City and sustainability do not match.

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Abstract: This paper reviews the meaning of two concepts – city and sustainability – and discusses their incompatibility. Since cities came into existence, they have managed to survive because societies have been able to withdraw from the ecosystem a vast amount of products at a much faster rate than they can be replaced due to scientific and technological advancements. The city implies accommodating a diversity of groups of people and activities in a very restricted space. Within the current paradigm focused on well-being, the demands of the modern city go far beyond the acceptable boundaries of its ecological footprint, requiring substantial modifications to the biogeophysical structure. Therefore, unless our concept of city is radically changed, bringing these two ideas together will prove a difficult task, since one is anchored in profit rates and the other is based on respect for the rhythms of ecosystems.
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1. Introduction

This paper has no intention of evoking nostalgia for the Lost Paradise, but rather aims to emphasize some of the severe consequences which may have resulted from the progressive and effective separation of man from his natural environment within urban contexts, and to illustrate how difficult it is for citizens to recognize and then solve severe negative impacts if they do not start by questioning the urban well-being paradigm.

In fact, a key approach to solving the manifold signs of unsustainability detected in urban areas may entail turning the city into "... a machine with component parts that everyone understands..." (Bridge, 2008).

The economic system in which we live today, based on profit, has transformed cities into indispensable artificial components for the exchange of goods, services and information. However, these exchanges are not conducted with a view to what is needed, but rather depend on what everyone already possesses. Profit is an inherently urban goal which means gaining a little more in each exchange than that which is given. This necessarily implies an unbalanced relationship within the urban system, which is in complete contradiction to the way in which exchanges should take place in the ecosystem.

The maintenance of this type of relationship is only possible due to a diverse set of solid units which, to all intents and purposes, manage the international economic systems, such as the European Union (EU), the Organization for Economic Cooperation and Development (OECD), the International Monetary Fund (IMF) or the World Bank. These large international organizations constantly supervise the system and force it to work within their guiding principles, i.e., ensure that the exchanges continue to take place in accordance with the rules imposed by those who detain the largest amount of resources. If we were to disengage from the entire socioeconomic and political milieu, reducing ourselves to our humble position as only one more element in the ecosystem, we would realize that these institutions and, above all, the aims which justify their existence are incomprehensible, unnecessary and generators of noise within the ecosystem.

It is precisely the awareness of how fragile our position is in the environment that weighs on our conscience, individually and socially, leaving us burdened with feelings of guilt for the uncountable situations of starvation and deprivation in the world. Often, it is only out of respect for the acquired right to own the resources, which only a privileged few have access to, that prevents the destitute from satisfying a basic need - nourishment. A problem that other elements in the ecosystem solve in much simpler and harmonious ways (Douglas, 1983).

Cities, as mostly artificial projections of successive generations of human desires, are good examples of how this control over nature can unleash and stimulate attitudes of progressive irreverence and detachment from the environment. The natural environment has come to be seen as a separate entity. The idea of cohesion has been completely lost in favour of a pretentious concept of man's immunity,

when confronted with the consequences of his actions (Hough, 1989; McBurney, 1990).

Were we to rely exclusively to our intuitive, primary sensibility, it would be easy to understand that the exaggerated anthropocentric view of the ecosystem has led us to develop concepts of self-sufficiency, of an excessive optimism and confidence in our capacity to control physical and biological processes. The notion of boundary and balance underlying any open system, as is the case of the ecosystem, has been lost (Monteiro, 1997). As one more operator in an urban ecosystem, we do not easily perceive the magnitude of the changes taking place and, above all, we do not easily recognize the cause-effect relationships between our actions and the responses of the urban ecosystem.

Cities are undoubtedly the most refined example of man's superior attitude in relation to the rest of the ecosystem, which McHarg (1970) designated as the peak of the pyramid of man's illusions of superiority in relation to his environmental support.

