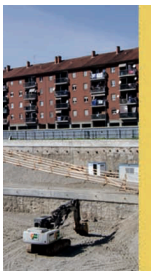

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Ecological urbanism

The eco-systemic framework of "informal" processes of urbanization

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"Informal" urban processes are increasingly expanding on the scarce fertile ground of the western outskirts of Cairo, populating unsteady waterfronts in Dar es Salaam, filling with pile-work shelters Lagos's lagoon. Such urbanization of "nature", raising issues of sustainability, overcomes the traditional urban/rural opposition and produces highly hybridized spaces, which may be interpreted at the scale of landscape urbanism (Waldheim, 2006, 2010) adopting an eco-systemic approach (Kay, 2008) and open ecological models (Odum, 1985).
A spontaneous, self-regulating, non-linear behavior defines the transformative nature of unplanned urban landscapes: rather than relying on a static state, they are constantly informed by fluxes of natural and cultural infrastructures, information and energetic chains structuring a distinct topography (Belanger, 2007). The field of urban action is an open exchange network system whose spatial and temporal dimensions are elastic, semi-stable or unstable, and multi-scalar. The terminological translation of such theoretical shift implies the development of flexible operational and working methods related to the progresses of new parametric and informational technologies (Corner, 2006) to adapt design to the multi-scale nature of contemporary urban landscape.

Keywords: landscape urbanism, ecological urbanism, eco-systemic models

1. Introduction

My research has been recently challenged by three different yet similar urban narratives facing some of the emerging issues of African cities: a huge increase in population, strong trends of migration towards cities and, in the meantime, severe consequences of climate change affecting urban environments. Triggered by economic pressure, "informal" urban expansion, still not taken in any adequate consideration by local authorities (Sakijege T., Lupala J., Sheuya S., 2012), is neither recent nor provisional: spreading rapidly into any available land, it oft populates inhospitable places where the relation with the environment is dramatic. Without going into the specifics of the three different situations, this research describes a relatively new

approach to their extreme complexity and spatial implications, as a support to traditional planning strategies.

2. Three narratives

The 17.3 million-inhabitant population of the Greater Cairo Region, increasing at a 2% yearly rate, is by the 63% living in the informal settlements (Sims D., Séjourné M., 2008). Whereas first residential developments may be dated back in the 50s and the 60s (Sims D., 2010;) (Sims D., Séjourné M., 2008), such trend of transformation, extremely accelerated in the last decades, has filled at a strong peace the gap between the city and small towns once structuring the rural landscape. Real estate perspectives, as compared to incomes form agricultural land use (Séjourné M., 2012)„ are valuable to farmers who keep fields under-cultivated, later declare them as no longer arable and sell them to unscrupulous building developers (Gertel J., Samir S., 2000; El Batran M., Arandel C., 1998). Such consolidated practice keeps producing a compact built environment based on solid building techniques, family-based aggregations and successive plot subdivisions.

Yet, when observed at a broader scale and in a long-term perspective, the shortening of limited fertile land, given the geographical and climatic location of Cairo within the regional scale, is extremely concerning and affecting at the national scale dynamics of food-import and water exploitation, which continues to be pumped out of Nile's decreasing water flow with little supervision (Gertel J., Samir S., 2000). As Belanger underlines "the history of agriculture, that of food production, energy resources, soil and water systems, cannot and should not be read as distinct from the history of urbanization" (Bélanger P., Roth C., 2011).

Dar es Salaam is the core of a 3 million inhabitants urban region, with an exploding growth rate of 4-5% per year in the last decade. The 80% of the population is living in informal haphazardly built settlements where healthy conditions, services, mobility and energy distribution are critical. Low-income dwellers mostly populate unsteady and vulnerable riverfronts, where the effects of climate change determine variations in precipitations and wind flows increasing frequency and intensity of floods. Since about 95% of the city is built on loamy soils of limited absorption and about 45% of the city area has a high water table, rainwater runoff is a permanent problem leading to an increase in malnutrition, diseases and climate-related injuries. Access to basic infrastructure services such as water supply, sewerage and waste management, storm-water drainage systems is limited [1]. Even so the unplanned city re-appears stubbornly after each flooding, despite of planning regulations.

