The city and the grid:
Building Beauty at Large Scale

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1. Introduction.

The enduring popularity of "A City is not a Tree" (Alexander, 1965) for scholars in different areas of knowledge does not seem to give signs of receding. Quite on the contrary, a quick search on Google Scholar reveals that its annual rate of citations in the past five years is about 3.5 times that of the overall period since its first publication in 1965. In this paper Alexander proposes a focus on the complex nature of cities that, along the same line of Jacobs' chapter 22 of *"Death and Life"*, entitled *"The kind of problem a city is"* (Jacobs, 1961), challenges to the hart the conventional approach to urban planning and design; this challenge is all the more relevant today, when the call for a profound renovation of the foundations of the discipline comes not just by planning scholars, but also governmental and educational bodies (Bothwell, 2004; Farrell, 2014; U.N., 2015; U.N.HABITAT, 2009). The urgency of this problem is obvious in an age characterized by both unprecedented urbanization, predominantly involving the poorest parts of human population in the weakest planning systems (U.N.DESA, 2014), and the unprecedented impact of human activities on the fundamental forces of nature (Steffen, Broadgate, Deutsch, Gaffney, & Ludwig, 2015). In the light of our failure in the post-WWII urbanization of the Global North, the question is simple: can we planners help at all with that of the Global South, which occurs far faster and at higher scale? How can we become part of the solution, rather than the problem? In a rapidly urbanizing world, patronizing a niche cannot suffice; we need *a new mainstream*, one that works.

One way of seeking a route out from the current disciplinary cul-de-sac is by re-framing the organic analogy of cities as living organisms. Notwithstanding the countless references to nature that have permeated the culture of cities since Plato some twenty-four centuries ago (Marshall, 2008; Steadman, 2008), we planners have mostly approached the analogy with an inspirational attitude, seeking inspiration from the nature's visible forms rather than from the structures and processes through which such forms come to existence; in fact, a plain *biomorphic* attitude. At a closer inspection, this biomorphic attitude is just the simplest expression of a larger *developmental* approach to cities, as opposed to a truly *evolutionary* (Mike Batty & Marshall, 2009). In evolutionary biology two different processes of form generation are clearly distinguished: *ontogeny* (where form is generated by "morphogenesis"), which characterizes *individuals* along their life-long (intra-generational) trajectory from the cradle to the grave; and *phylogeny* (where form is generated by "evolution"), which characterizes a *population of individuals* along an open-ended, long-term (inter-generational) trajectory. The two types of change are profoundly different, with

different forces at work; primary evolutionary forces like mutation, natural selection and genetic drift operate only at the population (phylogenetic) level, while entirely different forces, for example nutritional or cultural, are at work on the development of individuals. Confusing the two would lead straight into a Lamarckian dead-end, which is in fact where we planners have been for decades and still largely are. Planners have always found it rewarding to interpret cities as individual organisms because in such developmental analogy they could act in the role of God (or Nature): if a perfect adulthood exists for our cities, planners are the ones who know how it looks like and how to achieve it by comprehensively engineering all factors involved along the way. A paradoxical outcome indeed, for a way of thinking inspired by nature: in fact a rather mechanistic approach to a phenomenon—that of the city—of enormous, almost unconceivable complexity.

Historically planners have practiced the biomorphic/developmental analogy with nature predominantly as a source of pure inspiration (therefore, more appropriately, as a metaphor), rather than as a matter of rigorous investigation. That was functional to the establishment of urban planning as a discipline in the first half of the past century. The recovery from it though, is certainly needed if planners are to do their part for a sustainable future. However, that will never come painlessly. In all evidence, working in a truly evolutionary perspective requires re-thinking the object of our investigation, shifting from the good city form to the process that generates it and the role that certain spatial features play in such process: effectively, it requires a new science of cities (Michael Batty, 2008). That, in turn, entails a different way of conceiving our position as part of an ecological process of urban evolution, which goes together with a different configuration of the practices around which our discipline is conventionally shaped (C. Holling & Orians, 1971; C. S. Holling & Goldberg, 1971). That may include, for example, realizing masterplans that are resilient and adaptive, or building regulations that do not inhibit informal participation (Duany, 2013; Feliciotti, Romice, & Porta, 2015; Porta & Romice, 2014).

