THE CITY OF FUTURE: BIOURBANISM AND CONSTRUCTAL LAW

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ABSTRACT: Nowadays dynamic elements in urban fabric are often concealed by the insertion of stylish new architecture; real patterns of social life ('bios'), have been replaced by rigid geometric grids and compact building blocks. New Urbanism and Biourbanism affirm that cities are now risking to be unstable and deprived of healthy social interactions. As an expansion of older historical urban fabric patterns, harmonious architecture can have a positive impact on the fitness of both human body and mind. Not only Biourbanism attempts to reinstate balance and lost values in the urban fabric, but also reinforces human-oriented design emergences in micro and macro scales. As a multifaceted discipline, it embraces laws of physics, such as Constructal Law and acknowledges its noticeable and unremitting influence to urban human behaviours.

Urban life and behaviours are based upon systems of human communication formed by dynamic patterns; we are now talking about negotiating boundaries between human activities, changes in geographic mapping and mainly about sustainable systems to support uninterrupted growth of communities worldwide. Therefore, as a vital shift in architectural education, not only Biourbanism offers the opportunity to explore patterns and linguistics deeply imbedded into the built environment, but also enables scholars and communities to come together and participate actively into fast and innovative urban interventions. Projects developed during educational and professional training aim at reinstating memorable and preferential paths of communication, favouring everyday life rituals of the body and mind. Hence, by following everlasting laws of physics and formulas inherited from nature, architectural forms can be considered as the real innovation in urban design and planning of the City of the Future.

Keywords – Biourbanism; Constructal Law; Theories of human behaviours; Patterns of life; Living Urban Fabric.

1. INTRODUCTION

Globalization, fast urbanisation, climate change, natural and environmental degradation have formed a set of interconnected challenges for both architectural education and practice. Contemporary architecture has become part of the new global culture in which virtual images are the substitute for reality. According to Jean Baudrillard′s terms, as elucidated recently by some author (Proto, 2006), architecture could be seen as the supreme medium of contemporary visual culture, and especially in its potential to influence the individual's perception of reality, as a component of the mass – media system. Conversely studies carried out in social sciences establish that architecture may affect negatively everyday human urban life. Psychology and medicine are also able to determine how space design can nurture or damage human well-being (Salingaros and Marsden II, 2008a). All these challenges appeared especially in the new 21st century and may call for new epistemological and scientific grounds to be considered in architecture and urbanism. Hence, architectural

education should be the first step to help us to produce really sustainable new designs for the 21st century.

The main aim for this paper is to elucidate the new educational approaches in Biourbanism which can have the potential to educate the next generation of architects; these particular innovative approaches can empower graduate architects to create original and human-oriented designs. On specific occasions and by experimenting new learning teaching and assessment techniques, Biourbanism principles have been applied into architectural and urban design projects with the purpose to raise and test the standards in architectural education, as well. These principles and practices, including learning and teaching examples, can be found either in some primary publications on Biourbanism, such as *Biourbanism for a Healthy City: Biophilia and Sustainable Urban Theories and Practices* (Tracada and Caperna, 2012) and *A New Paradigm for Deep Sustainability: Biourbanism* (Tracada and Caperna, 2013). By introducing Biourbanism frameworks to students and scholars, such as the structural approach and the laws of form, and also emergent fields, such as Neurophysiology and Environmental Psychology, the researchers and teachers had the opportunity to evaluate the outcome of some practical experiences applied by a team of experts in three consecutive summerschools in Italy in some villages/small towns in decline in the outskirts of Rome (See information on the Artena village summerschool further); they also managed to integrate principles and practices in some modules taught in HE in the UK recently and other European countries. In particular, during some specific international Erasmus workshops with the title *Dance-Architecture-Spatiality*, held in three different countries and in cities with strong historical influences for three consecutive years during summer, one of the authors of this paper had the opportunity to observe human behaviours and creativity in rather uncommon urban situations. During the development of these student projects, which included performances and tactical urban activities, ephemeral urban phenomena were explored by discovering the potential of the historical fabric in relation to preferential communication paths of the past; these phenomena were paralleled to specific behavioural attitudes of the students themselves, whilst performing along and across these urban trajectories. Students' bodies and minds travelled in spaces heavily charged by everlasting energetic pathlines of communication, so that new interactions between them and the surroundings emerged. Most of the times the general public was also happily involved in these unique experiential activities. Public performances and presentations took place and publications (Villemur, 2012; Villemur, 2013; Villemur, 2014) and videos documented the observations of the teachers/researchers, the students' individual projects and the reactions of the public.

