SURNAME: ORTOLANI
NAME: CHIARA
MAIL: chiara.ortolani@uniroma1.it
ORGANISATION: Laboratory “Inhabiting the City", Sapienza University of Rome Department of Civil Engineering, Construction and Environmental (DICEA)
AXE: Commons
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Rebuilding relationships: from the competitiveness tree to the well-being tree

Abstract

Since 1950 there has been a huge worldwide increase in the percentage of population living within cities. The trend shows no sign of stopping - for the next 20 years, the flow of people is predicted to continue soaring. It assumes also that in 2030 this percentage will exceed 60%.
Furthermore the great contemporary global cities play, both in cross-border regions that in those sub-regional, the function of: a) point of power in the organization of economy, b) essential marketplaces for the leading industries of the current period, and the finance and the specialized services to the industries, and c) the most important area in which industries produce research and innovations too[1].
Therefore, great cities are both the places where a large numbers of people are concentrated and focal points for the growth at regional, national and international level.
Perhaps, besides the number of people living in the cities, one should consider the urban planning model chosen. Indeed, the contemporary city has been realised by considering private cars as a key element for internal and external mobility. This has led to a radical change both in lifestyle of people and policies and, in any case, to the increase of resource’s consumption (soil, water, time, material property) and services. In fact, today urban services are considered to be as supporting of the consumption’s policy because "they destroy the autonomy of men forcing - through changes of laws, environment and social structures - to become external assistances users”[2].
The western metropolitan cities were an important model for civil development, which was based on consumerism. However, it did not give rise to a widespread welfare, but instead, gave rise to numerous and increasingly large sacks of poverty and social exclusion. Under these conditions, the new deal of the economic degrowth means to rely on "energies" different from those upon which is based the contemporary city.
Energy, in this case, means renewable energy, which, however, has much lower EROEI than fossil fuels. Therefore, it must be accompanied by a change of habits of people, by a return to the use of individual physical and intellectual energies for purposes that affect the well-being of both communities and individuals but also the synergy among individuals. Either the western metropolitan cities or those of developing countries can escape from poverty (material and immaterial) coming back to a local production and consuming what is needed for their lives and well-being.
Poverty is growing in a world where basic necessities are increasing and induced by industrial products, generating a gap between the riches and the poor. .
As a consequence, it is necessary to reconstruct the social equity, environmental sustainability, economic resilience and renewable energies for the metropolitan cities and their neighbourhoods. It is necessary to rebuild their ability to absorb changes without collapsing and to reorganize them in a

[1] Sassen, 1997, p.33
[2] Illich, 1981, p.13

qualitatively different state from the present by controlling different structural and functional processes.
The extreme specialization of several parts of a metropolitan city carries out to the corrosion of functional relationships which are essential for the restoration of environmental sustainability and social equity, based on sharing of territory throughout people's relationships.
The dissolution of these relationships brings to the progressive dismantling of the local economies and to low attention for the consequences of deleterious anthropogenic activities occurring inside the urban system.
Through systems thinking and choosing the neighbourhood as preferred scale of action and observation, you can turn the vision bringing to the fore the local dimension and the needs and possibilities of people groped for a rebalancing of the global dimension that now is predominant**.**

Keywords: Urban growth, connectivity, self-organization, resilient relations, road network