The discussion of the organic analogy clarifies that the current call for a disciplinary re-foundation can only be laid out on the ground that Alexander anticipated in "A City is not a Tree", that of the city as a complex whole that is configured to respect and support the structure of urban life, and therefore to serve it, by sharing with it the generative principles of biologic evolution. Alexander has devoted his life to progressively clarifying such principles in the inanimate world of construction; he ultimately re-framed the conflict between the mechanistic/conventional and the human/living systems of space production in terms of the irreconcilable "battle" between, respectively, "System B" and "System A" (Alexander, Neis, & Moore-Alexander, 2012). In this light, the problem of a new discipline is one of establishing System A as the new normal, or, in short, that of *System A at the large scale*. Unfortunately, Alexander for first acknowledges that this is an unresolved matter. In a recent paper presented at the Pursuit of Pattern Languages for Societal Change conference of Krems in 2015, we have treated this problem, concluding that, rather than a compromise between System A and System B, we should seek a deeper understanding of the way System A works in the long term or, really, re-frame System A in an evolutionary perspective (Porta, Rofè, & Vidoli, in print).

More in detail, we found that what really defines System A is its capacity to generate beauty in the land, and that the fundamental factor characterizing System A's is the

amount of life that is generated into the process of making. We then observed, by looking at practical cases of beauty generation at small and large scale, that life occurs in fundamentally different ways depending on the *timeframe* of the process itself: in the short-term cycle of *project change* (sub-generational), life comes through coordinated activities of *observation*, *interaction*, and *co-action*, all based on the involvement—in various different ways—of the community of the builders (end-users, suppliers, planning officers, developers, technicians, designers…); on the other hand, in the longer-term cycle of *urban change* (super-generational), life gradually spreads through the process by the countless uncoordinated—or better self-organized—interventions of individual citizens, groups or organizations, each pursuing their own mission, project or interest. We termed this latter bottom-up form of change *"informal participation"*. Alexander as first acknowledged in "A City is not a Tree" the existence of *"informal"* decision making as a second semi-lattice-shaped structure operating within the tree-shaped structure of formal administrative and executive control: this informal line of control*"varies from week to week, even from hour to hour, as one problem replaces another. Nobody's sphere of influence is entirely under the control of any one superior; each person is under different influences as the problems change"* (Alexander, 1965, p. 4). Moving this reflection one step further, in fact beyond public policy and into the broader domain of social interaction, we identified informal participation as a primary evolutionary force in urban change and the fundamental driver of System A at large scale. Planners—we concluded—hold a crucial role in this framework: it is on them to define and set in place, in the design phase, the *spatial structure* that supports and enhances the occurrence of informal participation over the whole post-design phase, in fact over the entire duration of the place's successive evolution in time.

The way Alexander uses the term "morphogenesis" (Alexander, 2004) to identify the process of beauty generation that is typical of System A, elsewhere called "living process" or "life preserving transformation" (Alexander, 2003), is technically precise: in fact it refers to the process of natural growth of individual living organisms (a tree, a shellfish, a human being) that is so defined in evolutionary biology; in Alexander's own words: *"the emergence of a new structure in nature, is brought about, always, by a sequence of transformations which act on the whole, and in which each step emerges as a discernible and continuous result from the immediately preceding whole"* (ibidem, p. 19). Alexander refers to morphogenesis in direct opposition to the "mechanistic" or "artificial" process that characterizes System B; in this respect, his reflection remains very far from the simplistic formalisms of the biomorphic approach and at the same time firmly internal to the developmental interpretation of the analogy with nature. Nowhere in his writings the distinction—fundamental in evolutionary biology—between development and evolution, plays any role in addressing the problem of how living structures (and therefore beauty) are generated in the short as opposed to the long-term timeframe of the process. We argue that this distinction is crucial to capture the nature of the process that generates beauty in the long-term processes of change by informal participation, or the way System A works at the large scale of the city.

