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Resilience and Transformation: Can We Have Both?

David C. Prosperi, Sofia Morgado

(Professor David C. Prosperi, Florida Atlantic University, 111 E. Las Olas Blvd, Fort Lauderdale, FL 33301, prosperi@fau.edu)
(Professor Sofia Morgado, Universida Tecnica de Lisboa, Lisbon, Portugal, sofiamorgado@mail.telepac.pt)

1 ABSTRACT

This is a theoretical paper that develops the argument that change is best understood in terms of complexity theories. Most existing change models based on comparative statics simply do not capture the dialectic processes by which change is initiated, carried out, and eventually observed. On the other hand, complexity theory includes a number of status concepts including "state", "resilience" and "transformation" along with process concepts such as "multiscalarity", non-linearities, and decision points such as the "edge of chaos". Of these, resilience has captured the attention of the academic and professional literatures. In America, Europe, and Asia, resilience is generally defined as the ability of a system to absorb change without altering its fundamental "state" properties. Transformation occurs when "state" properties are altered into a new "state." In that sense, resilience and transformation are theoretically opposite to one another. The paper begins to ask the question of when, where and under what circumstances planners should seek "resilience" and when, where, and under what circumstances planners should seek "transformation".

2 INTRODUCTION

Two intuition pumps motivate this mostly theoretical paper about resilience and transformation. The first is re-state the argument for a complexity formulation of phenomenon – including cities and regions (Batty, 2005; Portugali, 2000; Allen & Sanglier, 1981; Nicolas & Prigogine, 1977) – that advances understanding of both **dynamic properties** and **status (static) representations** of those phenomena. The second is to lay the groundwork, guided by theories of complex systems, for more meaningful use of concepts associated with change, such as resilience and transformation. The phrase "meaningful use" is intended to challenge the notion that concepts – such as resilience – are "fuzzy". These concepts are not "fuzzy"; users who misapply them are (and there is a long literature in many fields that complain about the use of "other words" to describe "other words").

Not to be underestimated as a problem in this discussion of change is the definition of cities and regions as a phenomenon. Cities and regions are "wholes", admittedly made up of parts, but wholes nevertheless. While individual definitions may vary, these definitions will ultimately rely on description of the properties of the city and/or region. Among these properties are various spatial relationships, interaction patterns, and/or social or governance arrangements. Resilience and/or transformation ultimately must be discussed in terms of these properties, most usefully expressed as a system "parameter". We examine some common "property parameters" of cities and regions.

The primary issue is the characterization and measurement (or understanding/explanation) of change. There are numerous options; the simplest and most often used is the rubric of "comparative statics". In comparative statics, we simply measure some "thing" at some time Y and then again at some time Y+1 and create a ratio with Y in the denominator. For example, the population of Essen was 593K in 2010 and 597K in 2008 (http://population.mongabay.com/population/germany/2928810/essen, http://en.wikipedia.org/wiki/Essen) creating a growth rate of -.007 over the two year period. Generally, if the ratio is positive, planners say "good" and move on to something else. If the ratio is negative, planners begin to worry and argue for the need to develop strategies or plans to address the "bad". More often than not, these strategies or plans use fashionable terms (each with their own lifecycle, for example, formerly cities and/or regions needed to be "creative" or "competitive", now they appear to need to be "resilient"). The larger issue, however, is that comparative statics is largely unsatisfactory because it reveals nothing about how or why change occurs.

Complexity theory provides such tools. Complexity theory, in a nutshell, argues that learning agents self-organize in an open, non-linear, multiscalar, disequilbirum environment through complex adaptive processes to eventually achieve an emergent pattern (i.e., the observable city and regional structure). The complex adaptive process includes positive and negative feedbacks. The status of the emergent pattern (steady state?) is subjected to three possible responses to change: resilience, resistance, and transformation. Each of these responses if fundamentally different!; and each is perfectly desribable from an analytical viewpoint.

The remainder of the paper is organized in five sections. The next section lays out five primitive concepts of complexity theory – a resultant, three process mechanisms, and one major decision point. Because we are concerned with cities and regions, we next provide a brief discussion of how "properties" of cities and regions might be represented, at the scale of the "whole". We next discuss resilience and transformation as planning motivations. Four illustrative planning situations are introduced to show how resilience and/or transformation are an appropriate metaphor. The paper concludes with a discussion of when, where, how, and why these change motivations might be appropriate contexts for planning discourse.