1. Introduction

Urban growth
The city has become the place where a large part of the world's population is concentrated. In 1970 the urban population was less than a third (about 736 million people) of the world's population (about 2.535 billion). In 2010 rose to about 50% (about 3.494 billion people live in urban areas compared to a total of 6.906 billion) and it is expected that by 2050, the proportion of population urbanized will become the 70% (about 6.398 billion out of a total of 9.191 billion) (UN Population Division, 2007).
This increase in urbanized population, however, explains only a small part of the growth process carrying to an enhancement of the urban areas, and reducing the natural and semi-natural landscapes.
In Europe, about 75% of population lives in urban areas, which cover more than 25% of the European territory (EEA, 2006). About 20% of the EU population lives in large conurbations of more than 250.000 inhabitants, and another 20% lives in medium-sized cities counting from 50.000 to 250.000 inhabitants, whereas the 40% lives in small towns (10.000 to 50.000) (EU Regional Policy, 2007). This extensive land use of the urbanized areas can be distinguished into two phases: firstly, compact urban growth and secondly, urban sprawl.
The first phase is characterized by a high growth of the existing city (Schneider & Woodcock, 2008), still tied to population growth (EEA, 2006; Insolera, 1993) by increasing the height of buildings and filling voids. This first phase culminated in the 50s of the twentieth century: during this decade the average annual urban growth peaked at 3.3% (EEA, 2006).
The second phase began in the mid-50s, and it was characterized by a change in the principle of urban growth: the surrounding countryside began to be eroded, thereby giving rise to a new growth model called urban sprawl and characterized by low density areas and by edge areas separated from existing core by the presence of agricultural enclaves (Salvati et al.,2012; Insolera,1993; Antrop,2000; Antrop, 2004; EEA, 2009; Richardson and Bae,2004).
During this second phase, the population of metropolitan areas continued to grow until the '70s. From these years, the population began to decrease (EEA, 2011). Finally, from the '90s to 2011, the urban population (in the 15 EU countries) began to grow again (EU Regional Policy, 2007). This growth, however, has concerned the areas of external belt more than the central cores, even if with different intensities. This is due to economic changes, which affected all developed countries, changing thus the organizational and territorial characteristics of the involved cities (European Institute of Urban Affairs, 1992, Eurocities, 1989; Sassen, 1997).

Economic processes underlying the organizational and t spatial changes
Since the early 80s, the interests and needs of companies of various productive sectors affected the urban growth. Great amounts of the production, capitals and consumption goods moved into regions

providing cheap labour (both internal and external to EU's countries), due to globalization, technological changes and European integration (Eurostat, 2007, EEA, 2009).
As a consequence, many urban economies have been oriented to respond to increasing demand and production of services by enterprises (Sassen, 1997, EEA, 2009). A new economic core of banking (finance) and services becomes important to the overall economy of the city, even if it is only a fraction of this (Sassen, 1997).
The Tree of competitiveness (EU Regional Policy, 2007) illustrates how all the resources (roots) are committed to the best outcome of the industrial structure and productivity, and like other sectors depend on these . If industrial structure means the new economic urban core then it is comprehensible that high profits (so typical of the financial activities) may make difficult to the other sectors a genuine competition till recession or extinction.
An example could derive from the neighbourhood shops, established to meet the local needs; They have been replaced by large shopping centres, in the suburban areas, whereas in the central areas they have been replaced by boutiques, restaurants and high standard hotels designed for the opulent elites which are indifferent to local necessities of the medium and low people's classes (Sassen, 1997). Looking at these dynamics and to the resulting increase in property prices in central areas, we are witnessing a progressive reduction of population and the transferring in more external areas of inhabitants towards the edge zones and neighbouring municipalities.

Private car dependence. Environmental and social consequences.

Thees reported above have defined an urban model characterized by the dispersion of settlements and low density of inhabitants, carrying to the private car dependence for movements the (Rodrigue et al., 2009; EEA, 2009). This dependence leads to an increase in car ownership in the world especially in urban areas: in 1990 vehicles produced were between 34 and 40 million and in 2006 have exceeded 50 million. Worldwide, there are about 12 people per car and a significant share of the growth in car production is attributed to the motorization of developing countries (Rodrigue et al., 2009). For this reason, fossil fuels are the largest responsible for global warming and to achieving in short-term of the peak in the oil production (Hubbert, 1956). Fossil fuels, in fact, contribute with the 96.5% to the increase of CO_2 emissions (IPCC 2007; U.S.EPA, 2010). This increase of CO_2 concentration has caused an increase of the average global temperature of 0.8 ° C (Hansen et al., 2005) and several studies indicate that each degree increase in temperature of the earth is the cause of new and increasingly catastrophic events with large-scale impact.
The three sectors that use as much fossil fuels are, in order, the transport sector, the industrial and utility sectors. The 99% of the energy used for transport comes from the use of fossil fuels (U.S.EPA, 2010). Most of the travels causing these levels of fossil fuel consumption and greenhouse gas emissions are related to the urban areas. In Italy, a significant percentage of these travel concerns far short distances and proximity. In fact, in larger cities about 50% of car trips covers distances equal to or less than 5km and about 20% of the total covers distances of less than or equal to 2km (ISFORT, 2009). About the use of the car, the home-school trips have a considerable weight also . Choosing the car to cover such low distances seems to depend on inadeguate structure of public space and distribution of functions related to the daily life, which do not provide satisfying levels of safety, comfort and pleasure for moving without the use of motorized vehicles.
This car dependence has multiple causes such as the increase of the distances (between different urban centres), and lowing of the oil price. In this way, needs of movement and stopping of the car have assumed great importance. The increase of urban space is then used to solve these necessities at the expense of the public space that is reduced. The increase of the mobility by cars (EEA, 2009), at the same time, reduces accessibility at different parts of the city for pedestrians or people moving by other non-motorized and few space remains for encounters, free time and free play for children. The increase of the distance between people and the low local knowledge carry to a reduced quality of life, social segregation and reduced sense of community by the residents (UN-HABITAT, 2009; Berdini, 2010;).

