

**a new
urban
metabolism**

Barcelona / Lugano

case studies

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i.CUP—AAM

**a new urban
metabolism**

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Accademia di architettura - Università della Svizzera Italiana
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If we have to cross a desert and if we have the chance to choose a horse or a camel to do it, I'm sure anyone would prefer the camel. Although not having any special knowledge of zoology, anyone knows that the horse, fast and beautiful, is at a disadvantage in terms of resistance when compared to the camel, slower but more durable since its body, thanks to a particular morphology, is able to store large quantity of food and water. If you ask a scientific explanation to a zoologist, he will explain how the difference between a camel and a horse lays in their metabolism, and therein lays their different strengths and functionalities.

In the light of the growing urbanization of the planet, visible in the fact that by the middle of this century some 70% percent of the population will live in cities, we have to seriously consider how many of the causes generating the huge environmental crises of today - e.g. climate change - have their rationale in the metabolic inefficiency of our cities. Day by day is thus more and more necessary to think about the functionality and efficiency of our cities, and this will be crucial when the current financial crisis will be resolved and cities will take on the important role that the future reserves to them.

Beyond what constitutes a metaphorical comparison, any person can understand the big difference existing in the efficiency of cities and normally associates such efficiency to an urban model more or less feasible to be actualized. We know, however, that the issue of urban efficiency is not so simple and that dysfunctions or capacities are not implicit in any urban model.

To dismantle such equivocations and to establish a method of urban analysis consistent with our age is the primary objective of this work.

On one hand urban efficiency manifests a very subjective character since it is normally evaluated according parameters defined more by personal ideologies than by rigorous analysis. On the other hand, if it is true that contemporary scientific thinking asks for the incorporation of the aleatory, it is also true that any form of evaluation of physical systems goes through the rigorous and scientific detailing of data, these being predictable or not.

If we consider "the city as an open, complex system" - a definition which constitutes the starting point of this work - we assume that, before understanding its efficiency, we need to deeply understand urban complexity, actually facing its scientific implications in thermodynamics. But to understand the city through thermodynamics is as necessary as difficult.

The laws of physics clearly determine that, if we give a kick to an object, its position will be altered depending on the mass of the object and the force of the action. If the object is a ball and the kicker is a very skilled football player, the ball can even travel more than sixty meters, a thing which can be very well

envisioned through simple mathematics. But what happens if you kick a dog? At first the animal may alter its position according to its mass and the force to which it will be exposed, but we all know that this is not really essential in this case. The reality is that the behaviour of an inanimate object is essentially different from the one of a living being: by kicking a dog one puts in motion a process of feedback that "activates" reactive capabilities, dependent on the metabolism and the consciousness of the animal, which consequences are much more unpredictable than the trajectory of the soccer ball.

Herein precisely lays the difficulty of understanding urban complexity: the city is a complex and open system which exchanges mass and energy with its surroundings, but the city is not only a collection of inanimate buildings and streets, rather it is also an assemblage of people with physical and decision-making capacities that introduces unpredictability in what is the city. When Shakespeare said "What is the city but the people?", he was in fact opening the urban discourse to such unpredictability, a characteristic which finally constitute a crucial dimension of urban analysis.

Facing the city, we must act objectively by using measurable parameters, but we need as well to incorporate the subjectivity of all the citizens, which implies to disciplinary transcend the barriers of modern conventional urbanistic knowledge. If in 1915 Patrick Geddes was questioning whether an urban economist could do its job without knowing the Second Law of Thermodynamics, today I'm sure that in order to perform his job, an urbanist, beyond keep on updating its knowledge in architecture and human sciences, must also know the main concepts of thermodynamics and of "new cybernetics". If not, it will be difficult for him to really understand urban complexity, and even less he will be able to envision anything for the future.

The new ecological approach, so socially demanded, is perverting the discipline of many architects whose late interest in "greening the city" does not go beyond a mere exercise in the "epidermic" decoration of buildings. Urban green spaces have obvious psychological advantages and facilitate the coexistence of citizens, but they can become an effective ecological tool only through the very consideration of the complexity of cities. For example, actually considering urban complexity, if on one side we admit green spaces can permit the expansions of drainage systems and the optimization of energy demand profiting from temperature regulation by natural evaporation, on the other side we must warn of their difficulty of absorbing carbon dioxide. In fact, to absorb the carbon dioxide produced by a single average European citizen, it is needed a forest surface equivalent to a football field! In respect of this, the control of air conditioning systems, of industrial processes, and especially the replacement of conventional vehicles with electric ones are much more effective actions.