3 KEY PRIMITIVE CONCEPTS OF COMPLEXITY THEORY

To explore the question of whether resilience and transformation are conceptual opposites responses to change, we need to first describe a- or the theoretical structures from which these response possibilities are embedded. The view from systems theory, or more appropriately its parent complexity theory, provides such a perspective. The use of complexity theory is growing within the even more general field of planning theory (de Roo and Silva, 2010) It is also important to be rather direct in stating that this discussion is based in the "hard science" of biology (in the subfield of ecology) and physics rather than the thread that stems from "psychological sciences". The difference between resilience as a biology or physics concept and as a psychological concept is perhaps the major cause of confusion and ambiguity. The former is an attribute of a system; the latter is some sort of psychological response.

Five major concepts – a resultant, three processes mechanisms, and one major decision point are presented below. For each, the structure of the argument is explication, followed by some reference to "cities and regions".

3.1 State (of Being) or Emergent Pattern or "Steady State" of the Whole

Systems can be described in terms of both process and state. The "state" of a system is the visceral or observable patterns that most of us can describe. For example, "state" in physics may refer to (1) the organization of matter in a phase, (2) the complete description of a system in terms of parameters such as positions and momentums at a particular moment in time; (3) a mathematical object that fully describes a system and its observables, (4) a specification of a combination of properties (temperature, pressure, and composition), sometimes expressed as a set of equations. In all cases, the term "state" is bracketed for a moment in time, a point in time, or a single instant.

The same can be said of our cities and regions. At any point in time, we can take a snapshot of our cities and regions, as is done with censuses or significant cross-sectional studies. Upon execution of these studies, a picture is developed about the current "state" of the place or places. The "state" of the city or region can be described in terms of its **properties** – such as aggregate or overall form, its patterns of interactions, and its rules of organization. The "state" of a place sometimes is contextualized by reference to external criteria (e.g., obvious examples include position in global hierarchy or position in livability studies). For example, the current "state" of the City of Essen, Germany is describable as,

> A city in the central part of the Ruhr area in North-Rhine-Westphalia, Germany. Located on the River Ruhr, its population of approximately 579,000 (as of June 30, 2008) makes it the 9th-largest city in Germany. For the year 2010, Essen is the (sic) European Capital of Culture on behalf of the whole Ruhr area.

But, beyond this, it is also common to describe former "states", as the Wikipedia description goes on to describe Essen as,

> ... Formerly one of Germany's most important coal and steel centres and historically linked to the centuries-old Krupp family, the city has developed a strong tertiary sector of industry and (sometimes together with nearby Dusseldorf) claims to be the 'desk of the Ruhr area.' It is home to 13 of the 100 largest German corporations and seat to several of the region's authorities. … In 2003, the universities of Essen and the [nearby city of] Duisburg ... were merged into the University of Duisburg-Essen with campuses in both cities and a university hospital in Essen.

The difference between "states" (industry->desk->concentration of capital->universities->appropriation of nearby cities) captures change, perhaps in terms of a specific lifecycle path. The capturing of change could have (but does not) used principles of complexity theory, including the one of non-proportionality (described below). It is also possible to argue that change in Essen has been dramatic and perhaps even "shocking". The

"state" of Essen was different 70 years ago. Even though 70% of its area was destroyed in WWII, the place Essen remains; what is different is its functionality: the "state" of Essen changed from an industrial center to a tertiary center; it appropriated other cities (Duisburg and Dusseldorf) to reach the critical mass to make it competitive globally; the Krupp family was not resilient enough to maintain its status as a single entity, it was forced to merge with the Thyssen family, creating the new ThyssenKrupp (so, even at scale of the firm, a new "state" emerges).

The thing that we can describe as the "state" is, more formally, an emergent pattern, a resultant of self-organization and emergence. Emergence is (in philosophy, systems theory, science, and art) the way patterns arise out of a multiplicity of relatively simple interaction rules. We now explore three of these mechanisms.

3.2 Self-Organization through Complex Adaptive Mechanisms

The distinction between "resultant" (the emergent pattern) and "forces", "behaviors" or "rules" is crucial. There is an "arising of structure" due to the process of self-organization. Nicolas & Prigogine (1977) call this "order out of chaos"; Krugman (1996) calls this "order from instability". Self-organization is defined (as in Wikipedia) as the process where a pattern or structure appears in a system without a central authority or external element imposing it. Viewing the world through this lens is a different appreciation of dynamics and structures of urban agglomerations (cities and regions; city-regions; metropolitan regions; etc.) than one that relies on planning. The pattern/structure appears from the local interaction of elements that make up the system, thus the organization is achieved in a way that is parallel (all elements are active agents) and distributed (no agent is a coordinator). Self-organization normally relies on four basic ingredients: strong dynamical non-linearity, often involving positive (amplifying, growth) and negative (dampening, decline) feedback, a balance of exploitation and exploration, and multiple interactions.