Aim of the paper

The break-up of relationships is part of a series of actions reinforcing each other, and that it has its initial cause in the current economic and energy use model that lead to organizational and territorial changes.

Governments and companies should reconsider their energy policies by considering other energy sources that can replace oil and natural gas. Among the solutions considered uranium, coal and hydrogen have been considered, yet. However, as well as oil and natural gas, these energy sources are non-renewable energies (and therefore subject to the cycle of Hubbert) (Hubbert,1956) and not sustainable for environment.

Another solution could be in renewables. These have a completely different behaviour: their production follows a logistic curve that is stabilized with the saturation of the available area. The problem lies, in the fact that, even if the coefficient of EROEI on the production of global oil is constantly dropped from the 30s reaching an average of 20:1 - for each unit of energy used in the extraction process if they get about 20 units -, no other energy source can claim such high coefficients except that hydropower that decay, however, with the basin degradation (wind 11:1 and photovoltaic between 2.5:1 and 4.3:1).

So, it seems impossible that a consumer and capitalist society, which is based on the structural growth and increasing of consumptions, can find in the renewable energies (and in the energy saving), a valid substitute to fossil fuel, without which, in this passage, there is a widening of the existing sacks of poverty and social exclusion.

This step, in order to obtain positive results, cannot take place without there being a change in the shape, structure and processes of the current development system in general, and the city in particular.

In fact, the current urban form is based on a high consumption of soil and energy causing, in turn, the breakage of important relationships between those who live in a place and the place itself. Under these conditions, the resilience of a city or of its parts cannot longer guaranteed.

This paper aims to bring to light the linkage between the actual structure of cities and their scarce ability to reorganize without serious social and economic consequences. It will also suggest the choice of the size of neighbourhood as preferential scale of action and observation to groped a balance between the weight of local relations and global relations. The formers are resilient relations, linked to the needs and capabilities of people. The latters are relations of dependence, linked to the needs of the market, causing system vulnerability but, actually, these are dominant.

2. Shape, structure and processes of the contemporary city

In Europe, the 4% of the total area consists of artificial land cover. However, due to the urban dispersion, about a quarter of Europe is really affected by urban settlements (EEA, 2011). The growth of the continuous areas takes place with a speed of four times lower than the areas discontinuous and it is not expected that this expansion will stop in the future (EEA, 2009).

Italy, which falls in the area identified as the backbone of the European Megalopolis which are the major urban areas (EEA, 2011), has 500 km^2 of urbanised land per year (Ambiente Italia, 2011) for a total of 2,350,000 hectares of artificial land coverage - the 7.6% of the national territory (Ambiente Italia, 2011).

Similarly to Europe, this artificial land cover in Italy is happening mostly at the expense of agricultural land, favouring discontinuous settlements at low density, separated among them and from the compact city to agricultural enclave of poor consistency.

One example is the city of Rome. In this city, the not permeable of the total municipal area, between 1990 and 2008, increased from 19.3% to 26.1%. In 1990 the acres of impervious surface were in fact 25,285 and, in 2008, they were 34,068 (ISPRA, 2010).