By embedding Biourbanism in the learning outcomes of modules in Higher Education programmes today, we are able to convey sound educational assessment methods, which can guarantee focused future urban growth (Salama, 2005; Salingaros and Marsden II, 2008b). The use of live projects in the delivery of modules linked to Biophilic Design and Biourbanism can offer us the opportunity to get educators involved who may come from a variety of disciplines and actively share all research experiences together with their students at the same time. Therefore, active learners should be able to transform the future of urban spaces by successfully developing new innovative designs in agreement with the principles of Biourbanism. Early investigation and

research carried out during projects offers the opportunity to both teachers and learners to share common experiences and also evaluate important factors of anticipation of future actions, such as the life span expectancy of the built environment in urban areas and their future metamorphoses. Biourbanism interventions in urban spaces can reinforce Biophilic design values which are necessary to the survival and evolution of both natural and built environments (outdoors and indoors). Skills and knowledge acquired by means of the latest innovative architectural pedagogies aim at the creation of humane environments (Salama, 2005). Since the 1990s, new trends in architectural education appeared with some authors insisting that not only a New Paradigm appeared in conceiving and developing architectural projects, but also this trend was in effect the result of a radical change in architectural education (Salama, 1998).

The *Report of the United Nations. Conference on Sustainable Development* and in particular the *A. Outcome document: "The future we want",* adopted by the United Nations General Assembly on 27 July 2012, recognized that, sustainable urbanisation requires that cities generate better quality of life, income and employment opportunities, social equity, use of renewable energy, green transport, access to information and communications. We know that the 21st century cities represent the frontline where humanity will decide what kind of future the next generation is going to get. In this fluid environment, education plays a predominant role, because it is one of the ultimate devices set for change. During the last two centuries, the so-called Western civilization has been overwhelmed by rationality and scientific and technical education during processes of growth. So, the fundamental question is: Can the current paradigm face contemporary challenges? And how does this paradigm influence the education of architecture?

According to Edgar Morin, "*the paradigm selects and determines conceptualization and logical operations. It designates the fundamental categories of intelligibility and controls their use. Individuals know, think, and act according to interiorized culturally inscribed paradigms'* (Morin, 1999, p8). In Morin's *Seven complex lessons in education for the future* and, at the very beginning of the document we find the definition of the human condition in education in Chapter III: *Teaching the human condition*:

- Humans are physical, biological, psychological, cultural, social, historical beings. This complex unity of human nature has been so thoroughly disintegrated by education divided into disciplines that we can no longer learn what human being means. This awareness should be restored so that every person, wherever he might be, can become aware of both his complex identity and his shared identity with all other human beings.
- The human condition should be an essential subject of all education.
- This chapter suggests how we can go from current disciplines to a recognition of human unity and complexity by assembling and organizing knowledge dispersed in the natural sciences, social sciences, literature, and philosophy, to demonstrate the indissoluble connection between the unity and the diversity of all that is human. (Morin, 1999, p2)

In order to understand the current educational limits, it is necessary to understand its paradigm with its qualities and limits. Back in 1637, René

Descartes in his renowned introduction to science entitled *Discourse on the Method of Rightly. Conducting One's Reason and Searching the Truth in the Sciences* had presented ***"****the method of analytic reasoning*" (Bennet, 2010-2015), as it is also introduced by the present paradigm recently; this is based on the belief that the human reason is able to understand complex phenomena by reducing them into their constituent parts (reductionist method / science – scientific analysis and methodology). Another fundamental working hypothesis developed by Descartes was the idea of scientific objectivity. It introduces the distinction between observer and what is observed, and it permits us the "truthful" interpretation of phenomena. On the contrary, as this assumption does not use objectivity, it seems that we do not work in a scientific way. The result of this approach had an impact in creating a boxed kind of culture and education by dividing knowledge in isolated specialities with a deep knowledge of isolated micro-cosmos and a paradoxical ignorance of the whole. This paradigm is not only inadequate to grasp the multidimensional and global problems of the contemporary world, but also unable to conceptualise the human complexity by reducing it to a purely *"bi-anatomical substrate"* (Morin, 1999, p21).