Evidence of self-organization in human society is observable in statistical regularities or artifacts such as Zipf's law, Pareto principles, critical mass in sociodynamics, herd behavior and group think. In economics, the work of Hayek and Krugman are often invoked (and wrongly associated with certain ideologies, the principles themselves are ideological free). In cities, evidence of self-organization is found in the existence of cores and peripheries, hierarchies of polycentric employment centers, and spatial representations of social variables such as segregation by income or class; or more theoretically "emergent structures appear at many different levels of organization or as a spontaneous order, even when there is no planning or zoning entity predetermining the layout of the city". The pattern/structure of the city or region is the result of individuals, corporations, social groups, governments, economic necessity and modes of production, etc.

There are three related concepts. First, self-organizing criticality (SOC) is a property of (classes of) dynamic systems that have a critical point as an attractor. Their macroscopic behavior thus displays the spatial and/or temporal scale-invariance characteristics of the critical point of a phase transition, but without the need to tune control parameters to precise values. The concept was put forward by Bak (1996). SOC is typically observed in slowly-driven, non-equilibrium systems with extended degrees of freedom and a high level of nonlinearity. The second is a more specific description of emergence. Emergent behaviors occur when simple entities (agents) operate in an environment, forming more complex behaviors as a collective. Moreover, the emergent behavior may be either predictable or stable or unpredictable or unprecedented, and may represent a new characterization of a system's evolution. The complex resultant is not a property of any single agent, nor can they be predicted or deduced from behavior in the lower-level entities for in such systems, the interactions among components or agents increases combinatorially with the number of agents, thus potentially allowing for many new and subtle types of behaviors to emerge. The third concept, somewhat contradictory in general but true in certain cases, is the distinction between between "weak emergence" and "strong emergence". Weak emergence is concerned with new properties or perhaps microtrends (Penn, 2007). Microtrends, such as LATs (living apart together) could have profound effects on city structure as "couples" will need two housing units instead of one. Strong emergence is the notion that under certain circumstances, emergence may appear to defy entropic principles and the 2nd law of thermodynamics, and form and increase order despite the lack of command and central control. This is called the order parameter, slaving, and other such names, and is possible because open systems can extract information and order out of the environment. See Portugali, 2006.

3.3 Multiscalarity

Multiscalarity is the property of a system that focuses on the set of interlocking processes that occur at different scales. It relies on a primary assumption that the larger system is an important object to be understood – an ecosystem or an urban agglomeration. The most common explanations of multiscalarity occur within the field of ecology. Within the "whole" there are processes acting at various scales of resolution. Local processes with small spatial impact happen at fast temporal scales – they control, in ecology, plant physiology and morphology (e.g., houses, neighborhoods, or internal dynamics of economic clusters). At a slightly larger scale, patch dynamics witness the processes of competition for nutrients, light and water influences in influencing species composition and/or regeneration (districts in a city or region competing among themselves for external resources). At the mesoscale (say a forest, or a city), other processes such as fire, storm, insect outbreaks, and large mammal herbivory determine structure and successional dynamics from tens of meters to kilometers, and from years to decades.

Schelling's (1978) **Micromotives and Macrobehaviors** is the key to understanding multiscalarity. Individual decisions based on individual circumstances can and will, in a self-organizing system, lead to macrobehavior patterns. Schelling's basic example is individual desire to live next to someone who has characteristics "other" than ours. Over time, these individual preferences result in spatially segregated social structures. Multiscalarity thinking leads Peterson, Allen and Holling (1997) to discuss how resilience, biodiversity and scale are intertwined and to suggest a "cross-scale" model to evaluate attributes, such as resilience. Similarly, Sommerville's (2011) uses multiscalarity to "make sense" of what "neighborhood governance" might mean. The author distinguishes between hierarchical, self-governance, and co-governance and argues for a "multiscalar" conception of governance, one in which governance is the dynamic interplay of (1) community and resident's associations resisting government forces at the neighborhood scale by "scaling up" their arguments and (2) the asymmetry in power status of organizations at higher levels of in the hierarchy. Thus, governance is "trans-scalar" and, in the author's opinion, more effective (in terms of results) with coordination from the top down rather than the other way around.

There are two major points. The first is that important planning issues -- like governance – are better conceived in terms of multiscalar interactions between members of different "strata" in a hierarchical system. Methodological implications are discussed in Sheppard and McMaster (2004). The second is that different strata have different dynamics. The "whole" may be stable while the parts may be unstable; the whole may be unstable, while the different strata may be stable. These possibilities make up a framework for analysis, evaluation, and planning.