Great part of this urbanized area was characterised by low densities (Salvati et al., 2012). The decrease of the density means a greater diffusion of urbanized area and a reduction of natural and

semi-natural areas, but also leads to a change of the conformation of the tissue, by changing the individual and macro-blocks structure.
The variety of fabrics in Rome depends on the variety of dimensional and formal characteristics of the buildings and public and private open spaces. The fabrics, considered as homogeneous components of the city, based on morphological characteristics have been all identified (Cappuccitti and Piroddi, 2004), and referring to three different periods: pre-modern (the city built until the Unification of Italy), modern (from Unification of Italy until 1945) and contemporary (1945) (Cappuccitti, 2006).
Among the identified fabrics (Table 1), the more extensive ones are the "fine-grained reticular tissues" (low-density residential areas) and the "open forms" (especially public housing settlements often conceived as autonomous parts of the city, both morphologically that functionally, or as vectors for regeneration for the neighbouring squatters tissues). Smaller but still significant are the reticular or organic fabrics at medium grain, mainly generated by residential building, sort in according to the logic of incremental completion and in the absence of morphological development criteria of relevance (Cappuccitti, 2006).

Aree omogenee	Estensione (ha)	% della superficie complessiva dei tessuti
Intricate compact fabrics	386.0	3.0
Reticular fine-grain fabrics	3992.3	31.9
Reticular medium-grain fabrics	1659.6	13.3
Reticular coarse grain fabrics	715.7	5.7
Organic fine-grain fabrics	146.0	1.1
Organic medium-grain fabrics	529.7	4.2
Organic coarse grain fabrics	2174.1	17.3
Fabric fragments and composite fabrics	43.4	0.3
Open forms	2306.2	18.4
Buildings and complexes specialized for large equipment	613.4	4.9
Production and commercial buildings and complexes	928.7	7.4

Tab.1 - Fabrics types and their extension Source: Cappuccitti, 2006

Morphological and functional differences between the two types of homogeneous areas of greater extension (reticular fabric fine-grained and form open) can be analysed. It also interesting to compare these two types of homogeneous areas with homogeneous one consisting of reticular tissue medium-grained, and belonging to the compact city and not affected by the reduction of population that involve instead the neighbourhoods of the city.
Considering the Fine-Grain Fabrics (FF) the neighbourhood called Villaggio Prenestino (VIII district of the municipality of Rome) was analysed. This district is outside the GRA of about 8 km and was realised as a spontaneous sub-urban area. The spontaneous fabric is developed in origin along the path constituted by Via del Fosso dell'Osa and Via del Fosso Siciliano. These roads actually represent the main axis of the neighbourhood that allow the crossing and communication with the neighbouring districts. Moreover, in relation to the Open Form (OF) the district of Nuova Ponte di Nona (VIII district of the municipality of Rome) from the name of the main street of the neighborhood itself was analysed. Located on the eastern outskirts of the city above a previous agricultural land cultivated until the early 90s, it is outside the GRA of about 6 km. The project dates back to 1988 and the realization is of 2005-07. In December 2007, had about 20,000 inhabitants, but they are expected between 40,000 and 50,000. Furthermore, the area chosen for the comparison between the city sprawl and compact one is Monteverde (XVI district of the municipality of Rome). The main structure of the roads of this district was planned with the Master Plan of 1909. This is characterized by a Medium Grain Fabric (MF) which is another type of fabric which, within the city of Rome, has a relevant consistency.
An analysis regarding the morphology, structure and existing functions was conducted in the above mentioned districts to evaluate the extent to: total area, built core, streets, number of intersections,

public space and vehicle space (Tab.1 and 2). Was measured their extension to the shops and commercial building too (Tab1). With regard the building schools was analysed their presence and the location (Tab1 and 2). Was calculated their ratio (Tab.3). Shops, commercial buildings and school buildings are the functional services that most affect the daily life of the inhabitants. Furthermore, taking a macro-area with side of 250m (Cappuccitti, 2006) for each of the three areas, it was possible to make a comparison about the size of streets, squares, parking and spaces that originally were not intended only as parking spaces.

	Fine-Grain Fabrics (Villaggio Falcone)	Open Form (Nuova Ponte di Nona)	Medium Grain Fabric (Monteverde)
Total area (mq)	2,291,539.68	3,195,752.57	1,342,759.71
Built core (mq)	1,200,129.72	1,521,536.05	1,342,759.71
Streets (ml)	792.81	669.48	1,709.80
Number of intersections	6	4	12
Public space (mq)	7,996.76	30,519.78	25,153.03
Space dedicated to parking and movement of vehicles (mq)	6,426.55	25,301.35	16,847.59
Commercial buildings - covered surface (mq)	0	91,506.10	0
Shops (ml)	490.23	924.28	7,172.70

Tab.2 – Size of the spatial elements of the tissues and of the space used for the trade