Passions, love, feeling, all these emotions are inseparable in human beings because intelligence and affectivity are closely related: "*the ability to reason can be diminished or destroyed by an emotional deficit, and impaired ability to react emotionally may cause irrational behaviour*" (Morin, 1999, p5). Nevertheless the education of the future is not only challenged by this important problem of the emotional deficit, but also it is threatened by the transformation of architecture's values and symbolism of the post-modern era. French philosopher Jean Baudrillard affirms that contemporary symbols have lost their symbolic meaning and have become simulacra (Baudrillard, 1983). According to Baudrillard, contemporary world lives in an age of simulation where models, generated from reproductions of reality, precede the real world, and where representations no longer bear any relation to reality. For Baudrillard, images and signs have become more *"real"* to us than *"the reality"* itself. In this context mass media played a special role in the transformation of the reality into hyperreallity (Baudrillard, 1983). Referring to simulacra and truth, Baudrillard opens his essay by quoting this text from *Ecclesiastes*: "*The simulacrum is never that which conceals the truth – it is the truth which conceals that there is none. The simulacrum is true"* (From Ecclesiastes and now in Baudrillard, 1983, p2).

Hyperreality is a special kind of social reality in which a reality is created or simulated through models. It becomes more real than the reality itself, because it breaks down the boundaries between two worlds: the real and that of imagination. This has transformed architecture in pure visual art, where signature architecture and star-architects or their buildings' form/shape, symbols and codes have become the most important characteristics of the modern planning process. Today, by looking at post-modern architecture, what we experience is only spectacular images and empty symbols and signs (Serafini, 2011; Tracada and Caperna, 2012; Salingaros, 2010). At present, architectural education shares this philosophical approach in theory and practice. As architectural schools are becoming increasingly aware of the importance of imagery in constructing powerful international reputations, a new and highly competitive educational economy based on image production has emerged. End of year shows, catalogues and prospects now attract a significant proportion

of precious educational funds and efforts and time, because in a competitive market, they are crucial in attracting students and high rank staff.

In architectural practice, a large part of the architects' services today consists of image-making for the construction industry, tourism and commerce. The media has a big influence on creating what Guy Debord calls society of spectacle (Debord, 1967). The original in French, *La société du spectacle,* is a 1967 work of philosophy and Marxist critical theory by Guy Debord. In this important text written for the Situationist movement, Guy Debord develops and presents the concept of the Spectacle. It is in that society of the spectacle, where we are now witnessing the transformation of the architectural design from a social and political programme into some kind of hyperreal images' product; architecture as image production is becoming increasingly important to the architectural careers. In this context, magazines substitute the books. In this collective imagination, magazines are read and respected by the students of architecture. But often these publications contain projects, the final destination of which is not the building, the site, the people, but simply a gallery a cyberspace of images; that is some kind of an artistic and fictitious magazine again.

2. REFORM IN HIGHER EDUCATION

The incapacity of the current paradigm to face the real current challenges asks for an innovative epistemological approach to architecture. As stressed by Morin "*the education of the future is faced with this universal problem"* and *"our compartmentalized, piecemeal, disjointed learning is deeply drastically inadequate to grasp realities and problems which are global, transnational, multidimensional, transversal and planetary*" (Morin, 1999). Thus, we introduce Biourbanism as a new framework for an innovative educational model. It has been already tested on field, through several experiences of summerschools. Biourbanism introduces an integrated educational approach, where science, humanities and experience can provide the students with an innovative background and sensitiveness in creating/generating a human oriented built environment. *"Biourbanism, as science, considers the urban organism as an hyper complex system composed of several interconnected layers of dynamic structure, all influencing each other in a non-linear manner"* (Caperna et al., 2010). This interaction results in emergent properties, which are not predictable except through a dynamical analysis of the connected whole. This scientific approach links Biourbanism to the Life Sciences, and to Integrated Systems Sciences like Statistical Mechanics, Thermodynamics, Operations Research, and Ecology in an essential manner (Caperna et al., 2010). 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.