3.4 Non-Linearities, In-Homogeneity, and Surprise

Dynamic systems operate through time. Some system attributes are linear functions in either absolute terms or in relative terms (e.g., log transformations of simple curves); others are more complex, some even turn back on themselves as in chaos theory. Trends are sometimes susceptible to "step" behavior, where the line will be continuous up to a certain level of the driver variable and then jumps or declines to a new level.

The cause of the jump is of course the motivation or object of analysis and/or planning. Phenomena over time are subjected to a number of potential trend benders or trend breakers. These may be unplanned or planned. Unplanned events such as natural disturbances (hurricanes, volcanic eruptions) or man-made (hazardous materials, acts of terrorism) could cause trend lines to be broken. Planned events – such as megaproject or megaevent occurrences – also could cause the trend line to be altered. These "pulsar effects" are well understood. Sometimes, the impetus or cause of the jump is merely "surprise". If the impetus is large enough, it is possible for the "state" of the system to change.

Moreover, the principle of in-homogeneity argues that the impetus itself might change over time. Thus, a city built on the assumption that trade was to be accomplished by water transportation yielded a characteristic "form". When water transportation was succeeded by air transportation, a new (not resilient to the old) form emerges. It is perhaps useful to invoke D'Arcy Thompson's (1917) famous dictum about ecological systems (natural or social): Growth Creates Form, Form Limits Growth.

3.5 The Edge of Chaos

The final complexity theory concept is a decision point. In complexity theory, this point of decision is the funny sounding "edge of chaos" that is most critical in determining whether a system – or parts of a system

(see multiscalarity above) – is "resilient" or is being "transformed". There are three possibilities. First, the relationship between driver variable and resultant pattern will behave as expected, up to a certain level, resulting in "ordered" responses. Second, the value of the driver variable reaches its maximum value for the relationship to continue to exist – this is the point of maximum complexity (but still ordered, also defined as maximum efficiency). This is the "edge of chaos". Further energy or levels of input variables will cause the relationship creating the former emergent pattern to disintegrate; the resulting pattern will change from "state 1" to "state 2".

The intermediate cases are the most interesting in terms of resilience and transformation. Both economist and ecologist focus on the concept of elasticity. Using the economic example, in consumption functions, the consumer is indifferent (exhibits "inelastic" preferences) to a price rise or decline. Consider the price of petrol. There is a point at which the price of petrol will change behavior. Similarly, at some point in the conditions of a neighborhood, significant change will occur. Up to that decision point, neighborhood residents are indifferent and accepting; beyond that point, riots occur and change in "status" is possible.

Simply put, resilience and transformation are two sides of the "edge of chaos", a decision point in system dynamics. Up to some level of energy, the system dynamic will continue to operate – it will be resilient. At a higher (?) level of energy, the system dynamic will break, causing failure. The post failure condition is a new state. Krupps becomes ThyssenKrupps.

4 WHAT IS A CITY? WHAT IS A REGION?

It is quite remarkable that both the academic (witnessed in the academic journals) and the professional (witnessed by such organizations as the American Planning Association, the International Society of City and Regional Planners, and various NGOs including UN Habitat) use the word "city" to refer to everything from a neighborhood to an administrative city to an administrative defined metropolitan region to conceptual megaregions. The bottom line is that "results" or "case studies" are not easily summarizable; what appears to be knowledge is at best a collection of scale-specific stories that are not transferrable.

We focus here on city regions. The challenge, we ask, is to define a city or a region in terms of its properties. Tell us what we would expect to find. Tell us what relationships exist. On the surface, what appears to be an obvious question is tricky business; so tricky that established scholars are reluctant to suggest a definition. However, assuming some success in the prior endeavor, these "properties" and "structures" provide a first set of objects related to both the characterization of spatial analysis/planning and design and also a set of objects than can be assessed in terms of some evaluative (like resilience!) concept. We present two possibilities [the eventual set of indicators or property descriptions is only possible once this primary question is resolved!].

4.1 A Possibility: The Non-Definition of Bogart

Bogart's **Don't Call it Sprawl: Metropolitan Structure in the 21st century** (2006) offers a tentative definition of metropolitan areas. He uses both criteria ("properties" in complexity theory jargon) and benchmarks ("emergent patterns of structure" in complexity theory terms). For the sake of space, we include only a sampling of these, including:

- Employment in centers reaches 30-40%, downtown (historic core) importance is attenuating downwards; employment centers are specialized
- Social segregation by race (falling over time) and income (increasing over time)
- Institutions and branding, major building plans, high quality institutions, etc.