To properly face urban complexity from a thermodynamic point of view, the concept of "urban metabolism"

we propose - not to be confused with the notions introduced by the Japanese "metabolists" in the seventies, for which I have in any case always felt great admiration - must be understood as the mechanism that regulates flows of energy, mass and information, in the balance between "dissipative processes" that tend to undermine systemic stability and "processes of homoeostasis" that tend to recover it.

Here has arisen a specific notion of "metabolic efficiency" which we unfolded as the interaction of more than twenty variables participating to three different urban sub-systems: built environment, urban transport and human activity. It must be in any case noted that some of these variables - for example, the ones relating to the post-industrial transformation occurring in urban mobility as well as the ones relating to new metropolitan perspectives contained in the "Networks for Land" thesis - have been analyzed in greater depth since paradigmatic of the emergent global urban condition.

To obtain an overall evaluation of urban metabolic efficiency, the variables have then been aggregated using a hierarchically structured set of Sugeno type fuzzy models that mirrors the organization of the urban system in its different sub-systems and the input-output flows of each one of them. More precisely, such methodology has been chosen since capable of enabling the production of variants and the correction of its results during the very process of urban transformation design, permitting a feedback to be established between the activities projectively proposed and their actual urban impact.

This work includes the two case studies of Barcelona and Lugano, processed by Barcelona Regional Metropolitan Agency and by i.CUP - institute for the Contemporary Urban Project respectively, case-studies which choice laid in the different urban dimensions of the two cities and was meant to permit the investigation of the relationship existing between urban dimension and urban efficiency, as well as to check the thesis for which, more than urban size, "Urban Pattern is the question", a very debated issue which would allow to think that medium-sized cities can have a great potential in the globalized world of today.

In any case, three conclusive arguments constitute a very stimulating finding of this work:

- first, the acknowledgement of the professional and scientific synergy that occurs discussing the same topic from very different disciplinary positions, as architecture, mathematics, physics, ecology, economy or geography constitute (I know that by now I will not discover interdisciplinary culture, but in urban studies cross-culture is more a promise than a reality);
- second, the acknowledgement of the proximity between the concepts of metabolic efficiency, urban efficiency and urban quality, which is a small step in the objectification of something usually considered subjective and ideologically driven;
- finally, the assumption that metabolic analysis must form the core of a more disruptive urbanism.

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A new Urban Metabolism

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-Lugano

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Intentions

This section aims at theoretically framing the emergent conditions of the urban world in which we are living today and, while questioning the suitability of the urban paradigms we are still operating with, at introducing the necessity for urban metabolism conceptualisation.

theory

1

Post-Fordist Urban Paradigms

Josep Acebillo has been Professor at the ETSAB - *Technical Superior Architecture School of Barcelona* 1975-200; Visiting Professor in 1997 at the School of Architecture of the Yale University; Visiting Professor in 2002 at Graduate School of Design of the Harvard University; Visiting Professor in 2005/06 at the Department of Architecture of NUS - *National University of Singapore*. Professor since 2001, he was Déan of the Università della Svizzera italiana; Accademia di architettura di Mendrisio from 2003 to 2007. In 2008 he has co-founded the BiArch - *Barcelona Institute of Architecture*, an institution for the post-graduate education and research in architecture and urban studies.

Since 1981, he has been driving, through different positions, the urban transformation of the City of Barcelona: Director of Urban Projects of the City of Barcelona from 1981 to 1987; Technical Director of the Olympic Holding from 1988 to 1993; Chief Architect of the City of Barcelona from 1999 to 2002; CEO and Director since 1993 of Barcelona Regional Metropolitan Agency, which received the Special European Prize in Urbanism 1997/98. For his contribution to the urban transformation of Barcelona he has been awarded with the Honorary Medal "Barcelona 1992" by Barcelona Local Council and with the Gold Medal of Architecture 1999 RIBA - *Royal Institute of British Architects*. Under the urban leadership of Josep Acebillo, the City of Barcelona has received worldwide recognition for its positioning in the international architecture panorama and has been awarded with the Prince of Wales Prize in Urban Design 1990.

In 2007 he founded the architectural office AUS - *Architecture & Urban Systems* while today he is partner of the AS - *Architectural Systems* office, a firm which develops projects ranging from architecture to urban design.

