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PURPLSOC

The Production of Cities: Christopher Alexander and the problem of “System A” at large scale.

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Abstract:

This paper sets out to respond to the question of whether, and how, can Alexander's system A of generating beauty and life in the world be implemented at the large scale. We show that the generation of beauty in cities is a question of time not scale, and that it is a product of morphological evolution, typified by what we call: informal participation. The mechanistic system codified and developed in the last 70 years for building the environment (system B) is not able to accommodate informal participation, and thus incapable of creating beauty or life. It is not planning per se that is the problem, but knowing what needs and can be planned, and what needs to be allowed to evolve. Thus, planning's role can be redefined as creating the structures, both physical and regulatory that will allow informal participation to occur freely and create life, beauty and wholeness in the built environment.

Keywords: *urban design; grid, building process; urban morphology; built environment;*

ISSN (tba)
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1. Christopher Alexander and the large scale: re-framing the conflict between System A and System B.

Alexander's last book *"Battle"* (Alexander, Neis, & Moore-Alexander, 2012) describes how vital establishing a human system of construction is, as opposed to the current system dominated by image, power and money; Alexander names the former "System A" and the latter "System B". In the last chapter of the book, he leaps from the description of one complex project, the new Eishin campus in Tokyo, Japan, which he and the book's co-authors designed and built, to a vision of rebuilding a civilization. There is a gap, however, between the singular project, serving one client, for a single purpose, and the coordination and accommodation of multiple agents striving for different, often conflicting, purposes, typical of urban design. That this gap exists and is felt as an issue by the authors themselves, is confirmed by one of them, Hajo Neis: he describes how Chapter 24, entitled *"Large scale building production: Unification of the Human System and the Physical System"*, was ultimately cancelled before publication (Neis, 2014). This anecdote, as the authors confirmed in person, highlights how the problem of System A at large scale was felt by Alexander to be not resolved enough, at the date of "Battle"'s publication in 2012, to be included in the book.

This problem is of great importance to us for three reasons: first, because Alexander's approach has shown a considerable amount of success when applied at the small/medium scale, and bringing it up to the urban level would just expand its benefit; second, because his insistence on fine-grained community-driven and direct construction appears particularly aligned with the predominantly poor and informal character of urbanization in the Global South, which is where the fight for a sustainable future will be won or lost over the next two generations (Alexander, 2004; U.N.DESA, 2014); finally, because his profound attachment to the evolutionary principles of life in all aspects of building makes his life-long investigation increasingly central in the current debate on a new science of cities and city-planning (Mike Batty & Marshall, 2009). In order to approach the problem, in this paper we set out to explore the following: what is it exactly that prevents System A to be as explanatory and helpful in the large scale as it is in the small scale?

We start in Section 2 by reframing the question within an evolutionary understanding of urban form, by observing the way life occurs in small vs. large-scale, homogeneous vs. heterogeneous, and short vs. long-time building processes. In Section 3 we explore System A at work as a *beauty generating* system of production more than anything else; this leads us to conclude that the problem, which emerged as a *scale* issue, is rather in essence a *time* issue, in fact much more a long-term than a large-scale problem. We then go back to Alexander, in Section 4, reviewing his own attempts at defining the problem of System A at large scale, in the light of our new focus on time. In the Conclusions (Section 6) we sum up our findings and clarify that in order for System A to be viable at the large scale, and therefore capable of meeting the challenge of the mainstream, it must necessarily develop a closer comprehension of the specific dynamics involved when we want to build beauty *in the long term*.

2. Cities as products of cultural evolution: towards a discipline of the post-design.

At first glance, the problem of scale seems to relate to the difference between small and large "projects". That appears to come down to three essential dichotomies: small vs. large-scale, homogeneous vs. heterogeneous and shorter vs. longer projects. However, we should resist the temptation to link up too tightly the project's size, *per-se*, with its profound nature, for example its *complexity*. In other words, smaller projects are not necessarily simpler than larger projects. It is the architecture of the internal relationships between the components of a phenomenon that tells us about its complexity, not its sheer size. Weaver (Weaver, 1948), 1948, later quoted by J. Jacobs (Jacobs, 1961), notoriously distinguished in Nature three types of phenomenon: simple, complex/disorganized, and complex/organized. According to this distinction any process of construction, at any scale, is a problem of organized complexity, as it typically involves human systems of decision makers, environmental systems of spatially defined features and a cultural system of technology, language, images and habits, all of them entailing non-random patterns of mutual relationships between their internal components as well as between themselves as wholes. Projects that operate at the small scale of the building or the aggregate of buildings and those at the large scale of the neighborhood/city are certainly different in size, but the dynamics that govern them, the kind of actors and the system of control involved along with their fundamental mutual relationships are in fact similar.

One thing that we can see very clearly at the large scale, however, and tends to remain hidden at the small scale, is that change in cities does not happen only "by-design" through centralized "projects". In other words, dynamics of continuous modification of the built environment out of any central overarching control are normally clearly visible in the way the urban fabric of cities changes at a large scale (Whitehand, Gu, Conzen, & Whitehand, 2014). In such processes, the elements of the systems involved, human, regulatory, even cultural, typically change in a predominantly uncoordinated way, in a dynamic that is characterized by patterns of emergence and self-organization rather than central control and implementation. Far from being occasional, this type of change is ubiquitous in cities; it is the product of an *evolutionary* process which makes urban system similar, analogous in fact, to ecological systems at the structural level (Holling & Goldberg, 1971). On what basis then should we talk of evolution in cities in the context of the present discussion on System A at large scale?

Pretty much like beautiful cities, other products of human culture such as marvelous tales that make our life more significant to us all, majestic dreams which embed the essence of our feelings for things like death, birth, youth, courage and fear as a collectivity of human beings, incredibly intelligent skills that allow us to acknowledge each other, light a fire, fly in the air like birds at unbelievable speed or make others understand the most subtle nuances of our moods and thoughts, have never been designed as such by anybody. Though somebody at some point may have designed some of the intermediate steps that brought these things to their current configuration, overall they are what they are because they have *evolved*, and indeed they continue to do so. Obviously, when using the word "evolution" in the context of a study on urbanism we must be aware that we are practicing an analogy, that of the city as a living organism, which is seemingly as old as the human thought on cities and design (Marshall, 2008; Steadman, 2008). However, while biologic evolution increasingly seems to offer a fertile ground for the interpretation of phenomena that go well beyond the boundaries of life sciences, including cultural such as the human language (Pagel, 2009), a truly

evolutionary approach to cities, as opposed to a conventional biomorphic or at best developmental, is still to be regarded as a matter of pioneering research (Michael Batty & Marshall, in print; Dibble et al., in print).