While the empirical benchmarks are specific to the US experience, the criteria are universal in terms of their ability to structure cognition or appreciation of what a metropolitan region is. It is important to have a characterization of the "whole", beyond the individual and/or idiosyncratic local experiences.

4.2 Another Possibility: The Systems Approach of Bourne

Bourne's (1982) introductory essay to his edited book **Internal Structure of the City** uses systems theory to describe properties or attributes of the city region. At an observable level, Bourne distinguishes a number of static (or "state") properties including *form* (spatial patterns), *interaction* (relationships, linkage, flows), and *structure* (rules) of urban places. He also describes the urban agglomeration in terms of a number of system components: nucleus (initial settlement), geometry and boundaries, elements (social groups, land uses,

interactions), organizational principles (land market, growth determinants), behavior (activity patterns), external environments (external determinants), and time path (development sequence).

Growth, on the other hand, is a change attribute. Structural growth, according to Bourne (and others) is based on a number of factors, including: ***size*** (there is a minimum size or threshold necessary to ensure their existence and to produce a differentiated internal environment); ***in-homogeneity*** (the factors or principles that guide current or recent growth may or may not be the same as those that initially stimulated the establishment of the nucleus); ***non-proportional change*** (that a change in the aggregate size of the system invokes non-proportional changes in the relationships between/among the various parts of the system; (e.g., spokes and wheels, gears); ***growth-form dependency*** (that the growth of a system determines its initial form, but so too does the form of the system at any given time influence subsequent growth), and finally**, *designer principles*** (the work of planners). The final part of the essay identifies macro and micro criteria to describe and/or evaluate cities. Included are: ***context*** (timing, functional character, external environment, and relative location); ***macro form*** (scale, shape, site, and transport network), ***internal form and function*** (density, homogeneity, concentricity, connectivity, directionality, conformity, and substitutability), and ***organization and behavior*** (organizational principles, cybernetic properties of change – this is feedback, regulatory mechanisms, and goal orientation).

5 RESILIENCE AND/OR TRANSFORMATION AS PLANNING MOTIVATIONS

Traditional planning relies on the motivation than an anticipated and/or implemented change will result is something that is often envisioned as “better”, and more often than not is “different and better”, through a process of continuous improvement. Obliquely related (and this is a generous appellation) to this traditional view is the so-called resilient city literature (e.g., Adger, 2000; Douglass, 2002; Godschalk, 2004; Picket et al, 2004; Alberti, 2008) that seems to want to replace “continuous improvement” to dealing with “shocks”. Arising from classical ecological thinking, the class of “shocks” can be: anticipated, routine, episodic, or even, if we think far enough out of the box, even surprises. The objective of such planning is that localities should possess some general adaptive capacity for dealing with shocks and this “dealing with” has fostered the use of the word resilient/resilience as a desired signifier of planning activity.

There is a difference between “scientific” versus “psychological” formulations of the concept of resilience. Scientific resilience is a property of systems. Here, resilience is the property of a material to absorb energy when it is deformed elastically and then, upon unloading to have this energy recovered. It is the maximum energy per unit volume that can be elastically stored. Resilience is often equated with something less than efficiency or productivity, what with its emphasis on redundancy in terms of “ecological services” (in the ecological example) or “flexibility” (in the economic example of having an educated workforce capable of moving between and among economic sectors). Psychological resilience is the positive (note this is a value judgment) capacity of people to cope with stress and adversity. A resilient person, which most don‘t feel is a personality trait, copes with stress and bounces back to a previous state of normal functioning or uses the experience to produce a “steeling effect” to function better than expected.

But it is about CHANGE. By definition, no change implies “stability”. A normal definition of stability would have two elements: a description of some attribute, property or status and a reference to time. Here are some standard definitions.

- Economic stability: the absence of excessive fluctuations in the macroeconomy – macroeconomy is describable in terms of economic output, growth, low inflation. On the other hand, a macroeconomy that is subject to frequent and large recessions, pronounced business cycles, high inflation, or frequent financial crises would be “unstable.”
- Ecological stability: measure of the probability of a population returning quickly to a previous state, or not going extinct.
- Stability: noun. The state of being stable; firmness in position; continuance without change, permanence; in chemistry, resistance or the degree of resistance to chemical change or disintegration; resistance to change, especially sudden change or deterioration (e.g., the stability of the economy encourages investment); steadfastness; constancy, as of character or purpose; From Dictionary.com

The point is that change must be assessed in terms of something. The fundamental question: is this a change that is intended to be or results in resilience/resilient (keep the current status) or is it intended to be or results in transforming/transformational (changes the current form and pattern). Focusing on the former raises a series of questions: (1) what is it? (2) How do we know if a city or region is resilient?; (3) Should a city or region want to be resilient?; and, (4) Over what set of cases or circumstances? Furthermore, the questions become even more problematic if we change the perspective from planning (future oriented) to management (processes) to analysis (ex post facto explanation/understanding) of some situation. So, for example, is New Orleans a resilient city in terms of thinking about its future? Is the former New Orleans – the properties and structures of New Orleans prior to 2005 – resilient? Quite possibly and NO!