Lagos is also a coastal city and top destination of internal migration: with a population of 15 million inhabitants, is one of the fast growing cities in the world. As Dar, it is seriously threatened by constant coastal erosion and increasing rainfall, which regularly flood the densely populated areas lying below sea level and cause major injuries. Among other parts of the city, the Makoko 150-year "slum" settlement, structured by shacks built on stilts on the lagoon water, is one of interest. Specific recurring distances and spatial relationships modulate internal logics of the settlement according to the spatial needs of local water-based transportation (Sakijenge T., Lupala J., Sheuya S., 2012). Although raising issues of critical sanitary conditions and questioning the ground-based landlord/tenant concept, Makoko's specificity deserves a proper effort towards legitimization and integration. Instead, Lagos government recently proceeded with immediate forced evictions to replace them with a megalopolis-style waterfront and therefore revealing an impasse in understanding and managing the "informal" settlements at a large urban scale as *de facto* parts of the city.

3. Why using ecology to describe the "informal"

"Informal" is a category that needs to be unpacked and much has been written about it (Davis M., 2006). Today it is clear that, given its extended dimensions, durability and target-differentiation, any negative definition does not fit properly such character of contemporary urbanism, which needs to be re-evaluated

(Gilbert A., 2007). Informal and spontaneous are rather the processes shaping the territory according to a performative use of space: the whole city is an exchange network system, where "fluxes of infrastructures, information technologies, energetic supply chains –such as water, power and fuel-, people and goods" (Corner J., 2006) are traceable. No longer understood as a tabula rasa upon which built forms are displaced, the broader urban context is a multi-dimensional system engaging integrated and hybridized cultural-natural ecologies (Nyamwanza A.M., 2012; Lister NM., 2010). Such state of continuous, various and even subversive transformation –so evident in the informal city- shows some reluctance to be approached traditionally. Given its complex relational nature, multiplicity and multi-layer state of continuous transformation, informal processes of urbanization resemble, and may be interpreted as, ecological processes.

Figure 1. *Ecological variables in Cairo's informal settlements (Antonia Chiesa)*

4. From ecological to eco-systemic

As mentioned, the recent escalation in severity of seasonal perturbations and large-scale natural hazards focused the attention on the cause-effect dynamics of urban transformation on the territory and, in general, on sustainability of urban growth, which, in the case of unplanned settlements, seems to be particularly crucial.

However, even if in recent years ecological terminology as applied to urban design has been fairly much used, it has rarely meant a rapprochement of environmental science and urban design culture. Yet the work of projective imagination is today challenged by calls for environmental remediation, ecological health and biodiversity to the design of alternate urban paradigms (Waldheim C.; 2010). Firstly triggered towards a shift in contents, urban design has recently considered ecology as a disciplinary field through which renovate terminology and borrow useful metaphors (Lister NM., 2010). In the specifics, through the hybridization with systemic thinking as applied to ecology, a theoretical framework for a better understanding of living systems' dynamics has supported design culture. Indeed, Odum's definition of ecosystem (Odum H. T., 1983) frames a community of living organisms - population and species- and the non-living environment as functioning together.

Lynch already worked on the idea of an urban ecosystem provided with a set of codified rules –the so called organized complexity (Lynch K., 1981) - and aiming to the state of a final balance; but his vision, as for the reductionist approach to the stability of systems and the climax theory, seems to reduce the level of sophistication and infinite combinations of variables interacting in the urban environment.

Belangèr (Belangèr P., 2010) suggests therefore a re-evaluation of open ecological models, such those by Odum (Odum H. T., 1983), to explain the multiple inputs and outputs contributing to the functioning of the system. Eco-systems deal with a tremendous amount of intertwined variables producing by interaction a multiplicity of results, which may be only partially controlled: a certain amount of unpredictability and

indeterminacy, together with diversity and complexity (Holling C. S., 1986), is therefore to be considered. As Kay explains (Kay J., 2008), complex systems self-organize through positive feedback loops, and their openness predisposes them to dramatic reorganizations at critical points of instability caused by self-amplified internal fluctuations.