For the sake of this paper and the problem of System A at large scale, it will suffice to highlight that acknowledging the evolutionary nature of urban change means two things:

1) If we are to decipher why buildings and cities are what they look like today, we need to utilize a *structural* approach. That is: acknowledging that there is something in what we see that is permanent and ubiquitous – "patterns" of change, or *the structure* – around which endless diversity occurs by means of unforeseeable uncertainty. That is the way life takes shape on our planet from an evolutionary perspective, as well as the way other non-living realities work, like chemical or cultural. If city form is a cultural product, which in all evidence is the case, we need to understand how it evolves as such: an entire new branch of urban science has to be established and develop starting in the area of *urban morphology*.

2) We should, all of us, architects, planners, urban scholars, practitioners, make a big leap from a culture that is mostly preoccupied with the design phase (and the designer/author) to that of the *post-design*. Despite our widespread and undisputed obsession for the design phase, what happens to the urban realm after construction is much more important to us than what happens before it. If we design and plan cities under this new perspective, everything takes a different shape and seemingly established priorities get rapidly subverted: for example, the importance of what we do in the design phase is measured against the consequences that it generates in the post-design rather than *per-se,* like if "there was no tomorrow". In a nutshell, we find ourselves in a new territory: *designing for change*. This territory requires a whole set of different understandings and tools, or, in fact, *a different discipline*.

Most processes of change are of an evolutionary nature, and although they are more evident at the large scale, they regularly occur in fact at all scales (Brand, 1995; Moudon, 1986), interspersed as they are by designed projects. It seems that pre-planned, designed interventions are always followed by evolutionary change, which is made up of many, if smaller scale, designed projects. So our attempt to understand what makes the large scale of development particularly hostile to System A seems to reach a dead end, as there is nothing really, in the large scale per-se, that seem to make a real difference in the nature of the processes of urban change involved, being them centralized (projects) or emerging (evolution) (Fig.1). However, with the new focus on *time* that is central to the evolutionary approach mentioned above, we can capture two fundamental principles in urban change that would otherwise get lost: firstly, by definition project change always and solely occurs in the design phase, while evolution always and solely in the post-design; secondly, Project change occurs always and solely over a much shorter amount of time than Evolution. By "much shorter" we mean substantially shorter, in a way that involves an entirely different time-scale. If we compare the two types of change with the duration of a human generation, say about 25 years, we can assume that Project change certainly works at a sub-generational time-scale, whilst Evolutionary change usually happens at a super-generational time-scale[1].

[1] What we mean here by "time frame" is the generative time that it takes to decide, design and build the project, not necessarily its functional/structural/financial life-span, which may typically be much longer.

FIG. 1 ABOUT HERE

Left: spatial scale does not characterize either of the two different forms of urban change (project and evolution), which equally occur at small and large scale. Middle: time, on the contrary, effectively distinguishes the type of change: projects occur in the design phase only, while evolution in post-design only. Right: analogously, projects normally work over a sub-generational (five years) time-scale only, while evolution over a super-generational (five generations) only. Source: authors.

These two observations, as we will see in the rest of the paper, are of enormous importance, and key to resolve the problem of System A at large scale. Their importance comes through when we analyze System A as essentially a system of *beauty generation*. Under this light, the question is not only who generates beauty and how, but also and primarily: *when* is beauty generated?

3. West Dean, Piazza Santo Stefano and Athole Gardens: the problem of building beauty.

Our cities are very often, in all evidence, amazingly beautiful. Endlessly different manifestations of profoundly rewarding historical urban environments are before our eyes everywhere in old cities, and they emerge sometimes, often at smaller scale, certainly much more occasionally, in recent urban developments. We introduced this obvious observation in a personal conversation with Alexander, emphasizing the role that self-organization plays in generating beauty when large scale and heterogeneity are involved in the long term. We also dropped the word "evolution" by proposing that diversity and beauty emerges at the large scale, that of cities, in ways that may be entirely different from those that occur at the small scale. We argued that we don't work for building something immediately beautiful, but something that may become beautiful, everything going well, in five generations. After a few seconds of silence, Alexander replied: *"No, I can do that in five years"*. To demonstrate that, the day after we were accompanied to visit the West Dean College's Visitors Centre, built in 1994-95 near Chichester, West Sussex, UK, for the Edward James Foundation by Alexander and colleagues of the Center for Environmental Structure (CES). There we could test with our eyes the appropriateness of Alexander's claim: yes, that timeless quality, the one that makes you sit and breath in peaceful respect and joy, the "quality without a name" (Alexander, 1979), or "wholeness", or "beauty", or simply "life" (Fig.2), was there in tangible, startling abundance. And it is true: he did that in five years.

FIG. 2 ABOUT HERE

Christopher Alexander's "quality without a name" as a Wholeness/Life/Beauty circle. This diagram is our interpretation of part of hand-drawn sketch entitled "Chris' learning curve", created by Maggie Moore Alexander in 2014 and graciously donated to us. We use it here under her kind permission.

We were brought, on that occasion, before two apparently opposing realities: on the one hand, Alexander could actually generate beauty in five years (West Dean); on the other hand, the world is full of urban places which clearly exhibit the same quality without Alexander's design, nor indeed anybody else's. If we are to approach the problem of why System A has not become mainstream, we need to understand whether, and in what sense, Alexander himself was essential to creating beauty in West Dean, and how, on the other

hand, the same beauty comes across without Alexander, or any other particular creator, in so many other cases that we can observe in the world, and does that *as a rule*.

We propose that in order to resolve this apparent contradiction, in line with the evolutionary orientation that we have assumed, we need to focus primarily on the element of *time*: it took five years to generate West Dean; however, it took centuries to generate the same beauty in Piazza Santo Stefano in Bologna, for example, or the Athole Gardens in Glasgow's west-end (Fig.3). To advance in this direction we need to elucidate the nature of the processes that were at work at West Dean, as compared to those that shaped our historical cities to a similar level of beauty, but in a much longer amount of time.

FIG. 3 ABOUT HERE

Above: West Dean Visitors Centre, Chichester, UK. Designed and constructed by Christopher Alexander and CES in a few years. Middle: Piazza Santo Stefano, Bologna, IT. Evolved in about two millennia from a bifurcation along the street that connects Bologna with Tuscany. Bottom: Athole Gardens, Glasgow, UK. Master planned in the second half of the XIXth Century. Beauty is clearly generated in all these three cases. Source: authors.

3.1. The West Dean's way: building beauty in five years

In a System A approach to design and building, the most important thing is the *content of life* that is brought into the process. The way it happens may take different forms, but it is always and mainly about bringing life into the practical everyday sequence of actions that constitutes the building process in all its phases. There are three ways by which life can be poured into the shaping of a place: *observation*, *interaction*, and *co-action*.