In this paper, we build on those foundations and move on to shed some light on what that *spatial structure* is that planners should care of in the design phase, and how can they work on it in practice. We address this problem as the "problem of the grid", after Leslie Martin's article entitled "The Grid as a Generator" (1972). This work was

firstly published seven years after "A City is not a Tree" as part of a book that Martin co-edited with Lionel March (Martin & March, 1972). The article has been re-printed in several occasions including recently a special issue of Architectural Research Quarterly dedicated to Leslie Martin's memory just after his death in July 2000, where it is celebrated as Martin's *"greatest piece of writing"* (ARQ_Editors, 2000, p. 291), and the "Urban Design Reader" edited by Tiesdell and Carmona (2007). At least part of the resurgence of interest for Martin's article is probably due to the current popularity of the mechanistic vs. organic controversy in planning, of which it certainly was an early precursor. The reason why we find it relevant in this context is that this article is largely dedicated to a long confutation of Alexander's "A City is not a Tree", nevertheless ending up into unwillingly proving it by demonstrating a point that Alexander would have in fact entirely supported: that the most traditional model of planning cities at large scale, that of parcelling the land into a geometrical grid of orthogonal streets, does not prevent, but may even favour, the generation in time of complex and vital urban environments. That is of utmost relevance for our purpose here, in that we might be able to show that a rather conventional planning system, one that is relatively light and straightforward, is in fact perfectly capable to express System A's core constituency. In other words, it looks like there might be something there that can drive us towards a "System A at large scale" that is not confined within an academic reserve, that in fact has long been mainstream in pre-modernist urban planning and design, and could pave the way to reinstating System A as the future mainstream of a truly sustainable discipline.

2. The Problem of the Grid

That Alexander is against the grid is apparently common knowledge. Indeed, the continuous references throughout his work to naturally *"generated"* processes, as opposed to mechanistically *"fabricated"* (Alexander, 2003, pp. 182-185), makes this conclusion an easy take for the reader, one that immediately slips into the assumption that Alexander's agenda is essentially anti-planning altogether. Yet, we hope to demonstrate that a slightly closer look at his written work is sufficient to demonstrate that such conclusions are both fundamentally wrong. This misunderstanding has been there since the early days of Alexander's research, significantly contributing to establish the generally accepted assumption that Alexander's approach to a more human system of space production, later termed "System A", might be quite a good idea, but is inherently impractical at the large scale.

Perhaps one of the earliest and most influential examples of that misunderstanding is exactly Martin's "The Grid as a Generator". The importance of Martin's position in generating and establishing this misinterpretation of Alexander's thought is proportional to his relevance in the world of architecture, at least in the UK, in the whole post-war period up to his death. The stature of his figure is well portrayed by the introductory editorial of ARQ's special issue: *"Leslie Martin, who died in July, once bestrode the world of architectural practice, research and education like a Colossus. His buildings were written about by the young Aldo Rossi in Casabella, he held professorships at Cambridge and elsewhere and he established the Centre for Land Use and Built-form Studies (later renamed in his honour). He was one of the judges of the Sydney Opera House competition, he was architect of arguably the most successful and best loved post-War public building in Britain and he shaped the form*

that architectural education in Britain has taken for over forty years" (ARQ_Editors, 2000, p. 291). Less than one year later, on the same journal, Kenneth Frampton wrote of his *"exceptional leadership lasting [...] for nearly fifty years from the mid-'30s onwards. He was, I often think, with all his strengths and weaknesses, the Gropius of our time"* (Frampton, 2001, p. 12).