Finally, left unattended in the above is the overall question of the source of change: was it induced by government action **or** by (for the lack of a better word) the market or by nature? Are cities the result of planned concepts or are they the result of "ordinary" actions of developers, migrants, companies, social groups etc. While not directly equivalent, changes of the first type don't seem to challenge the thesis or current state whereas changes of the second type do challenge the thesis and serve to transform the thesis (via its antithesis dynamic) to result in a synthesis (or new thesis).

5.1 A Formal Approach

The analysis of change is really nothing more than a pair of alternative hypotheses, focused on properties of a city or region, abstractly referred to as "P" and the effect of time "t". Much like a statistical test (some would call this an "evidence-based" test); the determination of resilience versus transformation is formalized as a pair of hypotheses

$$\text{Change Does Not Occur: } dP/dt = 0$$

$$\text{Change Does Occur: } dP/dt \neq 0$$

only one of which can be chosen with a degree of confidence (and, within the appropriate language of statistical hypothesis testing: accept the alternative – change occurs or fail to reject the null – no change).

5.2 Resilience: $dP/dt = 0$

A property of a system is resilient if, over time, it doesn't change (we could become philosophical here and talk about *longue duree*, but path dependency will suffice). There are certain properties of the spatial representation of society that don't change very much. The urban agglomeration doesn't get up and move its GPS coordinates, the historic core remains the historic core, rails and roads tend to be long term elements of spatial structure, the city or region is a magnet for either attraction or defection.

Small changes will not change the property parameters of the WHOLE city or region. In fact, the WHOLE will large be resilient (notice that the change possibility "resistant" is probably more technically correct!) to these small, local changes. It will not matter to the functioning of the WHOLE city or region where exactly the global business district is (so long as it is accessible by multiple modes from key transport nodes) or where the lower income neighborhoods are (as long as they are hidden from the glitz).

Adaptation, if it occurs, is at the very local level. But, a lot of these local efforts (every municipality enforces stronger codes) could make the WHOLE procedurally prepared. Is that what we are about?

5.3 Transformation: $dP/dt \neq 0$

Large changes (e.g., a new highway, creation of a global business district, or the new biotech cluster by the airport) will create changes in the FORM PROPERTIES of the WHOLE city or region. There is little doubt about the effect of such episodic shocks here on the ability to transform. We simply refer again to D'Arcy Thompson's dictum: "growth creates form, form limits growth".

But, transformation is also possible from self-organized or slow shocks, that is, from "emergent" behavior changes such as changes in socio-economic organization from manufacturing to services to creative/intellectual activity – Castells' (1989, first mention) "space of flows". Some cities and regions were winners (anticipating the future, making strategic investments) and some did not. A simple US example – when railroads replaced water transportation as a dominant mode of interaction, the decision of Cincinnati "not to co-operate" left if as a "cute village" while Chicago emerged (no pun intended) as a major city and region.

5.4 Can We Have Both

From time to time (and in specific journals, normally with low impact factors) we get titles that fuse resilience and transformation together. Walker et al. (2004) discuss the relationship among the terms resilience, adaptability and transformation in socio-ecological systems. Although they "straighten out" the differences within, the title is misleading.

But, more disturbing is Gotham and Campanella's (2010) concept of *transformative resilience*, derived from the quote below:

> An integrative component of ecological systems and human systems, practiced by the Resilience Alliance through their journal Ecology and Society, suggests that "adaptive capacity" is an essential characteristic of resilient urban ecosystems. In this conception, resilience does not just mean adjustment, recovery, and return to a pre-disturbance state. Rather, resilience implies the capacity for renewal, regeneration, and re-organization when faced with disturbances. Resilient systems are those that are able to adapt to uncertainty and surprise, absorb recurrent disturbances to retain essential structures and processes, and build capacity for learning, improvement, and advancement over pre-disturbance conditions. Overall, resilience is not an inherent or static property of systems but varies by scale, organizational units, place, and time (p. 9, without original references)

This is theoretically an oxymoron! We assume that the [intended] desire is to say that resilience is the ability to be adaptive, that is, that they are synonymous. The authors use "resilience" as both a noun (resilience means … resilience implies …) and as an adjective (resilient urban ecosystem, resilient systems). The verb is "adaptive capacity".