To survive and succeed in very small spaces, man has lost the notion of his multiple dependencies on the surrounding space. The manner in which he understands the earth-atmosphere system, the hydrological cycle, etc., is distorted. Water, for instance, is used at home and is put at people's disposal by supply networks and drainage systems. They are supposed to be sufficiently efficient so as not give us enough time to appreciate the profound differences in the chemical composition of the water flowing out of the tap and that going down the drain. Wastewater discharges most certainly take place somewhere far away, which people avoid at all costs when they choose a place to enjoy nature. The way urban citizens appreciate nature's cycles and the trophic chain is totally distorted and, as several authors have put it, can be resumed to the shortest distance between the supermarket and the garbage bin (Monteiro, 1997).

The larger the city becomes, the more citizens are deprived of contact with the environment, the more disdainful they are and the more they ignore the other elements of the ecosystem. The environment becomes increasingly hostile and man takes refuge, for longer periods of time, in artificial environments. The building that started as a protective shelter for a few hours at night or during a season of the year has become the only possible refuge for the 24 hours of the day.

Nevertheless, the urban way of life continues to be preferred by a growing number of people (United Nations Environment Programme, 2010). It is currently estimated that 3.3 billion people, 51% of the world's total population, are concentrated into around only 2.7% of the planets' total area. And when questioned about their option, the main reason put forward is the hope to achieve a better quality of life (Wolch, 2011).

2. The current urban well-being paradigm

To understand what really matters in people's decision-making processes, we should perhaps start with what urban citizens regard as a priority during the individual, mental evaluation of their well-being status (Vallance et al., 2011).

According to Boyden et al. (1981), the notion of quality of life and well-being varies across socioeconomic and cultural groups and according to the political and historical context. For the common citizen, living in the first decade of the 21st century, well-being means: i) having the ability to survive and reproduce; ii) being able to spend their energy on several activities without becoming exhausted; iii) being able to improve and then maintain their position in society; and, iv) feeling emotionally well-balanced.

Even though these factors are all considered essential in the individual evaluation of well-being for most people today, the excessive importance given to the 3rd condition may explain the remarkable increase in the capacity to endure suffering of modern societies, and justifies, for instance, the continuous, massive exodus from rural to urban areas.

The main reason why cities attract people searching for better quality of life may also certainly derive from the fact that they provide the best-known combination of desirable factors, such as freedom, less societal monitoring and control, more family facilities, social responsibility, job offer, education, health, culture, leisure, recreation, etc. They are spaces that offer a unique 'menu' of boundless diversity. However, the powerful appeal of this new lifestyle exerts a huge influence on mankind's well-being paradigm. It calls for a profound redefinition of many preconceived notions such as: freedom, family values, social responsibility, job relationships, health demands, consumption desires or happiness. At the same time, it sustains a more distant and highly sectioned relationship with the ecosystem.

Thus, the advantages of the urban modus vivendi are clear and undeniable but also generate many threats. The high concentration of population and activities implies great pressure on soil, air, water, fauna and flora. The unquestioning belief in science and technology has forcibly led man to operate countless modifications on all components of the ecosystem, without bearing in mind that it could very well have the capacity to find its own solutions.

However, the ecosystem's answers do not always serve human interests and expectations.

Nevertheless, it is questionable whether the common citizen is able to grasp the mechanics of the multiple and complex stimulus-reaction impulses that occur in the urban ecosystem. And without understanding the cause-effect relationship, it is more difficult to identify the type of changes in attitudes, expectations or location decisions that may be required to promote the required balances. Thus, it is imperative to find easy tools to communicate with citizens and illustrate these impacts on the biosphere, atmosphere, etc.