The significance of the above affirmation permits us to use scientific methods to understand and explain the urban structure. Therefore, structural principles developed in computer science, physics, and in particular in biology are applied in order to determine certain structural quality that every urban environment cherishing specifically architecture must have. This is not simply a matter of aesthetics, but, it can provide us with the tools to develop deep sustainability and a physiological and psychological wellbeing (Salingaros and Masden II., 2008b;

Alexander, 2004; Caperna et al., 2010; Serafini, 2010; Tracada and Caperna, 2012; Tracada and Caperna, 2013). This statement is suggested by the last scientific developments and evidence, according to which, there is a connection between biological and natural structure within our neurophysiological system. Hence, we show how this link is evident in architecture and urbanism, too. Biourbanism considers architecture as an extension of biology. This affirmation has been used in turn by traditional still contemporary architects to support their approach to architecture. But, there is a substantial difference in the way we attain it and how we apply it. Biourbanism does not suggest a passive way, able to generate only fashionable buildings that imitate the morphology of nature without understanding the deep meaning and relationship between biological form and real living architecture (Salingaros, 2010; Tracada and Caperna, 2013).

According to Nikos Salingaros, 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 the unfolding process works in nature"* (Salingaros, 2010). For the first time in its scientific approach, Biourbanism manages to create links among things which are apparently separate, such as biological structure, nature (as animate and inanimate systems) and human beings, as sociological systems and living form (Alexander, 2002; Salingaros, 2010; Tracada and Caperna, 2012; Salingaros and Masden II, 2008a). Starting from this viewpoint, there are many questions to answer in order to explain how biology influences architecture and urbanism. According to this approach mentioned above, our research investigates on a set of questions such as why some built forms resemble some biological forms as well, or what types of built forms correspond more closely to some biological prototypes. Another fundamental review queries, if human beings are predisposed to like certain types of forms and feel comfortable with them as well; it queries if people may be inclined to build certain types of forms. Finally, we try to understand if we gain more than just aesthetic pleasure — such as physical and psychological benefit — from an environment that captures the essence of the biological structure. The study of the above set of questions, can open new scenarios, such as the role of the technological aspect, during the reproduction of natural processes and their application to our life system, or the role of our internal aspect, or cognitive processes, perception, and neurophysiology as an essential topic to answer at least some of the questions mentioned above.

During the last few decades, many researchers have provided us with a new hypothesis about human beings. For example, Steven Pinker's recent book, *The Blank Slate: The Modern Denial of Human Nature*, suggests that the contemporary culture has propagated a deception about the nature of the human mind in terms of a structure socially imprinted (Pinker, 2003). This assumption is called "*the blank slate*", referring to the notion that a human being starts with no inborn preferences, but, can acquire all neuronal structures exclusively from external sources. Incidentally Pinker considers this assumption false**:** *"the belief that human tastes are reversible, cultural preferences has led social planners to write off people's enjoyment of ornament, natural light, and human scale and force millions of people to live in drab cement boxes. ... the conviction that humanity could be reshaped by massive social engineering projects led to some of the greatest atrocities in history.*" (Pinker, 2003, pp *x-xi*). Pinker underlines the disastrous consequences of turning against the human

nature, by accusing architects, planners and legislators for acting contrary to the biological nature of the human beings. This biological connection, as said, is a very important focus for Biourbanism. It is becoming increasingly clear that architectural significance is indeed founded on shared aspects of the human mind (Salingaros, 2010). Such as universality relies on innate neural circuitry common to all human beings (Pinker, 2002). The connection between architecture, urbanism and inherited structures in the human brain, which can influence the function of the mind, becomes a study area able to formulate a new epistemological basis of architecture and urbanism (Caperna, 2011).

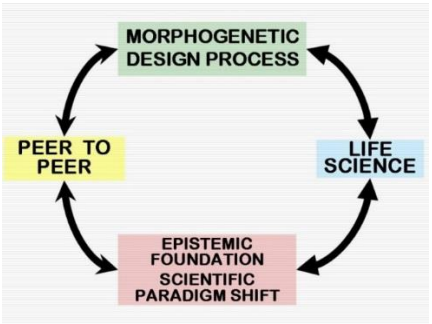

Figure 1. Biourbanism, as scientific discipline.