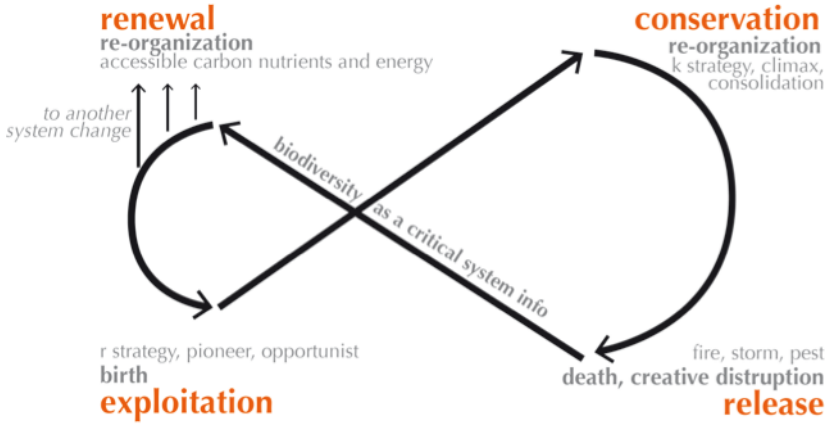

Figure 2. *Re-interpretation of Odum's open ecological models (Antonia Chiesa)*

A self-regulating, non-linear behavior may be observed and acknowledged in informal settlements as response to occurring changes in the system, such as flooding, forced evictions or layout of new high-speed infrastructure. The reaction to disturbance is one of self-adaptation through a buffering capacity (Kay J., 2008): up to a certain threshold ecosystems resist, then the change is abrupt and sudden; later on it reorganizes itself in a very dramatic and often unpredictable way generating new, partially unforeseen, patterns of development. This is the case of recurring migrations to any available, affordable site or also the development of parallel non-institutional, collective means transportation, such as the "dalla-dalla" in Dar and the "tuk-tuk" in Cairo, as efficient bottom-up response to urban challenges. The informal city represents a phase of urban transformation, as one step of the succession of semi-stable states, neither delicate or fragile, but dynamic and evolving. As eco-system approach suggests, a total recovery of all pre-existing conditions and former combination of elements is theoretically improbable, when not even desirable: urban management should therefore move towards integration rather then opposition to a supposed temporary phenomenon.

5. Resilience and adaptive design

Lister defines resilience as the "ability to recover from disturbance, to accommodate change, and to function in a state of health" (Lister NM., 2010) highlighting the inherent potential for adaptation of ecosystems. The concept has to be framed in Holling's distinction between engineering and ecological resilience. On the one hand the focus is the resistance to disturbances and the time required for a system to return to equilibrium or to a steady state after a perturbation or a disturbance (Gunderson L.H., 2000): a condition of global stability is therefore assumed as a given fact. On the other hand ecological resilience is concerned with the width of any stable state, and aims to measure the amount of disturbance which may be absorbed before the system changes its conditions. Such resilience, therefore, focuses on the tolerance of the system to perturbations in order to catalyze the evolution into more stable states [12]. Such theory aims to understand adaptive change from one state to another as well as cross-scale interactions – panarchy- and re-organisation after perturbations through adaptive cycles linked across spatial and temporal scales. The concept of adaptive capacity - the ability of a species to be able to live and reproduce in a certain range of environmental contingencies (Gallopin C., 2006) – seems to be suitable for describing

human-environmental or social-ecological systems; in fact it is a function of resources or assets inherent in and accessible to a given system deriving from natural, physical, human and social capital.
A resilient livelihood should have therefore a high adaptive capacity: a loss of adaptive capacity and therefore resilience would mean loss of opportunity and options during and after periods of stresses and shocks.

