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## Collective intelligence and cities more than an urban metaphor

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If cities are complex adaptive systems (J. Holland, 1995), their functioning and all interactions among their own internal structures could use as possible models plural examples, starting from our neuronal system till the immune one. This comparison has to deal with the complexity, which those systems have in common, but it is also based on their prompt responsiveness to stimulations coming from external context that systems must metabolize in order to evolve and mutate into “something else”.

Success of cities and languages (meaning survival and an optimized way of functioning and developing) is therefore crucially based on the capability of reacting to a constant changing environment whether this is shaped by social, economical, ecological and cultural agents. The next challenge should be then to “identify and build new common goals” safeguarding pluralism and heterogeneity as basic elements of a “collective intelligence”, our greatest resource.

**Keywords:** Collective intelligence, Urban adaptive systems, Responsiveness

### 1. Introduction

*“Cities have the capability of providing something for everybody... only when they are created by everybody”*. - Jane Jacobs

In this paper cities will be associated to other complex adaptive system not only to clarify and explain their functioning, but in order to discover - looking to a series of natural and artificial systems - how to implement the quality and the synergy among people who resides in them, strengthening the interaction among city users to create a better social, economical and ecological environment thanks to our capability of connecting our “minds” and working together gradually but exponentially also through the use of new technologies.

### 2. Urban adaptive systems and CAS (Complex Adaptive Systems)

In 1995 John Holland in his book “hidden order”, has highlighted many correspondences among certain systems, which he defined complex and how important is their tendency to change and mutate, through adaptability.



He clarified that those systems work as a whole, an unique entity despite they are composed of an enormous amount of elements, capable at the same time to maintain a certain degree of coherence.

“The human immune system,” he declared, “is a community made up of large numbers of highly mobile units called antibodies that continually repel or destroy an ever-changing cast of invaders called antigens. The invaders - primarily biochemical, bacteria, and viruses - come in endless varieties, different from one to one as snowflakes. Because of this variety and because new invaders are always appearing, the immune system cannot simply list all possible invaders. It must change or adapt its antibodies to new invaders as they appear, never settling to a fixed configuration. Despite its protean nature, the immune system maintains an impressive coherence. Indeed, your immune system is coherent enough to provide a satisfactory scientific definition of your identity. It is so good at distinguishing you from the rest of the world that it will reject cells from any other human” (Holland J., 1995).

The above definition, founds a profound connection with the way cities work, it is therefore evident that the comparison of those “invaders” to the continuous “stimulations” that cities have to stand, starting by accepting new fluxes of population and ending by dealing with economical crisis or lack of infrastructures or services, evokes many similarities.

And “the mystery deepens when we observe the kaleidoscopic nature of large cities. Buyers, sellers, administrations, streets, bridges, and buildings are always changing, so that a city’s coherence is somehow imposed on a perpetual flux of people and structures. Like the standing wave in front of a rock in a fast-moving stream, a city is a pattern in time. No single constituent remains in place, but the city persists.

What enables cities to retain their coherence despite continual disruptions and a lack of central planning?” (Ivi, p.1)

Certainly a lot has to do with the capability of the single elements (which are people, institutions, classes of professionals and so on) not to act following purely their own goals (which is also necessary for survival) but most of all interacting with their “neighbours” targeting common interests in the fastest and most performing way.

If we “consider the mammalian central nervous system (CNS),...it consists of a large number of component cells, called neurons, that occur in a wide range of forms.

Even a simple CNS consists of hundreds of millions of neurons, of hundreds of types, and each neuron directly contacts hundreds, even thousands, of other neurons to form a complex network. Though the activity of an individual neuron can be complex, it is clear that the behaviour of the CNS aggregate identity is much more complex than the sum of these individual activities. The behaviour of the central nervous system depends on the interactions much more than the actions. The sheer number of interactions – hundreds of millions of neurons, each undergoing thousands of simultaneous interactions in thousands of a second- takes us well beyond any of our experience with machines” (Ivi, p. 3).