The substantial changes in the first few hundred metres of the atmosphere, due to physiological changes in the fauna and flora, to alterations in the topography, the creation of new forms of accumulation (waste and garbage dumps) and removal (extraction of sand, gravel and rock), and modifications in water circulation, have brought changes to the weather and climate (Monteiro, 1998). Consequently, the behaviour of the local urban climate can serve as a good example to understand how the cities' physical-chemical impacts have an effect on the earth-atmosphere interface and may even create a hostile environment for human beings. If we bear in mind that 100% of the humidity, 75% of the heat input, as well as 40% of the kinetic energy are produced at the earth's surface, the magnitude of the climate changes generated by the urban form becomes easy to demonstrate.

Therefore, the urban climate, given its scale and complexity, can serve as a means to understand the profound changes in the type of approach needed to upgrade resilience in these preferred human environments.

3. The urban climate as a tool to change the well-being paradigm

Given the complexity of urban ecosystems when intending to conduct a useful diagnosis of their unbalances, it is particularly important to select sound examples and adequate time-space scales. Thus, it may be reasonable to select a small fraction of the city system – the urban climate subsystem – to discuss the incompatibility of promoting sustainability while trying to maintain the current paradigm of well-being in urban areas.

For the purposes of our study, the Porto climatope has been selected to show how a community of living beings interrelate with their environment, partaking of Boyden's idea of a "... city as a gigantic immobile animal, consumer of vast quantities of oxygen, water and organic matter and excretory of carbon dioxide, sulphur dioxide, fumes, water vapour and organic waste..." (Boyden et al., 1981). Additionally, atmospheric pollution is taken as an indicator of the rate at which urban functional activities interact with the climate in a certain area.

Porto is the second major city in Portugal and is situated within a metropolitan area with about 1.3 million inhabitants, located on the NW coast of the Iberian Peninsula. However, in 2005, Porto had only 233.465 inhabitants but a daily flow of more than half a million people. It is mainly dominated by the services sector – administrative, educational and cultural – and offers more than 218.000 jobs. About 50% of its employees commute from nearby municipalities using public and private transports (Monteiro and Madureira, 2009).

Official reports confirm the high rate of daily traffic in Porto – a total of 93 thousand commutes by car between 7:30 a.m. and 9:30 a.m. – and predominately towards the old town, the Boavista roundabout and the Asprela area (Oliveira et al., 2007).

Porto has two distinct areas: i) a western part, which is lower and plane; and ii) an eastern area, higher in altitude and more rugged in terrain. To city's southern boundary is formed by the Douro River, from which the old medieval town rises up steep slopes, with narrow, cobbled roads and alleys and surrounded by tall building blocks. The eastern area, spreading to the Atlantic Ocean, formed the city's rural ring at the beginning of the 20th century and has, since then, experienced a considerable rise in occupational density, mostly from the middle and upper classes. It is an area with a large number of new neighbourhoods, individual houses, large residential blocks and wide avenues (Miranda et al., 2009 1).

Oke's model (Oke, 1973), which served as the motivation to start the monitoring of thermal anomalies in Porto in 1990, predicts a maximum positive variation of 6.9ºC between the city and its outskirts, proved to be correct in the case of Porto (Fig. 1). [Figure 1 about here]

It was found that neither the E-W topographic differentiation, nor the proximity of two major bodies of water, the Atlantic Ocean and the Douro River, as well as the spatial outcomes of more than eight centuries of history, were sufficient to disguise the impacts of the urban metabolism (Fig. 1).The concentration of dominance fluctuated from 0.1 to 1.4 in oak and from 0.1 to 0.2 in pine forest (Table 3). It was comparatively higher in the oak forest. The low value of concentration of dominance indicates that the dominance is shared by many species. The ratio of family to species, family to genera and genera to species for the both forests indicated higher taxonomic diversity in pine forest than that in the oak forest (Table 4). Percent

contribution of perennial herbs is maximum in oak forest than the pine forest (Figure 1).