In "A Pattern Language" (Alexander, Ishikawa, & Silverstein, 1977) life is first of all *observed* at work. Here recurrent patterns of life expression are identified, recorded and linked up to both higher and lower scale configurations. The observation of how life occurs in the built environment is expected to inform our action of building. These observed manifestations of life in the land, as much as they are recurrent and reasonably ubiquitous, are "patterns"; they are, essentially, constituent parts of the structure of a place, in that they reveal simultaneously the nature of the land and that of the people who use and live in it. Importantly, as much as patterns are observed recurrent life/environment structures in the land, they cannot be turned into abstract formulations generated only through intellectual speculation. It is *the process* of pattern recognition that really counts. That has to be a living process, in order to bring life into the patterns themselves. Observation must happen by immersion into the occurrence of life in the land. Patterns emerge, for every project, from the physical, emotional and intellectual immersion of designers and the whole community of inhabitants and builders into a shared process of both speculative and emotional inquiry. This way of exploring patterns evidently requires skills that are normally alien to architectural education, very close to those typical of anthropology, sociology or even ethology.

In later formulations, however, Alexander himself has developed a more radically *interactive* orientation to the process of pattern recognition (Sergio Porta, Russell, Romice, & Vidoli, 2014). According to this approach, life must be carved out from the community of inhabitants and builders by a sensible operation of depth reaching that must be undertaken at the personal level on a one-to-one or one-to-few basis. The ground for that is the acknowledgement that people in our professionalized society grow-up along a path of increasing detachment from their own profound and authentic feelings and desires, such that

as adults they do not live in that authentic part of themselves any longer, and they would normally be scared to do so. In Alexander's own words, *"It's immensely hard to help people tell you what they want. Even in the simple practical issue of a building, its entrance, its rooms, its gardens… people cannot easily formulate their vision or their desire.*" (Alexander et al., 2012, p. 115). Why then is getting there so important in a building process? Essentially, because that is the place where people share their foundations as human beings. Once interactively solicited at that level, and only at that level, people's desires, feelings and visions are surprisingly alike, and one's vision is, more or less, everybody's vision. There, at that level, is where personal feelings cease to be (individual, idiosyncratic) opinions, and start becoming (shared, objective) realities. This way to reach patterns is again only accessible through an intensively human, life-generating process, a form of interview/interaction that requires a set of skills and attitudes that are in fact close to psychotherapy (and, again, completely ignored in current architectural education). It is worth noting how all this resonates with the Jungian notion of the collective unconscious, as well as in experiential approaches to counseling.

Life, finally, can be brought into the process of building by the sheer act of building together, or *co-action*. By that, we mean primarily the actual process of making that involves directly the hands of all participants into the practical fact of constructing. Even though co-action predominantly operates in the construction phase, to the extent that it's meaning is expanded to the wider notion of "acting together" it may permeate in different forms the whole building process[2]. That enables a wide, extremely subtle and complex set of abilities that emerge both within and beyond the actual making of things, and are shared by all those who work and build, including for example discussing, trusting, arguing, celebrating, dancing, drinking, playing and respecting. Skills that are crucially relevant to co-action may be very practical at times, but they are by no means limited to technical abilities: they cover for example the ability to listen and speak, visualize ideas in quick sketches or gestures, cook, dance and play, have fun with others, suffer and endure challenges with others, support others under pressure in a generous and competent way; much of these skills are in fact related, at a higher level, to *small-group dynamics,* and are normally very marginally touched, if at all, in conventional architectural education.

Crucially, co-action implies the elimination of the barriers that separate, in conventional decision-making, those who take decisions from each other, places where decisions are taken from each other, and the moments in time when those decisions are taken from each other. Carpenters and inhabitants, architects and electric engineers, planning officers and plumbers, financial advisors and sash-window supplier, in a System A perspective are expected to make decisions together in the same moment and in the same place: *the building yard*. Co-action in fact fundamentally implies direct hands-on construction, though that may be pursued along sometimes significantly different forms. It is this particular aspect of co-action, much more than anything related to observation and interaction, which creates the strongest conflict between System A and System B: co-action challenges the heart of the established timeframe, culture and overall environment of conventional decision-making throughout the whole building process and that, of course, means challenging the extant forms of *power*. System A is, in this respect, essentially one single solid process of power transfer from established to new subjects, times and places of decision. As such, System A

[2] The three modes of bringing life into the building process, *observation*, *interaction* and *co-action*, which are here illustrated separately for the sake of clarity, never occur in complete separation in real building processes.

is inherently subversive of System B's conventional practices; in this respect, Alexander walks on the same ground of other giants, along the line that from Koenigsberger and Turner's "radical development" of the 1970s (Boano & Talocci, 2014; Turner, 1977; Windsor Liscombe, 2006), leads to the current "self-build", "right-to-buy" and "right-to-build" agendas in the UK (Parvin, Saxby, Cerulli, & Schneider, 2011; Wilson, 2013), through various streams of informal, DIY or tactical urbanism (Finn, 2014; Lydon & Garcia, 2015; Sawhney, de Klerk, & Malhotra, 2015).

If we look at the stream of experiences of progressive planning, participatory or community design that have come up in the last half century or so, elements of observation and interaction have well made their way into the conventional planning framework and even, in cases like the Congress of New Urbanism "design charrette" or the Prince's Foundation for Building Communities "Enquiry-by-Design" (McGlynn & Murrain, 1994), managed to become themselves mainstream in some particularly advanced areas of the planning world-system. However, the same can't be said for co-action, which has always been practiced in "protected reserves" of the system, mainly academic, or in fact in geographic areas characterized by weak if not essentially absent planning systems, like in the case of informal settlements. Alexander himself, his personal career and his intensive and continuous practice as a builder, notwithstanding his extraordinary gifts of leadership and scientific penetration, has not escaped this fate: his is a story of a permanent conflict with System B particularly because of the co-action element of it, which System B has, as of now, certainly won. All attempts that have been made to shorten the distance between System A and System B have always come, sooner or later, to the point where either a compromise had to be reached to significantly reduce the co-action element, if not actually exclude it from the process, or to stop the process altogether. If the opposition between System A and System B is a battle, co-action is certainly the battlefield.

After a life on the battlefield, CA is very clear in not just accepting, but even defending the idea that the conflict between the two Systems is irreconcilable not just in practice, but in nature. System B *is* the established intricate network of powers that System A's co-action *is* the subversion of. If that is the case the only ground on which System A can operate is one where System B is, in some way, "paused". That effectively means creating an "ecological niche" for System A to survive in a System B dominated world. However, System B is by its same nature pervasive and capillary, it permeates all areas of the building system and it controls all channels that need to be utilized in a process of construction. Pausing it is not easy by any means. It includes managing differently, for example, the whole planning authorization process, countering design regulations at least to some degree and changing the way suppliers and professionals work. It is about challenging preconceptions and established assumptions first of all in the mind of those involved in the process, which are all very likely to be System B-orientated, if not by anything else just because System B is the normal way of doing things.