Can we have both? Paradoxically, yes, but it is tricky. Assuming that dynamics of cities and regions can be appreciated by their bureaucrats and actors, and that these are self-aware of purposeful change (for a really good discussion of this point within complexity theory, re-read Portugali, **Self-Organization and the City**, 2000), then is it really psychological resilience that we are talking about and it is as important as ecological, climatic, or spatial design resilience. A more hard-nosed scientific perspective would focus on the attribute of resilience at different scales and the relationship among system dynamics. So, we can have a resilient WHOLE and unstable parts, an unstable WHOLE with resilient parts. This has not been fully explored in the literature, as the resilience examples tend to focus on individual actions and stop there. Another possibility is the "steeling effect" noted above that could provides a potential area of interesting research, i.e., when due a change, a certain property becomes stronger, perhaps like the concepts of "strong emergence" and "order parameters" in the discussion above.

6 PLANNING FOR RESILIENCE OR PLANNING FOR TRANSFORMATION?

So, what is it that we want to do and at what scale are we thinking? The choice between resilience and transformation must be cast in terms of **multiscalar relationships**. For simplicity, we focus here on the city and region (or urban region, city-region, metropolitan region) scale and on changes that speak directly to the **properties** of cities and regions – such as functional structure of the economy, spatial distributions of employment or social attributes, or even cognized structure. The four examples below focus attention on improving our use of the concepts of resilience and/or transformation. .

6.1 Ebenezer Howard and Zaha Hadid: Clearly Transformers

Aside from the fact that both worked in and around London, the major item that ties these two together is the thought process to transform the spatial and social structure of the urban agglomeration. In both London in the 1890s and Istanbul in the early 2000s, there is a conscious effort to "decentralize" the city. The Howard (1902) plan for creating town-county magnets in the suburbs was in direct response to decentralize the metropolis in an attempt to reduce negative social and environmental conditions in the center. Hadid's proposal for Kartal (2006), Turkey is part of a deliberate part of the Istanbul Regional Planning Organization (2006) work to decentralize the economic and social distributions within the Istanbul metropolitan area.

There was/is absolutely no desire for either central London in the 1890s or the prior employment pattern of Istanbul to demonstrate resilience. In the former case, the clear focus was on TRANSFORMING the spatial structure of the London metropolitan area. In the Istanbul case, Kartal is a former industrial area for which

the Istanbul planners are desirous of changing into a satellite city based on high tech and creative economic activity. Both Istanbul as a region and Kartal as a place are functionally TRANSFORMED.

6.2 Schwechat and BBI: Both Transformation and Resilient?

The spatial economic structure of a city or region is an emergent pattern driven by economic forces. When the economic forces change, say due to new transport technologies, the "prior" emergent pattern (form) is at best a limiting, if not a negative, condition for the "new" emergent pattern. So, city and region after city and region are investing in airport and airport-related economic activities that must, almost by definition, occur at or intensify activity in a location not deemed as "defining" or "critical" in the previous phase. Current theoretical understandings focus on two effects – the spatial and the a-spatial. The spatial effect is that the airport and nearby land becomes a growth pole within the metropolitan area. Activity is increased (perhaps at the expense of other parts, but not necessarily so), and it will be specialized functionally. The a-spatial effect is the change in the distribution of occupations that are needed to support the economic activity. So, both the spatial and a-spatial economic properties are changed. In either case, this is TRANSFORMATION, unless the efforts fail.

This is also true "on the ground" in Schewchat or "on the ground" in and around BBI. A resilience understanding could be useful when and where a decision has been taken (formally, as in planning, or informally, as in self-organization) about a place. As air travel continues to increase its market share and catalyzes economic development, resilience is important to continue to seek and develop positive feedback strategies (further intensification of the idea). To this end, a few years ago, Manfred Schrenk initiated an ISOCARP Urban Planning Advisory Team to develop a strategy to TRANSFORM Schewchat airport and the nearby town of Schewchat into a modern, information-driven creative place. The city of Schewchat is located adjacent to the Schewchat airport. There existed a small "professional park" that was developed with high standards (for information use) but was considerably underutilized. Schrenk arranged for use of the building and set it up as headquarters for CEIT Alanova – a consulting firm that specializes in information use for better planning.