According to the diagram in Fig. 1 above, we can see that, Biourbanism is not only a discipline based on theories related to Life Science; it may also include epistemic elements and, thus, it relates to knowledge or epistemology. By also embracing Life Science, Biourbanism offers the opportunity to architects and urban designers to recognise and establish the biological roots of architecture and urbanism inside a scientific paradigm shift which commences within architectural education and manifests itself through the processes of conception and development of a number of integrated design projects. Before generating architectural forms, Peer-to-Peer urbanism may occur and the entire effort accomplishes morphogenesis through particular design processes; in turn, these can inform new Life Science and trigger more research and studies to develop new innovative models of architectural emergences for the years to come. As a matter of fact, morphogenetic design processes are based upon real recognition of optimal forms defined at different feedback scales (from physiological, to ecological); these scales are capable to guarantee optimal systemic efficiency only through morphogenetic processes, and, therefore, they can promise quality of life.

According to Biourbanism, the epistemological formation of architecture refers to the study of the form in comparison to the study of the matter. It implies a dynamical and evolutionary study of the structures, where the relationships (internal and external) have a significant role in the evolution of processes. The "*study of form*", introduced by D'Arcy Wentworth Thompson in his book *On Growth and Form* is a basic principle adopted by Biourbanism; it connects active structures and architecture, plus the urban environment as living systems. D'Arcy Wentworth Thompson's book suggests that biologists had understated the roles of physical and mathematical laws in shaping the form and structure of living organisms. After D'Arcy Thompson many other researchers produced studies which support the same approach, such as Vito Volterra, Italian and

Alfred J. Lotka, American, both of them mathematicians. In the 1950s, Alan Turing tried to explain the pattern formation in living structures (Turing, 1952). Later, Ilya Prigogine, physical chemist, wrote the complete study of physical and chemical theory of “dissipative structures” (Prigogine, 1955), characterised by the spontaneous appearance of symmetry breaking (anisotropy) and the formation of complex or chaotic structures where interacting particles exhibit long range correlations. This theory led to pioneering research in self-organizing systems, as well as philosophical inquiries into the formation of complexity on biological entities and the quest for the creative and irreversible role of the time in natural sciences. It is acknowledged that: *“A dissipative structure is a dissipative system that has a dynamical regime that is in some sense in a reproducible steady state. This reproducible steady state may be reached by natural evolution of the system, by artifice, or by a combination of these two.”* (en.wikipedia.org, 10/03/2016). It is also known that: *“A dissipative system is a thermodynamically open system which is operating out of, and often far from, thermodynamic equilibrium in an environment with which it exchanges energy and matter.*” (en.wikipedia.org, 10/03/2016). The notions presented above have been explored and studied further by one of the authors, who has been teaching students at level 6 and 7 (still ongoing) by introducing thermodynamic equilibrium in urban sprawl and also contemporary theories of fractal expansion; several concepts and projects have been developed by students under the supervision of this author and a number of publications and presentations in conferences materialised by also including selected student work (Tracada, 2013)

3. THE EDUCATIONAL EXPERIENCE IN RECENT PROJECTS

Lastly Biourbanism experts and teachers have now approached the Constructal Law and Second Law (Bejan and Lorente, 2011) that also defines the concept of design evolution in physics by describing phenomena in animate, inanimate and human systems; these systems are associated with dissipative structures and free flows of fluids, which are now being connected with the model of thermodynamic urban expansion of cities. Some theorists and practitioners in Biophilic architectural and urban design (who are currently involved into Biourbanism educational projects) are now exploring Constructal Law in order to develop either conceptual and/or town planning models based upon not only cutting-edge technology, but also upon natural laws and patterns of life and human behaviours strictly dictated by flows and movement in nature; some formulas regulating flows of fluids and stresses could be helping designers and planners to develop optimal models for urban sprawl, which would safeguard human well-being at the same time. Some theorist in Biourbanism affirms that: *“Stresses could be always distributed uniformly along pathlines of urban sprawl with attention and care for tree-shaped harmonious expansions.”* (Tracada, 2016, p. S165). As Barak (2011) puts it: “*Life is flow: all flow systems are live systems, the animate and the inanimate.”* (Tracada, 2016, p. S165). There should always be “a cause and a reason”, as Gregory Bateson puts it by distinguishing between working hypotheses and fundamental invaluable knowledge acquired through scientific processes:

> “Explanation" is the mapping of data onto fundamentals, but the ultimate goal of science is the increase of fundamental knowledge. Many

> investigators, especially in the behavioral sciences, seem to believe that scientific advance is predominantly inductive … they believe that progress is made by study of the "raw" data, leading to new heuristic concepts. The heuristic concepts are then to be regarded as "working hypotheses" and tested against more data. Gradually, it is hoped, the heuristic concepts will be corrected and improved until at last they are worthy of a place in the list of fundamentals … thousands of clever men have had their share have, in fact, produced a rich crop of several hundred heuristic concepts, but, alas, scarcely a single principle worthy of a place in the list of fundamentals. (Bateson, 1972, p5)