In all evidence, pausing System B in a project at the building scale is difficult, often extremely difficult, but what about pausing it in a project at the building cluster scale, or that of a masterplan? In this latter case it has to be deemed nearly impossible, as the number of parties involved is normally much higher, and, crucially, because their *size* is much larger. In urban-scale decision-making, "parties" mostly means large organizations, be they governmental, non-governmental or private sector. Changing the way people think, feel and operate is hard enough, but doing the same to large organizations is ways more difficult, requires different practices and, crucially, a completely different timeframe, which is

incompatible with a five-year perspective. We observe, in fact, that System B has been paused in some form in many instances in the last half century, allowing for System A to operate and demonstrate its undisputable value, West Dean being one of these cases. But we also observe that the same thing has never occurred at a large scale: no one single example of successful System A-driven large scale project is on record apart from the Eishin Campus in Japan. The Eishin project, the story of which is the subject of “Battle”, probably sets the upper limit of what a System A project can achieve in a System B dominated context.

In conclusion, if we want to deliver a large scale project through a System A human process in a System B dominated world, seeking some form of sub-optimal compromise between System A and System B is not the way forward because such compromise is impossible *in nature* (because of the co-action discriminant). Analogously, pausing System B in a project at the urban scale is not the way forward because it is just impossible *in practice*: System B is ways more “effective” than System A in getting the job done in a large-scale project, provided that it is in fact a project, i.e. it is centrally managed and engineered to be confined to a sub-generational timeframe. That may not generate beauty, in fact it inhibits life altogether and creates places that are anti-human as a rule, but does nevertheless generate outcomes that are reasonably predictable and profitable for the industry, the technical and legal bureaucracies and the financial investors that created System B. The only way to put System A to work at large scale, and give it a chance to be mainstream, necessarily involves re-conceptualizing our understanding of the way beauty emerges *in the long-term, as well as* how System A works in that temporal perspective. In short, we need to shift our focus from a System A at *large scale* to a System A at a *long time scale*.

3.2. Our cities’ way: building beauty in five generations

If it is evidently true, as recalled at the beginning of this chapter, that our old cities are very often beautiful in the most profound sense of the word, never do those urban neighbourhoods or districts that work best and we love most, those that all of us feel closest to our heart, appear to be the products of the organized System A process of development that we have seen at work at West Dean. Not at first glance at least. Beauty in the ordinary parts of our historical cities is very rarely the direct outcome of a “design” (neither one of the product nor of the process), or the coordinated efforts of any group of builders (neither a community nor a company), or the investigation of anybody’s self; nor did their generation in time normally include the on-purpose production of patterns whatsoever. In the history of beautiful urban places we never find the radical forms of co-action described above, with ordinary people building together in the building yard, testing materials and making decisions in due course. Nevertheless, as we experience marvelous ordinary places such as Piazza Santo Stefano in Bologna or the Athole Gardens in Glasgow, we feel ourselves pervaded by the same sense of deep joy, quietness and harmony that we experienced at West Dean; certainly though we can find in those places beautiful patterns that have nevertheless emerged. Quite clearly, a remarkable amount of life had filtered into the making of these places over a long period of time in ways that are hard to define in the first place, but certainly are not the same that generated West Dean or the Eishin Campus over a much shorter amount of time. Therefore the question is: if life was not brought into the generating processes of so many of our best urban places by a consciously designed System A sequence, what was it exactly that eventually did that? What different ways life took to

penetrate the generative process at that scale, and by that we mean primarily at that *time* scale?

If we observe the way our beautiful cities have come to their current configuration in time, we can easily distinguish recursive spatial patterns at work in the most different environmental, cultural, social and economic contexts. For example, we notice that cities have always emerged around central places, higher centrality tends to go with higher density, higher density is linked to a movement-based agglomeration economy, the plot is the smallest unit of change, dynamics of plot merger and split tend to follow local and global economic cycles, building types are effectively linked to the geometric character of plots, blocks tend to respond in different ways to the different centrality of their four (or three) street-fronts, and this whole universal complex and organic mechanism of city building is based on two basic principles: 1) plots are relatively small and are developed independently from each other, such that control is distributed, and exerted on any individual adjacent plot by different parties (Akbar, 1988; Habraken & Teicher, 2000); 2) centrality emerges in the street network at a reasonably human scale (main streets crossing each other at about 400 meters or less) (S. Porta, Romice, Maxwell, Russell, & Baird, 2014).

This structure may emerge "spontaneously" or develop from an initial planning determination or, in most cases, by a certain grade of mix of the two. What is important here is that "spontaneous" modifications of the environment are the way life takes place in cities, they tend to occur both with and without the existence of a planned initial state of development, and they are the force that builds beauty in cities. We name this force, i.e. the combination of all the complex and uncoordinated efforts that human beings put into the modification of the environment for their own direct spiritual or practical benefit, *informal participation*. In this sense, the way the "initial state" of the evolutionary process was determined, whether through authoritarian top down planning, coordinated community-action or spontaneous fine grained development, is not really important, as long as it did not inhibit the full occurrence of informal participation. The urban fabric of Piazza Santo Stefano, actually a bifurcation along the ancient road from Bologna to Tuscany, has never been planned as a whole, and has evolved to its current state since at least the Vth century A.D., while Athole Gardens was a market-driven planned development designed from the top down without any form of community participation. Again, from an evolutionary perspective the design phase is not the point. As long as it produces a *structure* which is fit to solidly bear and foster change in time, the design phase has delivered its task: it is society at large, through continuous informal participation occurring over the following centuries, that brings life into the process and therefore beauty into existence.

3.3. Manufacturing in the mystery of nascence.

At a first glance, Alexander's *"I can do that in five years"* sounded like a narcissistic statement, but it was not: clearly that "I" had no *personal* connotation in the most obvious sense of the word. It actually identified, with his person, the life-enhancing process of construction that he later named "System A", as applied in West Dean. Moreover, and most importantly, CA drove our attention away from a simplistic consideration of the opposition between the small and the large scale. The organized complexity that Weaver was alluding to applies to all human building endeavors largely independently from their size and even from the apparent grade of homogeneity of the decisional "arena". It would be irremediably

ingenuous, simplistic in fact, to underestimate the endless levels of inner conflicts and the incredible variety of themes and matters that even one individual human being has to tackle when putting his hands into even the smallest process of making, if s/he does that *authentically*. When we understood that, we finally captured the hidden level of truth that Alexander's words brought to light for us: the reason why only System A could deliver beauty at West Dean is not that West Dean is smaller in scale, and therefore less complex than building a block or a quarter: it is that *West Dean had to be built in five years*. The West Dean process, pretty much as those in Mexicali, Oregon, San Josè, like in all other built works of Alexander, and even like the complex of dozens buildings erected in the Eishin Campus, are all ultimately the application of a System A protocol applied to a centralized, sub-generational *project*, one that in fact operates mostly in the design phase (Fig.4).

FIG. 4 ABOUT HERE

System B is a process of construction that seeks the elimination of uncertainty for maximizing security of investment in the short term; its nature is mechanistic-centralized. Its time-scale is the five years, i.e. the sub-generational. System A is a process of construction that seeks the expansion of life and is, therefore, based on unpredictability; its nature is evolutionary and its time-scale is the five-generations, i.e. the super-generational. However, as a protocol for action System A has been expressed so far in a project form only, and as a consequence in a five years timescale only. The formation of a suitable System A protocol that expresses itself in the five generations timescale will also naturally fit the large scale of development.