It is because of this great communication and the faculty of responding to different stimulations, providing fast answers, that our brain has granted us survival.

Cities are not so far from our CNS and actually they recall an even greatest challenge: pull together an enormous amount of humans and a galaxy of different neuronal systems and let them work together in a very tight space. New spaces of interaction will be the test for all physical and non physical connections, and if in the past those connections were much weaker cause we used to live more separated from each other if not almost disconnected, today our ability to handle problems should be faster establishing a “very oiled connection system” mostly “instantaneous” because developed through the “network”.

### **3. Mutation and responsiveness to stimulations**

The comparison among different “living systems” such as cities, “organisms” and “urban ecosystems”, takes into account the complexity which those structures have in common and the fact that any successful system in order to evolve and mutate into “something else”, must be based on its prompt responsiveness to stimulations coming from external context and a very effective process of metabolism.

“The city - or at least many of its traditional manifestations– today tends to "explode," scattering over a

distance, and this explosion appears to impact –with greater or lesser force and density– our surroundings, thus affirming this increasingly ambivalent, heterogeneous and dynamic state of progressively entropic growths.

(...) They are not, strictly speaking, (stable) forms but (evolutionary) formations: open trajectories that –like the societies linked within them– fluctuate, change, shudder and alter, therefore manifesting an uncertain character: their movements synthesize, in effect, infinite interactive processes of dynamics and distortions, systems and contingencies, global logics and local situations, growing in complexity –and in diversity– just as they grow in and deal simultaneously with mobility, communication and exchanges between multiple levels of information”<sup>1</sup>.

But are the above only “metaphors, or is there quantitative and predictive substance in the implication that social organizations are extensions of biology, satisfying similar principles and constraints? Are the structures and dynamics that evolved with human socialization fundamentally different from those in biology? “

Many characteristics of the city behaviour and data collected with time demonstrate that is possible to “provide a framework for the construction of a quantitative theory of the average city, which would incorporate, for example, the roles of innovation and economies of scale and predictions for growth trajectories, levels of social and economic development, and ecological footprints” (Bettencourt L. M. A., West G. B. et al., 2007) and that presumably as fast a city is capable to front certain problems and answer to them, as fast is capable to satisfy and offer certain services, starting from the ability of solving different emergencies in the street like car crashes or fire explosions (that might create a collapse on the transportation system) , or differentiate activities for all the different ages of population, as much the city is successful.

This is not based only on the amount of resources we have but in the capacity to organize them in the best way, even what might seem a waste, often in reality, is simply not properly used or taken into consideration. Examples are different and we could start from the fascinating way of approaching recycling matters, and reuse of materials, buildings or energy, till the majority of social issues such as the integration of elderly people, that should not be seen just as a problem but as a great resource to help, for example, young working couples in need of assistance for their children, or simply as a “factor of control for public spaces”. Prompt responsiveness does not mean just solving problems on real time, but learn from them and act in long term like an organism (mammalian nervous system) able to store, elaborate information, and define new strategies to avoid again most dangerous situations or eventually being able to handle them in the best way.

From this perspective, complex adaptive systems have the capability to collect information and “learn from them”. Those systems, like cities, are eventually “self-organizing”, meaning being able to make the most of the complexity of the infinite information gathered from all different elements, which are partially responding to singular stimulations but at the same time transferring to the entire system (that we said works as a whole) the information granted in order to spread such information to all the other parts, so that “local information can lead to global wisdom”(Johnson S., 2001).

All the other “parts” make the same so that the continuous exchange and feedback among all the “components” creates a sort of consciousness in the organism and a simultaneous evolution of the system based on billions of data collected.

Such approach overcomes primordial instincts or basic singular senses, because is granted and realized by a common intelligent attitude to share all records, evaluating them through a series of statistics based on a constant flow of information granted by individuals (or in general agents) who act independently for their own good but also collectively in order to achieve certain results in short and long terms (Cfr. Kosslyn S. M., 2006).