The feeling, mentioned above, that System B was leading both our cities and the planning profession towards a disastrous failure, is not anything new by any means. It is in fact where Martin starts from in "The Grid as a Generator" (Martin, 1972). Martin acknowledges that *"The activity called city planning, or urban design, or just planning, is being sharply questioned. [...]. The attack is more fundamental: what is being questioned is the adequacy of the assumptions on which planning doctrine is based."* (ibidem, p. 6). Those assumptions, according to Martin, can be summarized in *"two powerful lines of thought:* […] *the doctrine of the visually ordered city [and the] doctrine of the statistically ordered city"* (ibidem, pp. 6-7). The former draws back to Kamil Sitte and has to do with the idea that cities are a total work of civic art which, as such; in this approach *"The planner then is the inspired artist expressing in the total city plan the ambitions of a society"* (ibidem, p. 6). The latter embodies a view of the city as a mechanism that, in principle, statistical sciences and industrial organization could understand, predict and reduce to perfect functioning; planners are here the masters of urban science, those providing the rigorous knowledge and firm guidance that is required for the endeavour. Conventional planning is a form of combination of both these two approaches. Against this vision of planning—Martin's argument continues—sharp criticism was being raised from a point of view that intended cities as *natural organisms*. According to that line of thought, the increasing failure of city planning was due to its *artificiality*, or its difficulties to acknowledge and understand the inner natural principles of cities. Martin mentions as champions of this city-as-organism counter-approach Jane Jacobs' "Death and life…" (1961), and in fact Christopher Alexander's "A City is not a Tree" (1965). And there is where things start becoming tricky.

Martin spends a few pages of his paper to explain why Alexander was wrong in blaming griddy planned cities as artificial, which in fact he never did, and equally Jane Jacobs was wrong in pretending that *"elaborate patterns of living can never develop within a preconceived and artificial framework"* (Martin, 1972, p. 9), which in fact she never pretended. In Martin's view, the natural city advocated by Jacobs and Alexander is "organic" first and foremost in its visible shape, i.e. it *looks* curvilinear on a map, or in any case ordered in a non-Euclidean geometric way; in particular, it is curvilinear the form of its street layout, as opposed to that of the artificial city, which is griddy; the griddiness of the street layout would *per-se* manifest the artificiality of the city. Needless to say, Martin's criticism operates entirely within a *biomorphic* interpretation of the organic analogy that is his much more than his alleged opponents'. The organic city in Alexander (as well as, though less rigorously expressed, in Jane Jacobs), is one were the physical units where life occurs have a structure that is not made of separated and rigidly hierarchical parts (the "tree" structure), but rather of parts which are overlapping and interconnected (the "semilattice" structure). Both Jacobs and Alexander, however, do refer primarily to the structure of urban *life*, not that of urban *spaces*. The physical structure of cities that works well according to organic principles is one that does not prevent, but actually enhances, the cyclical overlapping of life units. Quarters, estates,

playgrounds, shops, street types, pocket gardens, benches, newspaper racks, anything physical that in one form or another, at any scale, hosts definable units of life, cannot be separated in dedicated physical elements and set apart from each other: quite on the contrary, those physical units must be closely integrated in space so that life units can overlap and find their most appropriate spatial environment as they emerge and change in time. That has nothing to do in principle with one particular street layout model, being it griddy or curvilinear. In fact, three out of four of the historical cases that Alexander quotes as exemplary "natural cities" are manifestly griddy (Fig.1), while four out of the nine "artificial" cases—namely Columbia, Greenbelt, Greater London Plan and Mesa City, as appearing in "a City is not a Tree"—exhibit a curvilinear and seemingly organic street layout.

Kyoto, 1696 Liverpool, 1769 Manhattan, 1776 Siena, 1640

Figure 1.

Three out of four of the examples cited by Alexander in his "A City is not a Tree" as "natural cities" show a neat Euclidean grid-iron layout, with Siena being the only curvilinear case.

As for Jane Jacobs, the area of New York she has continuously referred to as an example of beautiful organic environment, the one where she has been living for long time, Greenwich Village, is a quarter of Manhattan, a notorious example of rigidly grid-shaped street layout.