This is, in fact, the profound nature of Alexander's life-long effort: he has penetrated like few others in history the subtle phenomena of building, being and living as one whole; he has profoundly understood the deep form of beauty generating processes in Nature as well as in construction, as processes that step by step expand and enhance the forms of life in the land over a long, definitely super-generational timescale; he then has moved on to conceive, test and validate a protocol of action that allows to generate beauty through a truly evolutionary process, but — remarkably — *over the tightly compressed, definitely sub-generational timescale of a project*.

What we have in front of us at West Dean is a tangible manifestation of the success of his endeavor: a nearly super-human achievement that emerges from a radical compression of time, where beauty/wholeness/life could be created in five years that should otherwise have taken centuries, ending up in the same genuine, crystalline, dynamic perfection. Effectively, he created an artifact that reached the quiet harmony of pure life in a timescale, that of developmental morphogenesis, which is normally only accessible to living organisms during the mystery of nascence.

By doing that, Alexander "invaded" the camp of System B: the focus on the design phase, the sub-generational timescale, the project setting, are all features that are home to System B. Altogether, they constitute the environment that tireless efforts of innumerable committed and talented people created with System B over decades. Public officers, management engineers, urban planners, artists, finance and law professionals, scholars in all fields of the built environment, have collaborated to the formation of the impressive construction that Alexander termed System B, with the only scope of taming the process of construction and steering it to its own benefit. System B is incapable of dealing with the long term and cannot cope with the post-design phase: they are too risky, too unpredictable, and too resistant to all its various forms of centralized control and management. All that which creates life in places through time, especially informal participation that is the primary and by far the most

important beauty generator in cities, is intolerable to System B. That is why System B since its full explication beginning after WWII has dramatically failed to create beauty on Earth in a way that has never been paralleled in the past, a failure that reaches its peak everywhere the large scale and the long term are involved. System B is incompatible with anything else than the design phase. That is where its obsession for the "iconic" and "artistic" comes from: an attitude that excludes any possibility for the user to act on the environment and change it as s/he sees fit after the project's completion, and does that *in principle*.

If what identifies System A in all circumstances is its ability to generate beauty in places, it goes without saying that in all cases where beauty comes about through the self-organized expression of a multitude of uncoordinated factors and actors, there we witness System A in action. It is that "version" of System A, the one that only emerges over a super-generational timescale, which planners need to translate into a protocol for action. This System A though, as all evolutionary processes of urban change, occurs in the post-design phase only. Hence the objective of the design phase in this context, and with it our role as urban designers, must be radically reconsidered: rather than struggling for building beauty ourselves, we should aim at setting in place the right structure for beauty to emerge over many generations *after* the completion of our project, where by "project" we primarily mean that action of setting in place. This positions us firmly in an ecological urbanism perspective as unsuccessfully advocated since the early 1970s: *"The suggestions for change are analogous to ecological control schemes and basically state that the system can cure itself if given a chance. The chance is provided if our interventions give credence to the basic complexity and resilience of our urban systems. […]. The idea is to let the system do it, while our interventions are aimed at juggling internal system parameters without simplifying the interactions of parameters and components"* (Holling & Goldberg, 1971, p. 229). The evolutionary perspective that we have assumed in this paper entails the entire reconfiguration of our role: *from beauty builders, we have now become structure enhancers*.

Identifying that structure, what it should include and especially what it should not, what needs to be matter of urban planning and design (the former) and what especially should not (the latter), is the subject of the new science of cities and city planning that we set out to seek with a System A at large scale. What is this structure exactly? What are its components, how do they come together and support each other, what are the rules that we must establish so that informal participation can flourish over that structure and continue flourishing in time? Apart from Alexander since the 1960s, all that has been explored in the past by scholars in urban morphology, as well as a new wave of studies from space analysis to the physics of networks (Barthelemy, 2011; Michael Batty, 2007; Michael Batty & Longley, 1994; Bettencourt & West, 2010; Boccaletti, Latora, Moreno, Chavez, & Hwang, 2006; Hillier, 1996; Sergio Porta, Latora, & Strano, 2010). This programme of research in urbanism is primarily a life science, and as such it needs to cross the boundaries with the established disciplines of life sciences. By looking at the dynamics of beauty generation in processes of evolutionary change, we have identified *informal participation* as a primary evolutionary force, like mutation in the evolution of life[3], while other important forces such as space centrality and

[3] Even though analyzing the ethical implications of an evolutionary approach to cities goes beyond the scope of this paper, it needs to be clarified that with "informal participation" we want to capture the essential, fundamental energy that moves human beings in making their environment fit directly their own individual needs and that of those towards which they hold a direct individual responsibility, first of all their closest relatives. This must be distinguished from change imposed to the environment by large private or public organizations for reasons of corporate gain (be it private/speculative or public/regulative), i.e. a gain that goes directly to their organization and only indirectly to their officers and employees as persons along the chain of command.

building density are equally part of the structure of urban change (Sergio Porta & Romice, 2014).

When action takes place in the long term and evolutionary change comes to the stage, this reframed notion of System A at large scale is the only positive available. Moreover, as an evolutionary process in nature, System A is a natural fit for that scenario: *that is System A's home*. The challenge in front of us, when talking of large scale "design", is that of fully embracing the super-generational time-scale of beauty generation. For the sake of clarity, that does not mean that *a design* in the System A at large scale perspective could only be delivered in generations. It means that in order to truly express System A, a large scale design must set in place a structure which supports and enhances urban change by informal participation, which *then* will occur over the coming generations. In essence: a System A design at large scale is a protocol for the post-design phase. In order to do that, we first need to get back to Alexander, and review his work on the large scale under this new perspective.

3.4. Building beauty at large scale: a review of Christopher Alexander's work and ideas at the urban scale.

Indeed, throughout his career, Alexander has struggled to define how beauty could emerge at the large scale, distinguishing between "generated" as opposed to "fabricated" structure (Alexander, 2003, pp. 182-185). In this section we look first at his indications with regards to how shall we build beauty at the neighborhoods and city scale. That means focusing on his planning approach in the first place. This comes across mainly in: a) the "Summary of the Language" section of the introduction to "A Pattern Language" (Alexander et al., 1977, pp. xviii-xxxiv) and within this framework, the master plan for the University of Oregon's Eugene campus (Alexander, Silverstein, Angel, Ishikawa, & Abrams, 1975); b) "A New theory of Urban Design" (Alexander, 1987); c) "The Masterplan and Process for Harbour Peak" (Alexander, Schmidt, & Buchanan, 2005) and d) Chapter 3 of "Battle" (Alexander et al., 2012, pp. 49, 58-60). Also, we discuss smaller scale examples of planning in his work as presented in e) "The Production of Houses" (Mexicali) (Alexander, Davis, Martinez, & Corner, 1985). Finally, we discuss f) three parts of "Nature of Order": Chapter 15 of Book 2, up to section 6 (Alexander, 2003, pp. 202-220), Chapter 9 of Book 3 (Alexander, 2005, pp. 283-310) and Chapter 15 of Book 3, up to section 6 (Alexander, 2005, pp. 334-351).

