

# *Biourbanism for a Healthy city*

## *Biophilia and sustainable urban theories and practices*

**Eleni Tracada**

Faculty: Arts, Design and Technology  
University of Derby  
Derby, United Kingdom  
[E.Tracada@derby.ac.uk](mailto:E.Tracada@derby.ac.uk)

**Antonio Caperna, PhD**

Department of Urban Study - TIPUS Lab  
Rome Tre University  
Rome, Italy  
[antonio.caperna@yahoo.it](mailto:antonio.caperna@yahoo.it)

**Abstract**— *Vital elements in urban fabric have been often concealed for reasons of design. Recent theories, such as Biourbanism, suggest that cities risk becoming unstable and deprived of healthy social interactions. Our paper aims at exploring the reasons for which, fractal cities, for example can have beneficial impact on human fitness of body and mind. During the last few decades, modern urban fabric lost some very important elements, only because urban design and planning became stylistic patterns of fancy aerial views to show mainly iconic signature architecture. Biourbanism attempts to re-establish lost values and balance, not only in urban fabric, but also in reinforcing human-oriented design principles to be easily implemented and understood. The Lancet Commission of Healthy Cities provides an analysis of how health outcomes are part of the complexity of urban processes, highlighting the role that urban planning can, and should play in delivering health improvements through processes of reshaping the urban fabric of our cities around the globe. This paper describes how the application of Biourbanism's principles can improve the quality of the urban environment with reference to both physical transformations of it and psychological impact upon city inhabitants. Therefore, these principles are accomplished to support urban structural sustainability.*

**Keywords-component;** Biourbanism; Complex Systems; Biology; Urban Policies; Biophilic Design; Peer to Peer Urbanism

### I. INTRODUCTION TO BIOURBANISM AND ITS PRINCIPLES

Either by observing satellite images of the surface of our planet or by reading modern geographical representations of it, soon we become aware that, some important features of urban fabric especially have been lost for good. Modern urban design and planning turned out to be not only stylistic aerial views, but, also, as some author puts it, “tumour imagery” ([www.drhern.com](http://www.drhern.com), accessed on 20/06/2012). During the last couple of decades, this fact becomes particularly evident, at the same time as we observe the randomness of the expansion of modern cities on the surface of our planet. Urban sprawl does not any more celebrate our links with natural environment, as artificial environment devours the rural areas.

In Biourbanism, we attempt to find a way in which not only early diagnosis can take place in malignant fractal growth of

the cities, but also new methods of care and restoration to health may succeed to establish wellbeing in both cities and surrounding landscapes. Biourbanism attempts to re-establish lost values and balance, not only in urban fabric, but also in reinforcing human-oriented design principles in either micro or macro scale. Biourbanism as a discipline (and a School or movement) operates as a catalyst of theories and practices in both architecture and urban design to guarantee high standards in services, which are currently fundamental to the survival of communities worldwide. By considering as top items in its agenda the humankind well-being and the dynamics of the urban organism, the discipline of Biourbanism approaches sciences and ecosystems in a particular way and with intend to appreciate “optimal forms [inside the built environment] at different scales which, through morphogenetic processes, can guarantee an optimum of systemic efficiency and quality of life of the inhabitants” ([www.biourbanism.org](http://www.biourbanism.org), accessed on 02/06/2012). In fact amongst the main aims of Biourbanism, we can see “the identification and actualization of environmental enhancement according to the natural needs of human beings and the ecosystem in which they live” and “deepening the organic interaction between cultural and physical factors in urban reality”, such as “the geometry of social action, fluxes and networks study” ([www.biourbanism.org](http://www.biourbanism.org), accessed on 02/06/2012). Therefore, it is evident that, this talented discipline has to study and manage complex systems of geometrical fractal patterns, thus, being generated during diverse human interactions with nature and the built environment. Healthy interactions may be able to offer the final cure to avoid the death of urban space as we shall explain further below.