The teaching experiences and development of projects based upon Biourbanism principles, and especially projects in declining urban areas, were further enriched by initiatives organised by the International Society of Biourbanism (ISB) relating to specialist summerschools. The School of ISB emerged in 2012 as summerschool and as an essential system of knowledge. From 2012 until 2014, each year, the ISB Summerschool has welcome groups of participants of different ages and backgrounds, who were keen to specialize in Biourbanism. In three years the course has welcome 75 students from 16 Countries (Italy, India, USA, UK, Germany, Slovakia, Turkey, China and Taiwan, Australia, Slovenia, Sweden, Czech Republic, Slovakia, The Nederlands, Colombia, Greece, Israel), 24 professors, artists and professionals. Participants lived at ISB's living campus in the medieval village of Artena (about 30 Kms south of Rome) and shared experiences, emotions and practicals with local inhabitants. In addition, the course tested on field the topics' attraction and the innovative educational approach and collected precious feedback from the participants. The main pedagogical system was followed by teachers, scholars and the local population participating at various tasks and levels. The main message across was that, the primary task of architects and planners should be to improve quality of life by creating an enduring legacy of beautiful, functional, equitable and healthy environments; the fragmentation of specialist education was overruled and an integrated methodology was adopted, in which theory and laboratories work in parallel.

By focusing on human condition, students combined the multidimensional explorations of the scientifically and cognitive basis of design with exciting practical experiences and informal studios, where scientists, artists, craftsmen and professional shared their expertise. According to a research-based curriculum the School of ISB has introduced participants to new emergent fields such as Complexity, Biophilic Design, Neuroergonomics, Biourban acupuncture, environmental psychology and peer-to-peer urbanism, and disclosed "*unexplored subjects*" to young students. The ambition of these very practical experiences was to transfer the most up-to-date interdisciplinary knowledge from neurosciences, psychology, biology, physics, and network theories, into new design's techniques and inspiration. The challenge was to teach and support science-grounded, genuinely sustainable, human-centred design and start a new professional field for designers, architects, city planners, artists, psychologists, sociologists, economists, policy makers, and social activists. Trustworthy sustainable design should deal with energy and environment-saving technical solutions, and also with functional and restorative connections to the human neurophysiological system (Tracada and Caperna, 2012). Psychology and medicine show how space design can nurture or damage our well-being.

In 2013, the summerschool following the first *Summerschool on Neuroergonomics and Urban Design* (held in 2012) aimed at a paradigm shift from ideology-centred to bodily and nature-centred design. In fact in 2013 the former edition of 2012 was enriched with more practical and participatory work in order to explore inner bodily resonance with truly vital architectural and urban structures; it was set to see what this experience might bring into the fields of *Neuroergonomics and Placemaking*. This programme aimed at architects, designers, engineers, psychologists, social scientists, and policy makers who were keen to study Neuroergonomics Design, a new field of practice and research with relevant professional opportunities. The numerous examples of beautiful and harmonious urban areas built during the last millennia in the area (Artena, Segni, and the gorgeous surroundings) allowed teachers and scholars to experience and test the theories of Biourbanism, complex systems, pattern language, isomorphism, and mimesis on-site. All ideas and individual projects were published in the Journal of Biourbanism (journalofbiourbanism.org, 08/05/2015).

Figure 2. The map of Artena village. This village was chosen because of its particular fractal historical development.

Figure 3. Scholars in practicals; the Eco Park of Artena during the practicals in 2013 (on the left) and today (on the right).

CONCLUSION

The Biourbanism research team is currently working on multiple activities in research and education. The ISB's main aim is to recommend a new epistemological perspective of the science to the students, and from it, they propose a set of tools able to generate factual sustainable environment. Biournanism experts' intention is to propose designs that could improve the

quality of human life, by combining physical form with physiological and psychological wellbeing. In Biourbanism and Constructal Law, the vision of architecture is an expression of the human dimension, which is simultaneously physical, perceptual, and emotional. We can always learn from the past, from our emotional system, and from the last scientific developments simultaneously, whilst developing important projects for future cities.

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