The case of Berlin is even more interesting. Faced with a perceived poor airport infrastructure, the BBI government decided to go ahead with the BBI airport, even though there are two operating airports (Tegel and Schoenefeld). BBI is located on a former airstrip to the south of the Berlin-Brandenburg axis. When completed, this area of the metropolitan area will experience major growth, create an "edge city" and probably move Berlin into a higher position on the GAWC typology. On the other hand, new uses will have to be found for the now functionally non-resilient Tegel and Schoenefeld sites.

6.3 Tinkering With Concepts or Rules: Resilience?

Two examples show how clear concepts become "fuzzy" in practice. The discussion below is not a testament to the rationality and/or critical thinking ability of planners, as the authors of those articles point out.

On both sides of the Atlantic, criticism has been offered on the concept of the "compact city" (Salet, 2010, Zonneveld, 2009, Neuman, 2005). The criticism has focused on both planning vision as well as (perhaps more interesting) how the concept has had multiple empirical meanings over time. Salet's reflective piece on Dutch national planning policy shows how the term in one year means "reinforce" historic centers and in other years means re-inforce the polycentric structure of the Randstad and in yet another to reinforce the polycentric structure within the poly-centers. The concept of the Randstad is not stable.

A second example is the climate change literature, which normally starts with apocalyptic visions of the world with no ice caps, but the real threat is lost investment in the built environment should sea level rise. Against such new structural forces, cities and regions are encouraged to be "resilient" – mostly to protect prior investment patterns. Indeed, what is meant here is that cities and regions must start to think in terms of adapting to these potential conditions by making smarter land use and/or spatial planning decisions. But, how to be resilient? Does this mean "moving to higher ground", "building better sea walls", or "making better buildings" that wont leak when groundwater swells? These places might be resilient (to potential change) by making better decisions now. Is this what we mean?

6.4 Migration: Transformation and Resilient

Seemingly unchanging over time is the phenomena of migration. Cities have always been the focal points of migrants – from rural areas to cities at the beginning of the industrial revolution, from nations to nations (particularly to the US around 1900), and continuing to today. Migration, then as today, is a source of growth in metropolitan regions (this is probably a causal relationship) but creates a nasty public policy problem in terms of its direct effects on the spatial social structures of our metropolitan regions. Inclusive cities are normally spatially segregated cities.

Simply, new migrants create stress. Stress in terms of the economic spatial structure (they need jobs, but they also do jobs that "pure" locals don't want to do). Stress in terms of spatial social structure (they are "different"; tend to cluster among themselves, etc). The former social and economic structures become unstable. The "shock" of migration causes turmoil until it is "worked out" as a new emergent pattern. A resilient place would be able to absorb the shock – this might be the case where an existing migrant community is enlarged by newer arrivals, but the overall pattern of spatial social structure remains the same.

7 CONCLUSION

In this paper, we have argued that theoretical complex systems offer a better appreciation of city and region dynamics as well as clearer definitions for such evaluative or planning behaviors such resilience and transformation. It is really tempting to paraphrase Burnham's quote about planning and imagination as follows: "make no small changes for they only serve to be resilient and fail to stir transformation". Yet, both are useful motivations.

Transformation is the appropriate objective when and where the "state" or "emergent pattern" is not acceptable or functional. Examples abound – a city or region on the verge of becoming "global" needs a place for global activities to take place. The emergence of global business districts not in the historic core is transformational for the form of the city or region. High speed rail networks change accessibility "emergent patterns". Neighborhoods fall into disrepair to the point where even Marxist analysts see the "profitability" of revitalization. Social spatial patterns are re-arranged.

Non-functional places normally desire to be transformed into something new. Transformation is clearly more appropriate for larger scale considerations, but is also appropriate at the local scale. Its conceptual opposite, resilience, may, in fact, not be a desirable attribute in certain circumstances. For example, why should a city or region want to be resilient in the face of global structural change? It would not, despite the slow growth movement. A city or place at the end of a product lifecycle in which complacency or bad social conditions exist certainly does not want to be "resilient".

Resilience is an appropriate metaphor when and where the "state" or "status pattern" or "emergent pattern" is acceptable and functional. Re-inforcing an historic center, increasing the specialization of an employment center with additional firms, and/or adapting building codes to foster better or sustainable materials are all examples where resilience is an acceptable planning motivations.

Many of these "resilience" actions are local and their scale of influence is local. Yet, complexity theory tells us that these self-organized slow actions are critical for system operation. Resilient means absorbing energy, most likely through positive feedback mechanisms, to get closer to the "edge of chaos", which is the point of maximum efficiency for the existing or "prior" state. This is probably a good thing in terms of delivering maximum output of existing economic, environmental and social processes and services, if the prior state is acceptable. Being resilient is maximizing potential of current systems. It could be a good thing!

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