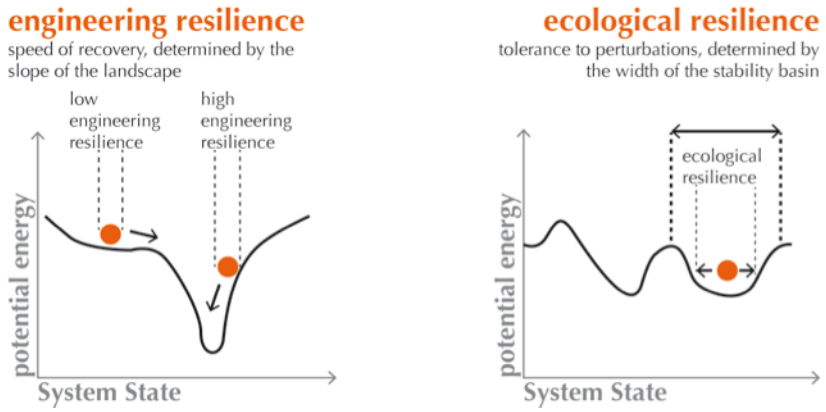

Figure 3. *Re-interpretation of Holling's distinction between engineering and ecological resilience (Antonia Chiesa)*

6. Implications of eco-systemic approach in urban design

In such theoretical context, the agency of design is aimed to the endorsement of ecosystem's resilience, where a compromised situation is declared and effective intervention is considered as necessary to speed up the recovery and catalyze the system to a more suitable or stable state. As for the case studies, design should move both towards an integration of bottom-up efficiencies (Kipper R., Fisher M., Howeidy A., 2009) and to a wiser human-ecological interaction. As Lister states (Lister NM., 2010), by introducing the concept of adaptive design, "These interventions and their forms must be both adaptive and resilient to sudden, discontinuous environmental change—change that is normal, but cannot be predicted with certainty or controlled completely".
Moreover, the concept of urban metabolism may be here recalled, since it acknowledges phases of transformation, substitution and maintenance of the urban fabric as processes regularly occurring in the life of a city. Contin interprets urban metabolism both as an analysis of the city and as a projective design catalyzing and triggering transformative operations within the urban fabric (Contin A., Sbacchi M. (eds.)„ 2007). Any input, as the layout or re-evaluation of an infrastructure, or the design of an urban park, produces indeed spillover effects in the surrounding landscape, and may trigger spatial regeneration.
In a broader sense the eco-systemic approach provide urban design with a flexible perspective over the city, encompassing the fluidity and flexibility of contemporary lifestyle and overcoming urban-rural boundaries (Mostafavi M., 2010). Moreover, if intended spatially, the eco-systemic approach merges the built and the un-built environments as a unique background to face ecological emergencies. Scarce or abundant, water is the common element to the three case studies, requiring both new and traditional technologies which may link ecological issues with geographical considerations and cultural specificity. Slope, permeability, drainage, climatic conditions determining evaporation - due to wind and heat – suggest that landscape is one of the privileged field of research to increase urban regeneration in compromised contexts, thanks to its connective, ecological and resilient role. Indeed, historically, ecology, planning and landscape architecture share themes and research within contemporary urbanism.
In particular landscape urbanism, even if considered as branch of landscape ecology (Waldheim C., 2006), represents a significant change to the analytical ecological approach: it indeed overcomes the traditional urban/rural opposition, considering the urbanization of "nature" as an opportunity to investigate highly

hybridized spaces which are considered as the given context of contemporary urbanism. Besides being a background, landscape becomes therefore the medium for the construction of the expanded city, as a layered multidimensional process influenced by social-cultural and political-economic dynamics.
The last implication is a matter of representation and imaging speculation, as for both the analysis of a site and the implementation of design strategies by subsequent phases: timing of transformation challenges design projects in its appropriateness and efficacy of expression. Yet Corner highlights the development of flexible operational and working methods related to the progresses of new parametric and informational technologies (Corner J., 2006) to adapt design to the multi-scale nature of contemporary urban landscape. Ecological processes inform the project through "a multiplicity of old and new methods, tools, and techniques in a cross-disciplinary and collaborative approach toward urbanism developed through lens of ecology" (Waldheim C., 2006).

7. Conclusions

Ecological terminology comes at hand in describing contemporary processes of urbanization, especially in the case of informal settlements. Urban design may benefit from such approach to improve the understanding and the theoretical framing of multiple dynamics, extended spatial implications, limited predictability of cultural and natural adaptation so that unplanned efficiencies and spontaneous phenomena may be better integrated and legitimated.

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