New Urban Conditions

Given its great complexity, we can approach contemporary territory in a number of different ways. However, bearing in mind that what interests us here is to highlight the leading role and the consequences that increasing urbanization has for the world we live in, we will focus on three aspects that have greatest impact on it: technology, economy and governance.

New Technologies

Although contemporary society generally continues to develop the techniques that already characterise modern industrial society, from a technological point of view it has made these new technologies its emblem and operative lever. Information technologies have emerged with such force that within the space of a few years they have redefined our economic, social and political outlook. The difference that access to the Internet, for example, has made to our everyday lives is plain to see from every point of view, and this access is the first step towards a new world in which highly complex information is within our reach, influencing all our actions at work or play.

From the steam engine to the Internet, technological developments have generated new models of behaviour. At its Fordist peak, the industrial economy was relocated everywhere, and since it was based on new technologies and on a new globalised vision of the world, a new productive culture gradually emerged. This was initially Post-Fordist, but it immediately evolved into a neo-tertiary system.



Neo-Tertiary Sector

If we look at the evolution of the productive structure of the countries around us, where the percentage variation of gross added

value by sector is concerned, we see that its proportion has varied greatly over the past two hundred years, but always in the direction of an increase in tertiarisation. In Spain, for example, the percentages in 1898 of the primary, secondary and tertiary sectors were 38.6%, 24.4% and 37.0%, respectively. Exactly a century later, in 1998, the agricultural sector had reduced its importance to 5.0%, the industrial sector had descended to 29.8%, and the tertiary sector had gone up to 65.2%. This enormous increase in tertiarisation at the cost of industry and the minimal presence of the agricultural sector is a universal phenomenon that is at the origin of the new economy.

Bennett Harrison [see bibliography 28, page 242] analysed the shift towards the tertiary sector in the American economy - the Great U-Turn - and attributed its causes to the breaking of the social contract that used to exist between the large industrial corporations, the unions and the state interventionism that subtended Keynesian Fordism after the Second World War.

What was initially described by Michael Piore and Charles Sabel [bib. 49] as "deindustrialisation or the second industrial revolution" has its basis in the failure of the "necessity of bigness" principle that fostered an increase in size in industrial production. With its giant corporations and its integrated production lines, Fordism, the emblem of mass production, reached its ceiling and declined in favour of "flexible specialisation". This reorganised the processes of production on the basis of the new technologies and a new conception of the space of production and of progress, which no longer needed such huge, rigid spaces. This was to give rise to what some people have called the "diffuse factory", which functions by using small interrelated spaces.

From that time on, the new production system, defined by Edward Soja as "Post-Fordism" [bib. 55-56], and managed on the basis of new organisational, technological and territorial aspects - what Michael Storper [bib. 57] calls the "Holy Trinity" of the new economy - was characterised by two new concepts:

- "Flexible production" on the basis of procedural changes in the productive system for achieving a reduction in costs, like just-in-time

operative systems, management by units of business, etc...;
-Different types of productive space and the possibility of networking give rise to a "new productive geography" which, based on the interrelation of productive settlements that were previously unrelated, makes it possible for metropolitan space to be visualised as a "neo-tertiary cartography".

The neo-tertiary sector is not a mere extension of the preceding one. It is mainly based on new sectors: high technology applied to the fields of electronics, aerospace and biomedicine, the design and conceptualisation of objects, fashion, jewellery, architecture, media, promotional activities and advertising, and in general everything that involves creativity and innovation. Moreover, the neo-tertiary sector develops new financial products and gives more value to tourism and to leisure, both of them which were present, albeit not so strongly, in the industrial phase. In this neo-tertiary sector neither the conditions of the territory nor its spontaneous wealth has that much weight and yet everything to do with the world of ideas occupies a pre-eminent place for bringing it about. So it is that we might speak of what Richard Florida [bib. 21] calls the "creative city" as one of the more significant urban tendencies. In order to develop this creative activity, geography is less important since anything can happen anywhere. This isotropic vision of the territory, to which we shall refer later, has one exception: the best cultural ferment when it comes to producing knowledge, and therefore new-generation companies and technologies, are the areas relating to highly qualified university groups. This seemingly obvious fact is very clear in the US if we look at the relationship between Silicon Valley and Berkeley, MIT / Harvard and Route 128 in Massachusetts, the Research Triangle of North Carolina and its three universities, or Chelsea New York and Columbia.

In any event, the new neo-tertiary economy, less dependent on the natural conditions of the territory and much more on intangible aspects like knowledge, will come about with the intelligent and creative use of the new technologies and, as has always occurred, economic change will also be expressed as urban change.