So the best cities of today in terms of efficiency, quality of life, etc...are for example those which have differentiated in the last decades transports, and that, starting from streets, have built contemporarily an

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<sup>1</sup> Gausa M., *Multi-cities, geo-urbanities, hyper-territories*, in <http://architettura.it/files/20030831/index.htm>

efficient systems of undergrounds and over grounds, of buses independent lanes and cycle paths. This has something to do with a reasonable way of developing more sustainable means of transport, but most of all (at least at the beginning with undergrounds) the need of differentiating a way to distribute lymph to the cities in a most efficient way before letting them collapse on their own traffic jam.

It is plain to the eye of everyone that cities without an efficient public transport system are destined to implode into themselves. This does not mean to delete cars, closing streets to stop the traffic, but simply demonstrates what “prompt responsiveness” to needs is meant to be.

This has a lot to do with economical factors regulated on the efficiency of movement in the city fabric, but also with many others like the health of inhabitants who needs to live in a less polluted environment, or the assistance to certain groups of population like elderly or teenagers that are the most incapable to move with their own car.

The majority of those cities “capable to face all different people needs, integrate different groups, prompt to change their infrastructures and built fabric, able to welcome new inhabitants” are turning into Metropolis or Mega-conurbation colonized by millions of “users”, and has been demonstrated that their “knowledge spillovers drive growth, that such spillovers in turn drive urban agglomeration, and that larger cities are associated with higher levels of productivity. Wages, income, growth, domestic product, bank deposits, as well as rates of invention, measured by new patents and employment in creative sectors all scale superlinearly with city size, over different years and nations with exponents that, although differing in detail, are statistically consistent. Costs, such as housing, similarly scale superlinearly, approximately mirroring increases in average wealth”(Bettencourt L. M. A., West G. B. et al., 2007).

#### **4. Knowledge spillovers and collective intelligence**

Based on those premises and observations, it appears correct to consider cities as the most important places where the future of humanity will have to deal with coming changes and challenges, and it is even more understandable that the competence to face those transformations are strictly related to our aptitude to collaborate with each other and connect our intelligences in order to solve problems and increase the quality of our lifestyle.

But if it is true on one side that many qualitative elements improve with the agglomeration, on the other side “super linear” phenomena concern also an increase in “urban crime rates, rates of spread of infectious diseases such as AIDS, and even pedestrian walking speeds” (Ibidem).

Following recent studies (Ibidem) and the fact that those phenomena can be definitely modified and adjusted, we can set a series of “common goals” in order to create a better social, economical and ecological environment.

We should look up to the stated problems and use our collaborative approach to decrease bad habits and implement good attitudes, safeguarding our differences and giving each other all the possible means to fight and overcome them. After all we have been doing it in the past and teamwork has given us best chances of survival, starting when we joined our forces in hunting bigger preys and culminating in the differentiation and specialisation of disciplines that improves the speed of research fighting diseases or implementing communication through the globe to predict weather catastrophes and support our “neighbours”.

Today, thanks to information technologies, our potential is raised exponentially so we have very powerful tools that a new social and cultural revolution should warmly support.

Finally we can cultivate the flourishing age of a real global “collective intelligence”, “a form of universally distributed intelligence, constantly enhanced, coordinated in real time, and resulting in the effective mobilization of skills... No one knows everything, everyone knows something, all knowledge resides in humanity... New communications systems should provide members of a community with the means to coordinate their interactions within the same virtual universe of knowledge. This is not simply a matter of modelling the conventional physical environment, but of enabling members of delocalized communities to interact within a mobile landscape of signification... Before we can mobilize skills, we have to identify them. And to do so, we have to recognize them in all their diversity... The ideal of collective intelligence implies the technical, economic, legal, and human enhancement of a universally distributed intelligence that

will unleash a positive dynamic of recognition and skills mobilisation" (Lévy P., 1994).