	Fine-Grain Fabrics (Villaggio Falcone)	Open Form (Nuova Ponte di Nona)	Fine-Grain Fabrics (Villaggio Falcone)
Presence of kindergartens	1	2	5
Presence of elementary schools	2	1	5
Presence of middle schools	1	1	2
Presence of secondary schools	0	0	4

Tab.3 – Presence and educational degree of school buildings

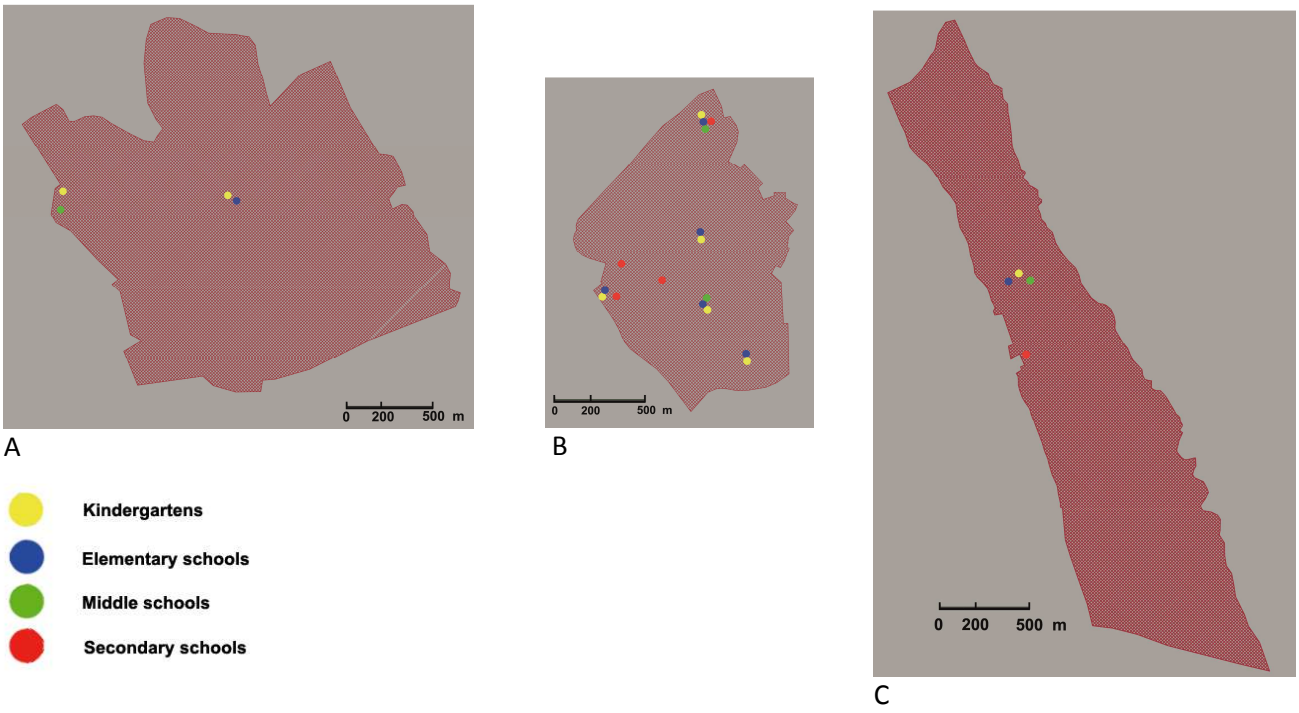


Figure 1- Location of school buildings. A: Open Form (OF); B: Medium Grain Fabric (MF) C: Fine-Grain Fabrics (FF);

	Fine-Grain Fabrics (Villaggio Falcone)	Open Form (Nuova Ponte di Nona)	Medium Grain Fabric (Monteverde)
Built core /Total area (%)	52	47,6	100
Space public/Core built (%)	0,66	2	1,87
Vehicles space/Core built (%)	0,53	1,66	1,25
Vehicles space/Public Space (%)	80,4	82,9	67