Alexander goes straight to this point when commenting the curvilinear Mesa City project designed by Paolo Soleri: *"The organic shapes of Mesa City lead us, at a careless glance, to believe that it is a richer structure than our more obviously rigid examples. But when we look at it in detail we find precisely the same principle of organization."* (Alexander, 1965, caption of fig.4). That is, in fact, what the "tree" and the "semilattice" structures are, in Alexander's mind: principles of organization, not physical forms. They are, as he put it right at the outset of his paper, *abstract structures*. Moreover, it is precisely the simplistic translation of one abstract structure into an aesthetic feature, especially as applied to representations *in plan*, that characterizes modern planning and makes it artificial and unsuitable to urban life.

Undoubtedly, Martin posed in his criticism a rather "careless glance" at Alexander's "A City is not a Tree". However, every cloud has a silver lining. In his attempt to disprove what he thought were Jacobs and Alexander's flaws, he devoted the rest of his paper to a brilliant demonstration of the benefits of the grid as a principle of planned and nevertheless evolutionary urban development. His point is that planned spatial structures can offer a valuable substrate to the "spontaneous" occurrence of urban life; or, as he sharply put it, that: *"an artificial frame of some kind does not*

exclude the possibility of an organic development." (Martin, 1972, p. 8). Indeed, Martin goes further in his argument, sustaining that *"an 'organic' growth, without the structuring element of some kind of framework, is chaos. And […] it is only through the understanding of that structuring framework that we can open up the range of choices and opportunities for future development."* (ibidem, p. 9). Because it would be difficult to find better words than Martin's to describe this essential concept, we quote him extensively: "*Many towns of course grew up organically by accretion. Others, and they are numerous and just as flourishing, were established with a preconceived framework as a basis. Both are built up ultimately from a range of fairly simple formal situations: the grid of streets, the plots which this pattern creates and the building arrangements that are placed on these. The whole pattern of social behaviour has been elaborated within a limited number of arrangements of this kind and this is true of the organic as well as the constructed town. […]. The grid of streets and plots from which a city is composed, is like a net placed or thrown upon the ground. This might be called the framework of urbanisation. That framework remains the controlling factor of the way we build whether it is artificial, regular and preconceived, or organic and distorted by historical accident or accretion. And the way we build may either limit or open up new possibilities in the way in which we choose to live. The understanding of the way the scale and pattern of this framework, net or grid affects the possible building arrangements on the land within it, is fundamental to any reconsideration of the structure of existing towns. It is equally important in relation to any consideration of the developing metropolitan regions outside existing towns. The pattern of the grid of roads in a town or region is a kind of playboard that sets out the rules of the game. The rules outline the kind of game; but the players should have the opportunity to use to the full their individual skills whilst playing it."* (ibidem, pp. 9-10).

In the rest of his paper, Martin goes deep into the description of three exemplary grids, those of Savannah, Chicago and Manhattan, and the way change occurred over all of them in different ways at all scales creating amazing diversity and ultimately successful cities over generations. His account of this change sits entirely in urban morphology, with reference to one of the founding fathers of this area, M.R.G. Conzen (which is highly unusual for urban planners). Urban morphology is in fact the branch of urban studies that deals specifically with the form of the city and the way it changes in time. That the same Manhattan which was portrayed by Alexander as an exemplary case of natural city was also one of the cases which Martin picked up to demonstrate that the "artificial" city can work just as well, should have suggested Martin that there might have been something wrong in his interpretation of Alexander. And it is a fact that Alexander's successive work has many times and very clearly touched the subtle interplay that a living process needs between a rigid—or indeed even "brutal"— geometry and the "natural" formation of centres around it, see for example (Alexander, 1987, pp. 162-170; 2003, pp. 401-412). That is not secondary: in fact, it is our opinion that Martin's demonstration of the potential of the grid to support organic life-enhancing patterns of change in the long term is fully aligned with Alexander's demonstration of the semilattice structure of natural cities. They are the same thing, and are in fact demonstrated by the same case, that of Manhattan. Martin's criticism actually proves Alexander's point in "A city is not a Tree" more than anything else; moreover, it gives a solid ground to our search of how System A can work in the long term, hence at the large scale, at the same time shaping the future mainstream in urban planning.