The driving question here is: to what extent are Alexander's planning principles oriented to creating beauty within the short term perspective of the design action (five years time scale) as opposed to *after* it, in the successive continuous process of evolutionary change (five generations time scale)? No doubts, Alexander understands fully the evolutionary principles of life; he integrates these principles in everything he talks about, from the "unfolding" structure of design and building to patterns. However, if we focus on the time span of the *action* that he proposes, it seems to be still confined by a project's timeframe, the five years sub-generational perspective. That is obviously true of his works at the small scale of the building, where his System A process manages to compress the inherently super-generational timescale of beauty generation into the sub-generational timeframe of a project. But is it true for his larger scale works?

Talking of larger designs for multiple buildings urban areas or complex facilities like educational campuses, for Alexander the unfolding structure of beauty must come out from each individual project helping to create a larger whole that is unknowable in advance. That

is the proposal of “A Pattern language”, where it is recommended that the "Towns" patterns are built up from small scale individual project interventions. That is the uniqueness of the University of Oregon's “master plan without a master plan”, where the initiative of user groups is supposed to be the driving force of the evolution of the campus. While there is an overall vision of the whole of the campus, it is given by the patterns as an abstract list and by the diagnosis map of the state of the environment: there is no physical master plan. This view of planning is brought full circle in "A New Theory", where the experiment is to create such wholeness, step by step, from individual building projects, under the guidance of a "planning commission" made up of Alexander and his fellow instructors, able to judge and guide the evolving wholeness. A process, that by Alexander’s own admission, was not fully successful (ibid. pp. 235-249). The structure that was developing was too loose, too idiosyncratic, lacking the simple order of streets and plots that is typical of an American city like San Francisco, and strangely enough completely at odds with the surrounding area.

Perhaps even more important though than Alexander's insistence of building large scale structures, neighborhoods, towns, cities and even regions, from small scale projects, is his insistence on the project being always connected to a human group, be it a land owner/developer, an association of people or a community building its own neighborhood. This is the principle of *interaction* discussed above, and is obviously a prerequisite of any *co-action*. That, and his inherent suspicion of large impersonal (System B) organizations and governments with their bureaucracy, abstract rules and regulations, which do not allow for personal adaptation or exception to the rule where the land needs it, is perhaps the origin of his anti-masterplan stance. This criticism of master planning is not unique to Alexander, it is shared by critics of planning such as Jane Jacobs, and others in the 1960's who saw in comprehensive master planning a form of 'physical determinism', representing the power of the elite. Martin argues that the opposition to conventional planning came forth in the early 1960s from a “city as living organism” standpoint, which privileges “spontaneous growth” against mechanistic top-down planning, and includes as main figures in this camp Jane Jacobs and Alexander himself (Martin, 1972). The same decade saw the beginning of planning as advocacy (Davidoff, 1965), and the rise in power of neighborhoods which insisted on participatory planning. Under these waves of criticism, planning lost much of its previous assurance in its ability to rationally prepare a city for the future, using scientific methods, and became much more preoccupied with process, communication, and politics.

Lost in the shuffle, by all critics of modern comprehensive city planning, are the many historical cases which clearly demonstrate the ability of a master plan to structure the growth of a city, as well as allow enough flexibility and autonomy to different subjects in the city to adapt the plans to their needs in such a way that creates beautiful, living structures; Manhattan, Amsterdam, Barcelona, Paris: the examples are many, varied and at different scales. As a rule, these were speculative developments created for financial profit, and under all forms of government, and yet today they clearly exhibit the substrate canvas that has allowed immense beauty to emerge in time by the self-organized efforts of individuals, groups and organizations, what we called above “informal participation”. Indeed, the street and plot structure of a city often outlives its particular foundational circumstances, and outlasts most social and political upheavals. It allows and expresses much more fundamental structures of urban life that go beyond culture, society or politics. That is, in fact, Martin’s argument in “The Grid as a Generator” mentioned above, in defense of griddy or however geometrically shaped places proposed as structures for change rather than rigid blueprints of envisioned final states.

Martin addresses this point in open juxtaposition to Alexander's advocacy for complexity in cities as proposed a few years earlier in his notorious "A city is not a Tree" (Alexander, 1965). In all evidence, however, Alexander has fully acknowledged the emergence of very complex living realities over geometrically rigid spatial structures since his very early years. In particular, that comes through quite neatly in "A City is not a Tree", where a list of "natural" cities includes numerous griddy layouts like Manhattan, Liverpool and Kyoto, while conversely curvilinear and seemingly "organically designed" cities like Columbia and Greenbelt in Maryland are labeled as "artificial" (Alexander, 1965). This point returns many times in his further works: for example in "A New Theory" at some point a grid street layout is imposed quite forcefully over part of the project site in an otherwise loosely defined step-by-step design process. But it is in "Nature of Order" that the "brutal" imposition of a formal geometric structure over the complex reality of the land is thoroughly addressed and proposed as a fundamental passage of any beauty-generating design process, seemingly at any scale (Alexander, 2003, pp. 401-412): here Alexander reiterates as a general rule that at some point there needs to be a focus on the structural geometrical order of the building itself, ignoring for a while all other considerations of program, land and context (ibid. 408). The same principle applies at the larger scale of the town in the Masterplan for Harbour Peak at Brookings, in Oregon, delivered in its draft form to local public authorities in 2005. In essence, this draft proposal expresses thoroughly the attempt on the one hand to exert control on the overall structure of the future settlement (natural reserves; streets and public spaces; built fabric location, density, rough position and alignment, landmark public buildings) while relaxing it progressively as decision-making goes down to the scale of neighbourhoods, plots and buildings. That was expected to enable *"a multitude of processes, acting individually, yet geared towards the evolution of a coherent whole"* (Alexander et al., 2005, p. 12). The small scale of such individual processes comes increasingly to the stage from the neighborhood level down, but requires a certain level of control from the neighborhood level up in order to preserve and enhance the structure of the whole.

In the same way, when the problem is the foundation of a new city, the extension of a city to allow for rapid growth, the reconstruction of cities after natural or human made disaster, or the re-organization of cities which have outgrown their movement channels, as has happened again and again in the last two hundred years of accelerated urbanization, there is a need to think of the city as a whole, to provide it with its basic street structure, which will probably last for the duration of its history, to divide the land according to some socially acceptable rule, and to safeguard important natural and symbolic resources. This is essentially what master plans have done throughout urban history. In particular, the "long" 19th century — to paraphrase Hobsbawm (2010), lasting in this case almost until the middle of the 20th century, has left us a legacy of planning for growth that has created urban textures of lasting value, able to adapt to change and to allow for the emergence of beauty and life. In contrast, the legacy of 20th century planning has left us an overly prescriptive and essentially anti-urban and anti-street planning legacy. That is a system tending to create closed and isolated neighborhoods and projects, to zone uses separately from each other, to separate through from local movement, to limit density and to over-supply public open space, often, in order to pre-determine the economic level of the inhabitants, preferring few large projects (either public or private) to many small and individual ones; and in recent years, in response to criticism of the physical planning of the post-war period, and under the pressure from neo-liberal doctrines to abdicate planning completely (Koolhaas, 1995), to abandon any attempt at a holistic vision of the city and the well-being of its citizens, and to allow large private projects to determine public plans.