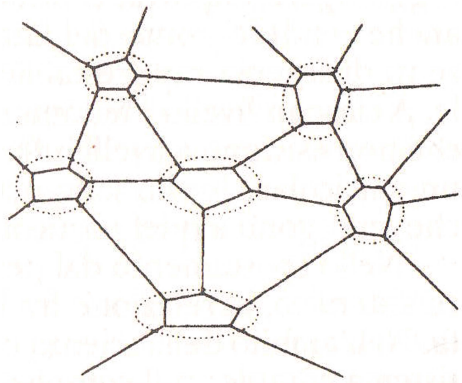
Tab.4: Ratio among the spatial elements of the tissues

Hence, It is evident as in homogeneous areas undergone to the urban sprawl the road networks are reduced (and the streets for pedestrian are absent), although in the OF the surface of the roads is high. This is due to the fact that the road section is greater. Furthermore, compared to the area belonging to the compact city, the presence of commercial fronts is reduced to benefit of shopping centres. In fact, in relation to the commercial function, in the OF is preferred the concentration in mono-functional buildings whereas, in TF, the concentration in mono-functional buildings is almost completely absent and there are few neighbourhood shops. For buildings concerning the education, the situation is the same: while in TM there are the schools of all grades and they are spread evenly over the territory, in the other two cases there are not some types of schools and those present are united in the same place. The squares equipped and accessible for people are absent in TF and OF. The surfaces destined for parking are much greater in these rather that in TM where the current parking areas have not been designed basically only for this purpose.
The basic tenets of TF and OF, which reduce the complexity, connectivity and interaction between elements - streets, shops, offices, houses, green areas, squares, etc.-, are not able to generate comfortable, efficient and psychologically positive urban environments due to the lack of urban consistency, both formal and structural (Salingaros,2000). This deficiency is extremely evident in the road network, which also affected the morphology of the totality of urban public space and the built environment.

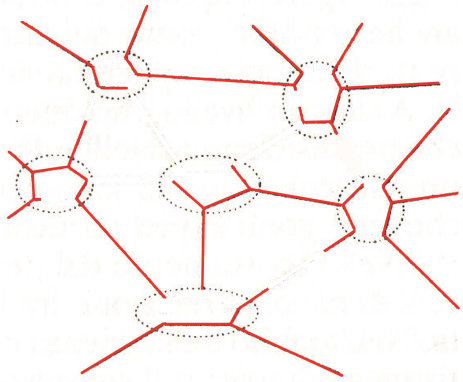
3. Resilient relationships and depending ones

These issues can be explored through systems thinking. While in the mechanistic point of view, the world takes the form from a set of objects, the systems thinking neglects the reasoning in terms of objects and assumes the living world as a network of relationships (Capra, 1996).
The essential properties of the complex systems (Edmonds, 2000 and 2010) derive from a configuration of ordered relationships (Capra, 1996) and this implies a certain form, a well-defined structure (with its schema) and a spec\ific process (Newman, 2003; Niklas, 1994; Samaniego, 2008).
The schema is the layout of the reports determining the essential characteristics of the system. The structure is the physical materialization of the organizational scheme of the system. The process is the activity necessary for continue materialization of the organizational scheme of the system and it is, therefore, the link between pattern and structure.
Fundamental property of the structure and of the schema, of a complex system, is the connectivity that is manifested by a reticular organization (Capra,1996). The higher the capacity of interconnection between components of a system, the greater is the difficulty that can be found in the break it down. These connections give shape and structure to the system. Hence their gradual disappearance fragment in isolated parts of the system determine the destruction of the systemic properties (Capra,1996).
The system connectivity is given by a set of sub-networks interconnected each other and allows the self-regulation of the system the ability and its self-organization.
These general concepts about the complex systems can be transposed to the urban system (Samaniego, 2008). In fact, as in any complex system, also in urban system the coherence between the elements, determined by certain rules of a general nature, represents a quality that allows to the

city to adapt to boundary conditions differently from the present ones and, at the same time, to ensure the well-being of its inhabitants even in the presence of major changes.



A) relationships graph in a complex intact system. Source Capra 1996, p.50



B) relationships graph in a complex System with reduced systemic capacity

Figure 2: Relationships graph

The scarcity of services needed to meet local daily necessities, and public spaces for meeting, playing and autonomous movements (without the use of transports) loads to the advantage for parking and circulation of cars. These conditions carry out to a reduction of the relationships of proximity. The dissolution of these relationships is either a cause or a consequence of the gradual dismantling of local economies, the reduction of widespread prosperity and a substantial disregard for the implications to the environmental system. Hence, the graph of the relations (Fig.2) related to the various urban sub-system (environmental, economic, socio-cultural, etc.) loses one of its priorities in order to be a resilient system: the connectivity (Casti, 1977). This loss, in turn, leads to the loss of the systemic capabilities in general and to the ability to self-organize by the system in particular.