A serious and complex approach to cities and human problems capable to elaborate the infinite amount of data we have, organising and filtering them, is needed in order to promote a constant and updated knowledge able to provide tangible results: politically, economically and socially.

But implementation is not based as explained previously just on the promptness of solving problem but, especially on long terms, on the ability to ameliorate gradually our way of acting and living.

The most contemporary researches from IBM explain: "today's cities can collect and analyze data to monitor, measure and manage the complex systems that facilitate life in urban environments.

They can understand how transportation, water and energy systems interact, and optimize their operations, individually or collectively. They can predict the impact of changes to the public safety system on adjacent systems, such as education, healthcare and social services. In doing so, they can make confident, informed decisions that will reduce costs and improve living conditions citywide.

In particular, we are seeing the most advanced cities focus on three areas of expertise:

- Leveraging information to make better decisions, which means that using advanced analytics solutions, both structured and unstructured data can reveal insights that make it easier to understand and to act at every level of city administration, from the mayor's office to the subway train conductor;
- Anticipating and resolving problems proactively, with the chance to spend funding effectively on time where is most needed;
- Coordinating resources to operate more efficiently (for example, a simple lack of coordination may result in the city and private enterprises digging up the same road twice within the same week. At times, this lack of coordination can be even more expensive and inconvenient, such as when flooding waste water systems cause electrical outages that shut down traffic lights and require public safety intervention)"(IBM, 2012).

## 5. Conclusions

All above issues are just a small amount compared to the relevant number of topics that we may consider and start to work on.

Certainly all the instruments that are at our disposal should not remain simple utensils to be passively used, but become smart devices to inform all the vital processes of the city and life in general.

At the same time governments should profit from the information that city users can spontaneously put at their disposal. When for instance we travel with our smart phones in our pockets and these are activated to send signals to "transport government headquarters" showing the level of traffic in the streets, it could be useful on one hand to users in order to find alternative path to their destination and on the other to dedicated public structures -in order to manage flows of traffic during different hours of the day- to prevent problems or simply reduce the traffic. There are loads of others examples in which the communication of information can institute virtuous processes that can help administrations and inhabitants.

The strong interconnections among all cities, humans, technologies, has never been so tight and capable of stimulating all the other disciplines at the same time. Technology is not merely a mean to communicate but actually is a real extension of our neuronal system.

This way of looking at it holds much further implications considering our instruments a way to overcome our physical and mental limits, but also the "place where our brain spreads out" and creates new possibilities pushing the boundaries of new objectives.

Internet is a new tool and a powerful door as well, able to give us access to all the other human knowledge. So virtually, our brain, memory, way of learning and support others, extends till the furthest periphery of the network.

As S. Kosslyn mentioned on "the role of social prosthetic systems" "we rely on other people as extensions of ourselves. Specifically, we rely on other people to extend our cognitive and emotional capacities. Others help us formulate alternatives, evaluate options, and make decisions; others also help us interpret and control our emotions. Evolution has allowed our brains to be configured during development so that we are "plug compatible" with other humans, so that others can help us extend ourselves"(Kosslyn S. M.,

2006).

Such synchronized and complex approach, inclined to show what collective intelligence means, combined with the speed of dialog through Internet, is one of the most powerful instruments we ever had.

This way of exploiting our new tools and the new web language can lead humanity, if well structured and developed, to an higher degree of consciousness and knowledge; and this will constantly happen all the time stereotypes or faulty forms of functioning of existing systems will be criticised and revised with the perpetual support of individual and plural intelligence. This likely will not turn into past conformism, but contrary to this will give humanity many different perspectives creating an open process of innovation and research evolving increasingly.

One of the implications of this idea is that “diversity is not a luxury, but rather is essential in many walks of life. Think about why a carpenter has many different devices in his toolbox. It's impossible to know in advance what challenges the environment will produce, and what abilities will need to be marshalled - and if you need abilities you don't possess, you'll need to draw on others as prosthetic devices. Variety is more than the spice of life - it's the essence of life”(Ivi, p. 549).

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