So the issue is not between master planning and organic growth; it is about *the appropriate amount of planning* in the appropriate time, at the appropriate scale, to hit just the right balance between structural control and super-structural self-organization. In their overall trajectory of evolution cities are certainly capable of organic growth while at some point needing planning interventions on a large scale, or they may go across periods where parts of them need to be planned at a single moment. Organic growth continues un-abated after more planning intensive periods, or even in parallel with them, working to change and adapt spaces with time. The appropriate amount of planning is one that is enough to create structure and protect essential public resources, but leaves as much freedom to individuals and groups to build and create their own spaces and bring life into the evolution of the city. The existence of the structure of the larger whole is necessary to allow the beginning of the process of unfolding of the smaller structures, and those in turn of the further smaller structures, in a process that is continuous in time and space and is absolutely essential to achieve the quality of a truly "generated" structure": *"that is the secret of the whole thing"* (Alexander, 2003, p. 195). But part of this secret is that the sequential nature of the process is respected so that structures at different levels are shaped autonomously on the basis of those already completed. Any attempt to "skip" this step-by-step form of action and determine structures at many different levels in one shot results in inhibiting the system's capacity to generate beauty by, in fact, overruling the process. In this perspective, planners should consider what they should *not* plan with equal attention, if not even more, than that they normally devote to what they should.

In conclusion, System A at large scale is not an anti-planning agenda: rather, it is about *planning less, and better*: difficult as it is, a problem of a pure *disciplinary* nature, not one of a larger reorganization of society across its various aspects, social, political, or economic. That leaves us in a quite comfortable, if not overoptimistic, position: System A at large scale *can* be made mainstream.[4]

4. Conclusions. Invitation for a reformed Master Planning practice: towards a System A at large scale.

The evolutionary framework that we have outlined so far answers the question: when is beauty generated? At the large scale, in the long term, it is only generated *after* the design phase by a process of continuous evolutionary adaptation. That is essentially enabled by dynamics of *informal participation*. This process as a whole falls, largely and in principle, within the control and the responsibility of planners and the planning system. In order for it to occur in a way that enhances life, urban evolution requires the establishment of a structure that is both spatial and regulatory. *This structure* is the responsibility of planners and the planning system.

Both Piazza Santo Stefano in Bologna and Athole Gardens in Glasgow are examples of evolutionary developments that have reached beauty in a super-generational time frame.

[4] A similar proposal is made by Shlomo Angel in his proposal for planning for the future growth of cities in the Global South in this century (Angel, 2012). He advocates the creation of a grid of main streets that will carry major infrastructure and public transportation, and conserve those open space resources necessary for insuring water supplies and environmental health. He makes the point that since political and economic resources for safeguarding these public spaces are lacking – planners should not be maximal but minimal in determining the public infrastructure.

Bologna used to be a colonial military camp built by the Romans in 189 BC. Since then, the historical core of the city developed in what is now considered an example of dense, compact and diverse medieval urban fabric, now the thriving home of the Alma Mater, the most ancient university of the world, as well as innumerable commercial, residential and cultural facilities. Piazza Santo Stefano grew at the bifurcation of the ancient road from Bologna to Arezzo and Tuscany, along the same route that led to one of the two original axis of the ancient Roman camp. Not part of the first grid, the Piazza is therefore more appropriately a street junction, gracefully surrounded by palaces, ordinary housing and beautifully adorned porticoes all around. On one edge of the square, some seven different places of worship have been layered on top of each other since the V Century AD, by destroying or substantially altering the previous.

Glasgow was not much more than a village until the mid of the XVIII Century AD. One century later it reached over one million inhabitants and was the second city of the Empire after London, with a booming economy based on shipyards, industry and trade around the fluvial harbor over the river Clyde. Nowadays, Glasgow has abandoned the industrial economy and made its way into the post-industrial, with a flourishing tertiary economic base mainly relying on culture, education, tourism and the professions. All these enormous changes have taken place between two city centers: the Merchant City, home of administration and commerce offices, theatres and clubs, and the West End, where respectable middle to upper class residential estates are graciously mixed with services, urban parks and retail. Both the Merchant City and the West End of Glasgow have been planned on a rigid grid system of Victorian streets and blocks which were destined to be completely demolished in the immediate post-war period to be replaced by a Corbusian scheme of highways and high-rises, laid out by municipal planners: the Bruce Plan. After the Bruce Plan was fortunately abandoned in the late 1970s, the two centers have continued to serve the city, the region and the nation up to our days, across countless adaptations and developments. Athole Gardens is a residential development in the West End, planned and realized in the 1860s for the industrious middle class of the times around a beautiful residential pocket park. It is now a quiet, beloved part of the lively district around Byres Road, the main street and certainly one of the most popular commercial strips in town.

Evolution has taken place in Piazza Santo Stefano and the Athole Gardens starting off in different ways and changing differently along different historical cycles. Life has flourished gloriously over both the rigid grids of the original military camp in Bologna and the Victorian planning schemes in Glasgow, making these two places among the most beautiful and successful on Earth. The diversity of these environments is simply inconceivable by a single human mind; nevertheless everything continues to change and adapt over a *structure* that remains mostly in place, which actually favors and disciplines the occurrence of endless variations in time. Most significantly, by no means are these two stories exceptions; in fact they are the rule: once backed up by reasonably accurate and simple planning structures, both spatial and regulatory, evolution occurs spontaneously by the uncountable and completely self-organized contributions of all, what we have called *informal participation*. Hundreds of cities in Europe and Africa have grown from the initial seeds of Roman camps, or from other grid layouts that are in fact typical of all cities of foundation, anywhere at any time in history (Fig.5a,b).

FIG. 5 ABOUT HERE

Panel A. *Rigidly griddy military camps of the classic roman age have been cradle to hundreds of cities that are now regarded as jewels of urban living. Here we see Pavia (left), Turin (middle) and Verona (right), in Italy. Source: (Conventi, 2004):* ***Panel B.*** *Urban evolution at work on previously rigid geometries. (A) From left to right: the progressive transformation of an ancient roman grid into an Arabic layout; (B) Campo Marzio, in Rome, Italy, in the classic roman age and nowadays; (C) Baghdad (Iraq), in the VIII and the IX Century. Source: (Donato & Lucchi Basili, 1996).*

As Martin points out, in cities of foundation *"the best use of land meant an orderly use, hence the grid plan. In siting it and building it estimates had to be made about its future, about its trade, its population, and the size and number of its building plots. This contributes a highly artificial procedure. But it is of course by no means uncommon. Indeed it is the method by which towns have been created in any rapidly developing or colonial situation."* (Martin, 1972, p. 8).

