind, perceptions and experience enriching my past and of course future experience. In fact, after these I could not go to a social gathering, or to a wedding, or to a beach in summer, without observing the positioning of the people, the movement patterns, the patterns of co-presence, or the shape of visual fields. That is, Bill's lectures had changed the way I observed and understood the world.

In fact, I used to compare the resonance of Bill's lectures to that of more traditional lectures. Living in London, and wishing to make the best of the opportunity I attended many lectures. I remember, for example, listening to a lecture on mud sky-scrapers in South Yemen, a subject I had no prior familiarity with. And yet, while my knowledge was enriched, such lectures did not

change my way of understanding the world. By contrast, with Bill it was not as important that I learned about the Bororo village, which or course I did, but that I learned how the positioning and classification of the dwellings transmitted social structure through generations, by restrictions on the random process. When, in the private domain of the house, we teach our children to eat at the table, or to address the elderly we partake in the same process of transmitting culture and social structure.

I feel that I have to finish this session with something more: with how Bill marked us all by just being Bill, that is as a person. When I was invited to chair this session, I knew each of the speakers would make a robust presentation of how Bill's ideas had marked them, but maybe they would not mention how Bill had marked them as a person. I was wrong, several of the testimonies referred to Bill's as an inspiring teacher who shared ideas and challenged his students at the same time.

Also, I did not realize that if trying to summarize Bill's ideas is difficult, it is even more difficult to try to summarize him as a person. But anyway, I committed myself to it and I will try to do it. On the one hand there is the obvious: he was a wonderful teacher. But I am not referring to attributes that could typically be associated with a good teacher, such as patience, or subtlety in letting you know when you were mistaken. On the contrary, he was not a diplomat, nor would he hide his displeasure from what he did not like.

Second: he was not a simple person, nor easy to understand; but we soon learned how to interact with him. I think it was Vini that mentioned that we were not allowed to talk to him during the mornings! I mean: not even to say 'hello' if you crossed him in the corridor, and this was not easy!

Third and most important: having such clarity and analytical mind, together with a passion to understand the world and, as I mentioned before, little patience, he nevertheless invited us all to contribute to his thoughts and ideas. In that respect he was extremely generous in opening his mind, showing us what he was thinking and listening to our contributions. That is partly what I think has been so important for building this community and that is what makes me believe that it is his greatest legacy. He left us a set of theoretical ideas, innovative concepts and observations, together with a methodology for observing, representing and analysing the socio-spatial phenomena that is not closed, but open for all of us to enrich. Contrary to what one would have thought, it is an eminent bottom-up and top-down system in constant construction.

Lastly and I have to say it, he was a wonderful traveller! Together with my husband and Bill's wife Sheila, present today, we made some beautiful trips, we tasted good wine and enjoyed them thoroughly. We are all missing him today, and will keep on missing him.

Figure 2: Prof. Bill Hillier at the 40th anniversary of the master program Advanced Architectural Studies (AAS). © Akkelies van Nes

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