### II. SUSTAINABLE DEVELOPMENT AND CITY WELLBEING

There are over 200 definitions of sustainable development (SD), and various graphic schemes have been developed to portray the multi-dimensional nature of sustainability (Adam 1993; Elliott 2004). Over the past three decades there have been many events that have contributed to the evolution of the concept of sustainable development. Many people consider the year 1962 as the seminal year in which, people began to understand how closely linked environment and development

are. Rachel Carson's *Silent Spring*, a book that collects researches on toxicology, ecology and epidemiology, suggested that agricultural pesticides were built at catastrophic levels and there was a link between the damages to animal species and those caused to human health. It shattered the assumption that, environment had an infinite capacity to absorb pollutants.

Even though since then, there was a growth of researches about the connection between human population, resource exploitation, economical pattern and environment. Only in 1980 the World Conservation Strategy defined the word "development" as "the modification of the biosphere and the application of human, financial, living and non-living resources to satisfy human needs and improve the quality of human life", and in 1987 the United Nations World Commission on Environment and Development published *Our Common Future* (also known as Brundtland Report). It ties problems together and, for the first time, gives some direction for comprehensive global solutions; it also popularizes the term "sustainable development" giving the following description: "development that meets the needs of the present, without compromising the ability of future generations to meet their own needs" (WCED 1987).

Even though there is no accepted definition about sustainable development, there is a substantial agreement about the three pillars of sustainable development: economical, environmental, and social dimension. Thus, a sustainable system must achieve distributional equity, adequate provision of social services, including health and education, gender equality, and political accountability and participation.

It has been underlined that sustainable development must also take into account the institutional policy (Brandt, 1980; Cernea, 1987) and cultural environments (Cernea, 1987; Korten, 1990) of the local governments in which such efforts are initiated. We would like to underline how the problem with sustainable development is not so much the word "sustainable" as that of "development". Historically, the term sustainable development is an extension of a cultural view based on two paradigms: the development paradigm, based on growth theory of accumulative economics, and the mechanistic-rationalist paradigm. The association is volatile and noxious, both in cultural terms, as well as in terms of environmental impact.

Contemporary development paradigm used economic indicators, such as Gross Domestic or Gross National Product (GDP and GNP, respectively) to define and assess the level of development and human well being. The higher these economic indicators are, the higher the level of achieved development and human wellbeing is. But this cultural model is inconsistent to face the environmental challenges and the unsustainable life conditions of three quarters of the world population.

We know that, by removing resources from the natural world to become part of economic resource throughout systems has over time exceeded nature's unique capacity for self healing and replenishment, resulting in an alarming rate of

environmental destruction and a worldwide environmental crisis. This destruction puts both economic and social development at risk as it threatens the foundations of human existence. Economic growth without limits, as forwarded by actual development paradigm, leads to a contradiction between objective and achieved result.

In this unsustainable context the cities play a fundamental role. The contemporary cities concentrate most on the problems related to sustainability, from the energy consumption – in 2006 city population consumed two-thirds of the total energy used and emitted more than 70% of the energy-related carbon dioxide emissions – to growth of the population and the megacities, whereas the concentration of people gives rise to some of the world's greatest problems, such as air and water pollution, poverty-stricken slums and epidemics of violence and illness. Another problem that takes place in modern cities refers to the effect of city leaving in urban areas. There is noticeable research and evidence, in which it is clear how the brains of people living in cities operate differently from those in rural areas, according to a brain-scanning study. Scientists found that, two regions involved in the regulation of emotion and anxiety, become overactive in city-dwellers, when they are stressed and they also argue that, the differences could account for the increased rates of mental health problems seen in urban areas. Previous research has shown that people living in cities have a 21% increased risk of anxiety disorders and a 39% increased risk of mood disorders. In addition, the incidence of schizophrenia is twice as high in those born and brought up in cities (L. Krabbendam and J. van Os, 2010)

The WHO Expert Committee on Environmental Health in Urban Development noted that:

*"The health of a city's people is strongly determined by physical, social, economic, political and cultural factors in the urban environment, including the processes of social aggregation, migration, modernisation and industrialisation, and the circumstances of urban living..... [T]he impact of urban processes on health is not just the sum of the effects of the various factors taken individually, since they interact synergistically with each other."*  
(WHO, 1991, pag.11)

Moreover, the Committee noted:

*"In some respects, urbanisation can itself be considered to be a key variable in the health equation: when the pollution produced by a densely packed population outstrips the natural absorptive capacity of the city's ecosystem,*

*adverse health effects can be increased where controls are lacking or unreliable." (WHO, 1991, p11)*

Lately the second UCL-Lancet Commission on Healthy Cities entitled "*Shaping Cities for Health: Complexity and the Planning of Urban Environments in the 21st Century*" has been published. The report provides an analysis of how health outcomes are part of the complexity of urban processes. It argues against the assumption that urban health outcomes will improve with economic growth and demographic change, and it highlights:

- (i) The role that urban planning can play in delivering health improvements through reshaping the urban fabric of our cities;
- (ii) Cities are complex systems, so that health outcomes are emergent properties;
- (iii) A linear or cyclical planning approach is insufficient in conditions of complexity;
- (iv) Inequalities in health outcomes should be recognised at the urban scale;
- (v) Urban planning for health needs to emphasise experimentation through projects.

As said above, more than half of the world's population now lives in cities, and the urban population is swelling by 1 million every week. By 2030, almost 6 in 10 people will live in metropolitan areas, which exert a powerful pull as economic and social magnets. This makes the creation of a sustainable urban environment a major policy priority. However, it is necessary to adopt new strategies and new cultural patterns. Mechanistic-rationalist time is culturally and scientifically obsolete and incapable to handle the challenges.

In this paper we would like to introduce Biourbanism as a new way in which, we can study and plan the cities in which, deep and structural sustainability can furnish us with health wellbeing as well as with environmental benefits

### **III. BIOURBANISM. A NEW PARADIGM FOR A DEEP SUSTAINABILITY**

Biourbanism introduces a new conceptual model for a new kind of city. It combines technical aspects, such as zero-emission, energy-efficiency, information technology, etc., and the promotion of social sustainability and human wellbeing. To do this, Biourbanism focuses on the urban organism, considering it as a hypercomplex system, according to its internal and external dynamics and their mutual interactions.

Biourbanism considers the "urban body" composed by several interconnected layers of dynamic structure, all influencing each other in a non-linear manner. This interaction is evident in emergent properties, which are not predictable, except through a dynamical analysis of the connected whole. This approach therefore links Biourbanism to the Life Sciences, and to Integrated Systems Sciences like Statistical Mechanics, Thermodynamics, Operations Research, and Ecology, in an essential manner. The similarity of approaches lies not only in the common methodology, but also in the content of the results (hence the prefix "Bio"), because the city represents the living environment of the human species. As a result, a design that does not follow these laws produces anti-natural, unsustainable and hostile environments, which do not fit into an individual's evolution, and thus fail to enhance life in any way.

The aim of Biourbanism is to create a living city through:

- (i) Implementation of the premises of Deep Ecology (Bateson) on social-environmental grounds;
- (ii) The identification and actualization of environmental enhancement according to the natural needs of human beings and the ecosystem in which they live;
- (iii) Managing the transition of the fossil fuel economy towards a new organizational model of civilization;
- (iv) Deepening the organic interaction between cultural and physical factors in urban reality (as, for example, the geometry of social action, fluxes and networks study, etc.).

Finally, Biourbanism acts in the real world by applying participation and helping methodology. It verifies results inter-subjectively (as people express their physical and emotional wellbeing through feedback) as well as objectively (via experimental measures of physiological, social, and economic reactions).