Evolution does not apply only to grids. It does apply to all planned cities, in all cultures and climates, it is the way cities develop as long as their site and location are fortuitous (Vance 1990), enough time is given for them to develop and flourish, and — critically important — no rules are set in place to specifically prevent it, for example by inhibiting informal participation. What Alexander terms "System B", or the conventional planning system which is dominant in the most "advanced" areas of the Global North of the Planet, is in fact, essentially, a gigantic and capillary set of organizations, powers, rules and procedures precisely aimed at countering and inhibiting informal participation in any form. Not by chance, the fortune of processes of formal participation begun to grow exactly with the historical crisis of all the traditional forms of informal participation, after WWII, when professionalization, bureaucratization and, later on, globalization, have taken control of mainstream building production. And not by chance, the *modus operandi* of System B at the large scale is essentially the same that it exerts at the small scale, the mechanistic and centralized one that is typical of the project. System B cannot cope with evolution, in nature. It cannot deal with the risks of uncertainties that are inherent in the long term and informal participation. It must occupy all spaces of action, all moments of decision, it must control all and everything.

What created both Piazza Santo Stefano and Athole Gardens is in all evidence a different process. It is, essentially, a System A at large scale. If we are to recreate beauty in cities, we need to understand and re-enable the *underlining principles* which drove those processes, which were both evolutionary *and* planned, to generate beauty in our future cities at a large scale, and in the long term. That quality, the quality without a name, does not come by design, it comes through evolution in the post-design. However, the way we lay out the design is crucial to enable evolution in the post-design; it is entirely our responsibility as scholars, professionals, decision-makers, stakeholders and lay citizens, to make sure that the right conditions are set in place for that to occur, first of all by distinguishing large scale speculative deployment of common resources from the right-to-buy and the right-to-build of the ordinary people. Without this fundamental distinction, informal participation gets banned by-law from our world, together with change and ultimately with beauty, while — as we can easily see on the ground — speculation and exploitation flourishes as never before. In a mechanistic environment, the biggest, the most powerful, the most insatiable, is undoubtedly the fittest.

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FIGURES:

		CHANGE BY	
		PROJECT	EVOLUTION
SCALE	SMALL	✔	✔
	LARGE	✔	✔

		CHANGE BY	
		PROJECT	EVOLUTION
PHASE	DESIGN	✔	✗
	POST-DESIGN	✗	✔

		CHANGE BY	
		PROJECT	EVOLUTION
TIMESCALE OF CHANGE	5 YEARS	✔	✗
	5 GENERATIONS	✗	✔

Figure 1

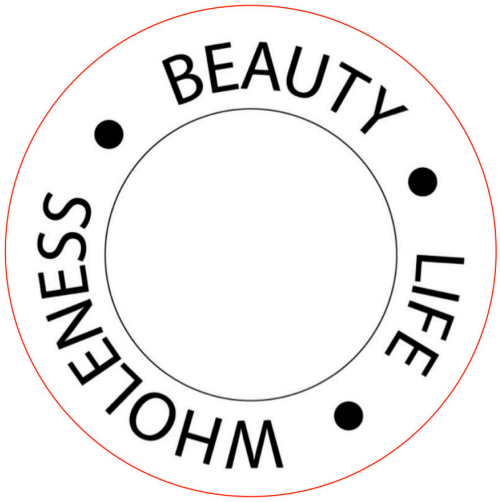

Figure 2

Figure 3.

CHANGE		NATURE OF THE SYSTEM: Centralized (PROJECT)	NATURE OF THE SYSTEM: Self-organized (EVOLUTION)
PROJECT DESIGN 5 YEARS		System **B**	System **A**
EVOLUTIONARY POST-DESIGN 5 GENERATIONS		✗	?

Figure 4.

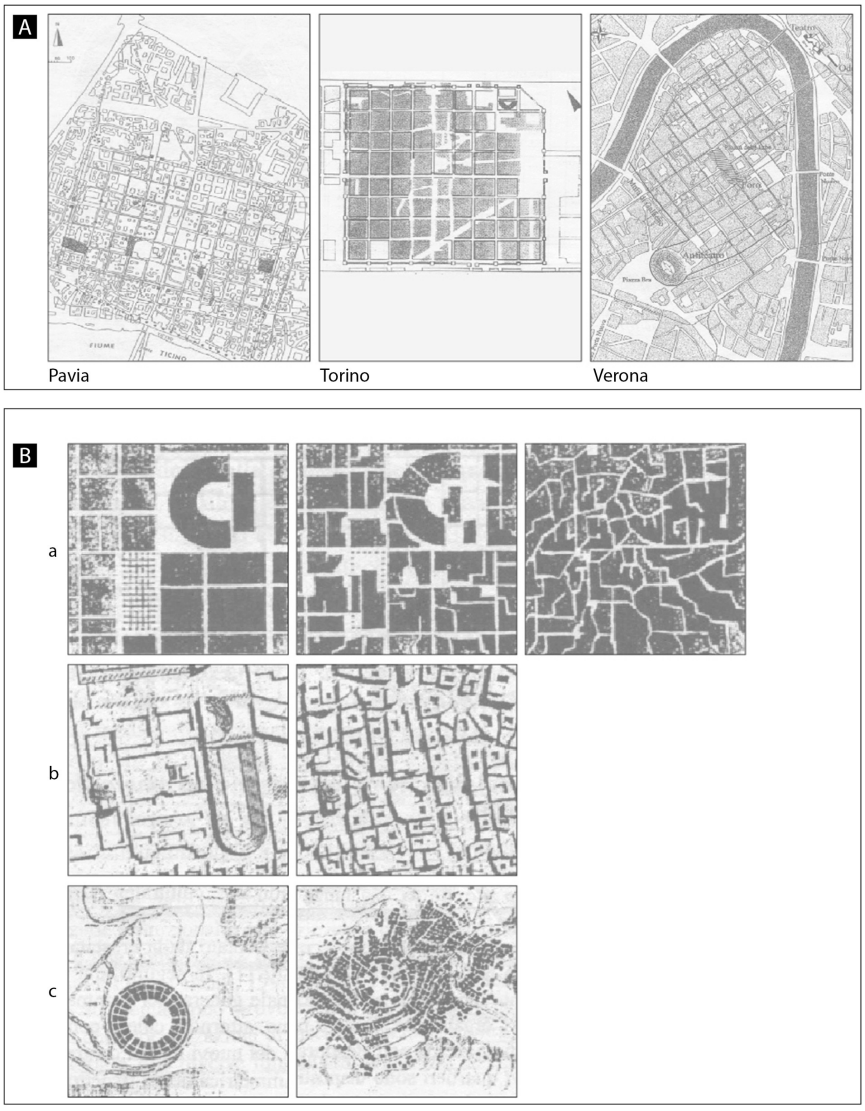

Figure 5