Therefore, the relations of proximity are resilient relations (Casti, 1977), allowing the system to reorganize itself after destabilizing external events. Instead, the relationships of dependency are strengthened: for the energy supply, for the care and treatment of the sick (Illich, 1981), for the care of the places, for the care and education of children (Illich, 1981). In this way, the system becomes vulnerable.

If in the complex systems in general and in the urban system in particular, a specific form and related structure, underlying a specific process, it may act on the form and structure, with specific starting conditions, to change the process. So, it is possible to change the urban structure to create conditions for a possible reconnection of the broken relationships. Of course, because a complex system is a nested network of networks one can act at various levels on the urban structure and form.

Stead et al. (2001) identified three levels: strategic, local and neighbourhood level. According to this study we have that:

a) at the strategic level the urban form is more affected by:
- the location of new urban settlements in relation to the city centre, adjacent cities and existing infrastructure,
- the structure (shape and size) that the city assumes
- the type of land use and the global functional mix

b) at the local level the form of the city is more affected by
- the compactness of the settlement
- the degree of functional mix of land use at different scales and levels

c) at the neighbourhood level the form of a settlement is more influenced by:
- the density of population and employment
- the spatial configuration given by the type of fabric and by the characteristics of the street grid
- distribution of resources and residents

(adapted from Stead et al., 2001).

Obviously, the three levels cannot be considered disjointed elements, although they do influence each other.

4. The neighbourhood as a key element for the reconstruction of relations resilient

The dimension of the neighbourhood is important (Jacobs, 1961; Wellman, 1996; Castells, 1997), because it allows its residents to meet the small and everyday needs, functional and socializing, without the use of motor vehicles. Give strength to the size of the neighbourhood means then to work for revitalising the local economy, social relations of proximity and to contribute significantly to the reduction of emissions and energy consumption.

A high degree of mobility allows to remove residents from the opportunities (Levinson and Kumar, 1997; Sultana and Weber, 2007) a high degree of accessibility, instead, there is when opportunities and residents have a relationship of high proximity and when this relationship is more effective.

It is therefore necessary to think about the concept of accessibility. It has been treated so far especially considering the distribution of resources and residents (Hansen, 1959; Horner, 2004; Krizek, 2005; Kwan et al., 2003) but it is also important to consider the characteristics of the fabric and its road network. In fact, as in a body the cardiovascular system distributes energy and materials to the cells, so the road network (which, for its size, is the main component of the public space) distributes energy, people and materials in different places (Samaniego, 2008) . If the space needed for these transfers is not effective, the transfers themselves and therefore the relations are not effective (Samaniego, 2008). Analysing and working on the spatial networks that connect people and places is thus a good starting point to increase the accessibility and then rebuild the resilient relations.

According to the Allometry and Metabolic Scaling Theory (MST) in biology (Banavar et al.,1999; Brown et al., 2004; West et al., 1997) the characteristics of vascular networks determine, in an organism, its volume (Banavar et al., 1999; West et al.,1997), the velocity of the flows of energy and materials, growth (Moses et at.,2008; West et al., 2001), the duration of life (West and Brown, 2005) and other key features of the functioning of organisms (Brown and West, 2000).

Samaniego (2008) points out that according to the MTS, the networks that distribute the energy are characterized by hierarchical branching. Similarly, the urban road networks should distribute cars and people in the city through a hierarchical structure (Samaniego, 2008).

Within neighbourhoods, however, the road network has lost all hierarchical rank and it is standardised towards a model that allows for a greater mobility, but at the same time, it has reduced its accessibility degree.

However, road network has lost all hierarchical rank inside the neighbourhood, and it is standardized toward a model that allows for greater mobility, although it has reduced the degree of accessibility.

Searching for a high level of accessibility can be a starting point for reconnecting the broken linkages, and increasing thus the overall connectivity of local networks. This systemic reconnection can help to ameliorate the well-being of communities and individuals. Just as today the tree of competitiveness is gradually removing the lifeblood to well-being tree, reshape the form of public space (of which the road is the primary element) to increase accessibility could be a first step to getting a turnaround.

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