The Principles of Biourbanism constitute a new epistemological model and a framework on how we might be able to tackle the enormous challenge of transforming existing cities or neighbourhoods, and on how we can re-think the way we analyse, design and built our urban environment. These principles are derivate from latest scientific developments of the past decade, such as fractals, complexity theory, evolutionary biology, and artificial intelligence. This scientific "corpus" gives us an idea on how human beings interact with their environment; it has permitted us to understand that organisms, computer programs, buildings, neighbourhoods, and cities and share the same general rules governing a complex hierarchical system; all matter - biological as well as inanimate - organizes itself into coherent structures.

The ultimate goal is a new, human-oriented architecture combining the best qualities of traditional architecture with the latest technological and scientific advances. Architecture is able to generate "life" in the built environment, and to improve the way in which buildings and cities relate to people.

Theme	Biourbanism Principles (Source: Caperna A., 2012)	
	Aims	Principles
<b>Epistemic foundation and shift paradigm</b>	Epistemological re-foundation of architecture and urbanism. Paradigm shift.	1. Deep Ecology 2. Complex approach
<b>Biological roots of architecture for a living city</b>	<i>Architecture and Urbanism as "living bodies". Application of "natural laws" in the study of urban "body"</i>	3. New Life Science and the biological roots of architecture and urbanism 4. Urban environment as a hyper-complex organism 5. Morphogenetic Design Processes 6. Study of the form
<b>New urban policies.</b>	<i>Here we have a double goal: (i) Biopolitics as new theoretical corpus able to promote the urban revitalization; (ii) Green policies or Environmental policy, consist of any action deliberately taken to manage human activities with a view to prevent, reduce, or mitigate harmful effects on nature, natural resources and city, ensuring that man-made changes to the environment do not have harmful effects on humans;</i>	7. Biopolitics 8. Green policies 9. Bioeconomy 10. Peer to Peer philosophy
<b>Design tools.</b>	<i>They relate: (i) The way in which we must organize the urban space in a way to generate an efficient "organism", inclusive and able to nourish our Neurophysiological system; (ii) Green technology, from city level to buildings</i>	10. Geometrical coherence 11. Biophilic Design 12. Universal Design 13. BioArchitecture 14. Biomimesis
<b>Design methodology</b>	<i>To furnish to architects and planners an "algorithmic procedure" that will be consistent with the "genetic code" of the site and work in accordance with a generative process.</i>	15. Generative processes 16. Peer to Peer Urbanism (as new participatory approach)

#### IV. FUTURE RESEARCH DIRECTIONS

In the current design paradigm, the notion of sustainability has to be imported from outside the discipline. The strong relationship between economical structures, international star architects and media have furnish us a technical dimension of

sustainability in architecture and urbanism, without attention to the real needs of people. The result is to get architecture as an expression of a hyperreality (Baudrillard, 1981); the urban environment has become "*mere representation of the life*" (Debord G., 1967).

Biourbanism considers architecture as a corpus linked to biology. The idea of a biological connection has been used in turn by traditional architects, modernists, deconstructivists, etc. One might say that architecture's proposed link to biology is used to support any architectural style whatsoever. When it is applied so generally, then the biological connection loses its value, or at least becomes so confused as to be quite meaningless. Is there a way to clear up the resulting contradiction and confusion? Certainly, Biourbanism doesn't promote a structural imitation of the natural form, but our goal is "*to study the scientific aspect able to describe how we connect and perceive form from the environment around us and in which way work the unfolding process in nature*" (Salingaros, 2011).

The above principles represent a new way in which we may approach the study, analysis and design of the urban environment. In this perspective we consider the urban environment as a living system and the new standards of architecture will be inherently sustainable (Salingaros, 2005). The notion of sustainability has always resided in living systems for over two millennia, prior to the industrial revolution and the alienating influence of technology as an idol (Salingaros, 2005).