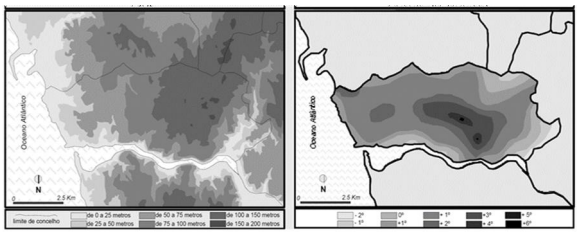

Figure 1. Porto morphology (left) and thermal anomalies (right) obtained during itinerant night measurements conducted from 1990 to 2010.

It was also possible to determine that the type of weather, the hypsometric differences, the effect of the sea breeze, the climatic influence of the Douro River, the unequal distribution of green areas throughout the city, the different types of urban land uses, contribute to generating different shapes and magnitudes of the heat island but rarely annul it. The temperatures recorded within Porto's city centre were repeatedly higher than those recorded, at the same time, on the city's outskirts. Moreover, there has always been a close cause-effect relationship between the pace of the urban modus vivendi and the magnitude of the positive thermal anomaly at night. We can mention, to this end, an episode in Porto during 3 days of late-night Christmas shopping in the city centre when no decrease in the night temperature was recorded for 2 consecutive days (Monteiro and Madureira, 2009).

Heat islands in the city are particularly evident on nights with stable weather, weak winds, low temperatures and no rainfall in the previous days. Days on which higher pollution levels are recorded also coincide with higher positive thermal anomalies (Monteiro, 1997; Monteiro and Madureira, 2009).

The monitoring conducted from 1990 to 2010 shows continuously persistent shapes and magnitudes that are closely correlated with the urban morphology, construction materials, urban activities and weekly and daily rhythms, as well as with traffic intensity (Monteiro, 1997; Monteiro and Madureira, 2009).

Moreover, there is evidence pointing to the aggravation of a number of diseases, such as asthma for instance, on more polluted days when the thermal anomalies are particularly high (Monteiro A. (Cord), 2000).

Thus, by means of a bottom-up approach to the climate system, it is easy to make citizens understand how their options can have an impact on their outdoor and domestic comfort, health and well-being. Moreover, this type of explanation can act as important motivation to rethink society's well-being goals and priorities.

4. Discussion

If we do not question the urban lifestyle and the currently well-being paradigm, it is not worthwhile to try to implement sustainable strategies, mainly because they will not adequately adjust to human desires and aspirations (Bridge, 2003). They will be seen as sacrifices and will be rapidly doomed to failure (Monteiro, 2009).

A solution is particularly difficult in cities, because the diversity of lifestyle ambitions per square metre is enormous. The vast array of the goals individuals and groups strive to achieve, usually when living far too close to each other, comprise threats and at the same opportunities. Threats, because it is practically impossible to find answers which suit both each person and the ecosystem. Opportunities, because human density favours, once accepted, the contagious spread of new lifestyle models (Finnnegan, 2002).

Unless we find good reasons to stimulate profound changes in the well-being paradigm of citizens, it will be impossible to promote real and efficient sustainable strategies. And motivation cannot be achieved through simple fear of the future, through education and culture or based on altruism. It is fundamental that measures be taken to promote a clear understanding of some of the simplest mechanics of the ecosystem. Without this understanding, the ideas of city and sustainability are bound to collapse. Bottom-up perspectives such as the one exemplified with the urban climate impacts on comfort and health due to human activities may contribute to significantly changing human well-being paradigms.

The changes in topography, altitude, precipitation, temperature and soil conditions contribute to the diverse bioclimate that results in a mosaic of biotic communities at various spatial and organizational levels. Diversity represents the number of species, their relative abundance, composition, interaction among species and temporal and spatial variation in their properties. Where richness and evenness coincide, i.e., a high proportion of plant species in the vegetation are restricted, community of that area is supposed to have evolved through a long period of environmental stability.

The observation in the present study showed that the oak forest was typically moister than the pine forest which is consistent with the study of Saxena and Singh (1982). Pine forest was about 25% more diverse (40 spp.) in comparison to the oak forest (32 spp.).

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