6. Conclusions.

The discussion of the paradoxical case of Leslie Martin's criticism of Alexander's "A City is not a Tree" in his 1971 paper entitled "The Grid as a Generator" has brought us to establish a point that is important in our exploration of a way to make System A working at large scale and at the same time be mainstream in urban planning. The point is: a "natural" city, a city that is supportive of human life, a city that is resilient and adaptive to ever-changing surrounding conditions, in short a System A city, is not a city that replicates the exterior appearance of a natural organism, but one that replicates its inner structure. This structure is first and foremost *organizational*, in that it has to do with the way its parts are related to each other at all scales. It is this organization, at this level, that Alexander refers to when talking of a semi-lattice structure as characteristic of "natural" or "generated" cities, as opposed to "artificial" or "fabricated". Importantly, this has nothing to do with one particular shape of the city, be it in plan or elevation, be it the street layout or buildings.

In particular, a System A street layout may be curvilinear or Euclidean, that does not matter. What matters is that the street layout, and indeed the whole organization of blocks, plots, buildings, public spaces and in short of urban space, does not establish barriers that separate from one another the spots in the land where life takes place, or the urban components at different scales. That is important because life in cities changes continuously, in a way that naturally overlaps in space in unpredictable ways, and therefore it must be allowed to "flow" unconstrained over the spatial substrate of the urban system and across its various scales. This idea, far from being just a notional descriptive observation, is commonplace in the sciences of complex networks (Boccaletti, Latora, Moreno, Chavez, & Hwang, 2006), and defines the core of what a living system is well beyond the boundaries of urban design and planning. In system theory for example, inner interconnectedness has long been recognized as the universal property of complex systems—both natural and human, for example societal and urban—that essentially enables the system's dynamic interactions across scales and ultimately its evolution in time (Gunderson & Holling, 2002). The essential opposition between the fluid spatial boundaries of urban social communities and the fixed geography of "neighbourhoods" in modern planning theory is the heart of Alexander's argument in "A City is not a Tree"; interestingly, he illustrates this point on the ground of an early work of a sociologist, Ruth Glass (Glass, 2013, c.1948), who about two decades later would significantly contribute to the discussion of the social implications of urban regeneration by pioneering the debate on "gentrification" (Glass, 1964). However, the profound implications of understanding neighbourhoods as essentially social constructs whose boundaries naturally overlap in space and continuously changes both in space and time, which Alexander anticipated as early as fifty years ago, have gone entirely unheard within the planning community as yet.

Alexander himself has spent considerable efforts in his later production into the exploration of what are the founding rules of the semi-lattice structure he proposed in "A City is not a Tree", and crucially that of the process that generates it. That opens up an entirely new front for this discussion: if beauty does not come by-design, but rather by a natural process of "morphogenesis", how can we reconcile this principle with the notion of an initial planned layout, for example one that establishes a

geometric grid in the land? This is a controversial point that can be resolved only in a truly evolutionary perspective. At a closer look, far from being contradictory, the combined presence of a deeper permanent structure and an endlessly diverse visible superstructure, or of *"diversity and unity"* (Savage, 1963, p. 3), is the tangible universal signature of biological evolution. This structure in cities may well emerge spontaneously at inception, but when the size of the settlement increases beyond that of a village it is very likely that at least in part its growth is planned. Planning in cities is always part of the overall evolutionary process, not distinct and certainly not opposed to it. In cities of foundation, the whole city can start off according to a plan, and certain mixture of originally planned and originally "spontaneous" areas is what we see on the ground almost without exception in all large cities of our time. Nevertheless, what really counts is not how cities started off, or what their design phase was. What really counts is what occurs to cities after their initial design, the evolutionary process that changes both the grids and the "organic" urban fabrics bit by bit, endlessly, in time. The primary force that animates this process is the informal participation of individuals, groups and organization to the shaping of change. As long as the initial structure is such—no matter if planned or not—that it supports and fosters informal participation as well as protecting the land, the conditions for a long-term unfolding process of beauty generation to start and flourish are set. That is a System A at large-scale perspective. And, indeed, one of System A as mainstream urban planning.

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