The most exciting scientific developments of the past decades, such as fractals, complexity theory, evolutionary biology, and artificial intelligence give us an idea of how human beings interact with their environment. This new theoretical *corpus* permits us to discover that organisms, computer programs, buildings, neighbourhoods, and cities share the same general rules governing a complex hierarchical system. This unfolds new innovative research scenarios, wherever it is necessary a cross disciplinary investigation supported by the "traditional studio". The goal is to introduce a new human-oriented architecture in which we can combine the technical aspect and the reinforcement of human life. In this perspective, architecture becomes a necessary expression of human dimensions; that means it becomes immediately physical, perceptual, and emotional and, in which design must provide a positive sensory connection for human beings with their environment in their everyday lives. This is an indisputable right that should never be subverted by the agency of architectural fashion.

According with the above perspective, biophilia and design produced according to its principles are able:

- (i) To create an environment that reflects the inherent human affinity for nature;
- (ii) To nourish our biological, physiological and psychological systems;

(iii) To respect the “genetic structure” of the site (Caperna, 2012) represent another very important research field to design responsive environments.

Urban space is often related to information theory, as its use is concurring to the information framework generated by surfaces rising from the ground; this information can be sensed and accepted by human beings navigating through it by means of pedestrian and often preferential pathlines (urban indicators of human communication and relationships). Successful spaces should offer perceptible indication from local structures, such as those for standing and sitting and, also that, “the total information field in turn determines the optimal positioning of pedestrian paths and nodes” (Salingaros in [www.math.utsa.edu](http://www.math.utsa.edu), accessed in 13/06/2012). Thus, human life in cities emerges during ‘connectivity’ via geometrical continuity of grids and fractals, via path connectivity among highly active nodes, via exchange/movement of people and, finally via exchange of information (networks).

Christopher Alexander offers a diagnostic method of investigation on growth of urban fabric, which is defined by active pathlines and human activities alongside them. Pathlines form crosses and powerful nodal areas, which make fractal connections easier and systematic rather than random. Urban space encloses built environment, which is defined by boundaries/filters and open interactive and multifaceted areas, being originated by bounding fractal skins of the surrounded buildings, as we saw before in Christopher Alexander’s day-by-day schemes/sketches. By referring to architectural scales inside the built environment, we discover that natural complex systems (to which both architecture and urban space relate closely) have hierarchical structure, regardless if they are biological or inanimate.

## V. CONCLUSION

Biourbanism sustains that, smoothness and uniformity, which are the main visual characteristics of long-range ordering, are unfamiliar to natural materials, because they do not survive on the largest scale. In natural environment, structural qualities exist on a variety of levels of scale, from the macroscopic to the microscopic (intermediate scales). Moreover, physical forms possess natural scaling hierarchies as a result of internal and external forces. Natural biological forms, such as communities of organisms in an ecosystem, organs, cells, etc reveal a definite scaling hierarchy in decreasing order of size with more structure as the scale becomes smaller. This is the most important manifestation of biological survival, to which ‘Bios’=Life relies on.

Structurally coherent units will define a particular scale at different sizes; these scales are distinct and included inside a complex structure that exists in large scale. According to Salingaros (2008, p66), “architectural scales arise from the

materials, structures and functions of a building and their distribution expresses an architect’s organizational ideas”. In fact, design units cooperate to achieve scaling coherence when a distinctive feature connects them visually. Architecture influences people’s lives often in a very conventional way. And nature, as manifested in its fractal existence (See, Fig. 1) celebrates randomness and complexity inside precise frameworks, which have emerged by ordering systems to support human physical and mental health at all times. Human beings feel always healthy and safe by interacting between them and navigating in a coherent Biophilic world (See Fig. 2). By all means, structural order in architecture depends upon human perception. Thus, it cannot be judged strictly from abstract formal criteria, as the observer (people/users) becomes part of and also influences the behaviour of. Thus, architecture exists because of the existence of the humankind and cannot be isolated into an abstract world.



Figure 1. Fractal natural form and harmonious natural randomness (Photograph by Tracada, E. (2012))



Figure 2. Human beings following artificial pathlines which connect city and nature (Photograph by Tracada, E. (2012))

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