# Antifragile Planning

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## Abstract

We argue that antifragility is a valuable and contentful goal for planning. We present a possible definition and outline the tenets and essential properties of an antifragile planning and compare it with approaches of urban resilience. We further present an argument for the legitimacy of an antifragile planning, by exploring its possible conceptualisation in terms of the capability approach. Hence the recommendation to incorporate antifragility into planning practice and content.

**Keywords:** antifragile planning, complexity, antifragility, urban resilience

## 1. Introduction

The complexity of urban systems, of which cities are but the most plentiful navels, adds trickiness to the already burdensome responsibility and political implications of planning. Other than making the evolution of urban systems unpredictable in the strong sense (Hillier, 2012; Moroni, 2015a), such complexity also brings about greater uncertainty of ultimate outcomes of policies and actions, raising both operational and deontological concerns for planning (Chettiparamb, 2019; De Roo and Hillier, 2012; Innes et al., 2010; Moroni and Cozzolino, 2019; Portugali, 2006, 2008; Portugali et al., 2012).

To address these concerns, we here advance the proposal that the concept of antifragility (Taleb, 2012) offers a *contentful* and *legitimate partial* goal for planning. To appraise the merits of the proposal, in this paper we attempt to do the following:
1. first, we situate our discussion in the more general debate on the problem of policy and agency under conditions of complexity of urban systems;
2. second, we outline the essential properties of antifragility, and contrast it with the concept of resilience; we argue that, in general, resilience should be understood as a limit case of antifragility, and therefore that the distinction between antifragility and resilience is theoretically relevant and operationally useful;
3. third, we argue that antifragility is a valuable goal for planning, and discuss its affinities with approaches of planning for resilience, to claim that antifragility should be elected as a more general and superordinate goal for the government of urban systems;
4. fourth, we sketch out what the main tenets and features of an antifragile planning may be;
5. finally, we examine the conditions of legitimacy of antifragile planning, and argue that for some of its tenets antifragile planning can be assumed as a partial condition of legitimacy of planning, beyond being just a question of mere policy preferences.

Before beginning in earnest, we want to clarify that throughout this paper we use that overworked word, planning, without reference to any specific set of tools, norms, techniques for the construction and design of spatial plans, but rather more in general as a stand-in for the practices of governing and collective management of urban systems.

# 2. Complexity of Urban Systems and Antifragility

## 2.1. Complexity redoubled

The complexity of urban systems is twofold, the two modes of complexity compounding each other. One mode is in the "simple", purely *mechanical* sense of them being large "many-body systems" (Anderson, 1972), composed of many components interacting in a non-linear fashion. By way of these interactions and feedbacks such systems are capable of exhibiting forms of spontaneous order and of emergent properties at higher levels of hierarchy. The second mode of complexity of urban systems is due to them being social systems, with some of the systems' components being autonomous agents (Hilier, 2012; Moroni and Cozzolino, 2019; Portugali, 2000, 2006, 2012). If not ultimately ontological, this autonomy cannot but be presupposed as a moral, and an operational assumption.

The redoubled complexity of urban systems brings an unavoidable uncertainty to the planning practice. It raises questions of what the normative content of planning may legitimately and realistically be, but also casts a shadow over certain planning *methodology* too reliant on the effectiveness of overly specific goal-oriented attitudes. Among attempts of conceptual overhaul of planning theory and practice to deal with the complexity and uncertainty of urban systems, a prominent, and thriving, approach is that of urban resilience (Davoudi et al., 2013; Davoudi and Porter, 2012; Meerow et al., 2016), together with that, somewhat related, of adaptive planning (Kato and Ahern, 2008; Rauws, 2017; Skrimizea et al., 2018). Our key claim in this work is that the notion of antifragility developed by Nassim N. Taleb (2012) introduces a fruitful conceptual framework to engage and broaden the general coordinates of the debate on planning under complexity and uncertainty.

## 2.2. The idea of antifragility

To define antifragility, we ought to situate the concept within a general examination of the ways in which things (objects, organisms, institutions, systems) respond to uncertainty, to events, perturbations, stressors, volatility, disorder – in short, to time. Here, the conceptual triad "fragile, robust/resilient, antifragile" proposed by Taleb offers a theoretical framework useful to clarify things.

Following Taleb, the essential property of something fragile is that time can only harm it: events, perturbations, stressors, volatility – in short, time –, can only damage, break or destroy it, and never benefit it. This does not necessarily mean that *every* perturbation harms it. Rather, the above definition of fragility states two conditions which sim-

ultaneously need to hold, that there is (*i*) the possibility of harm, and (*ii*) no possibility of gain from perturbations.

On the other hand, something is robust or resilient if it is largely indifferent to perturbations. In the case of robustness, the perturbations do not affect it, they leave it as it is. In the case of resilience, it can absorb, bounce back and recover from perturbations. When attributing the property of robustness or resilience to something, it is always in relation to a certain threshold of intensity: things are robust or resilient always only up to a certain intensity of perturbation. Strictly, an urban system should be said to be resilient if it is capable to absorb shocks, perturbations, volatility, to recover and bounce back to its prior equilibrium or to its functional equivalent. With this we are deliberately narrowing the definition of resilience from a more extensive meaning often encountered in planning literature, not only limited to recovery, bounce back and restoration of prior equilibrium. Reworking this distinction between "strict" and "extensive" resilience, by framing the later as antifragility, is a key point we return on below.

Antifragility is different. Taleb proposes to call something antifragile if it *can* from time – from events, perturbations, stressors, volatility, disorder – also gain, get stronger, improve, evolve, better adapt. Analogous to fragility, not *every* perturbation is necessarily gainful; some, perhaps the majority may be inconsequential but – contrary to fragility, robustness and resilience – some *can* be[1].

Hence, to assess if something is fragile, robust, resilient or antifragile means to examine its possible responses to stressors, perturbations, and volatility, and to place those responses somewhere along a harm-gain dimension.

## 2.3. Resilience as a limit case of antifragility

Besides the harm-gain dimension of response to perturbations, there is another way useful for our discussion to arrange the four terms. In fact, when practically conflating robustness and resilience, Taleb somewhat misses to point out one relevant distinction. Indeed, along the harm-gain dimension, Taleb places:

    i.     *fragile* on one extreme ("possibility of harm, never gain");

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[1] In a nutshell, the distinction between robustness, resilience and antifragility is thus introduced by Taleb:

"Some things benefit from shocks; they thrive and grow when exposed to volatility, randomness, disorder, and stressors and love adventure, risk, and uncertainty. Yet, in spite of the ubiquity of the phenomenon, there is no word for the exact opposite of fragile. Let us call it antifragile.

Antifragility is beyond resilience or robustness. The resilient resists shocks and stays the same; the antifragile gets better. This property is behind everything that has changed with time: evolution, culture, ideas, revolutions, political systems, technological innovation, cultural and economic success, corporate survival, good recipes (say, chicken soup or steak tartare with a drop of cognac), the rise of cities, cultures, legal systems, equatorial forests, bacterial resistance … even our own existence as a species on this planet. And antifragility determines the boundary between what is living and organic (or complex), say, the human body, and what is inert, say, a physical object like the stapler on your desk. The antifragile loves randomness and uncertainty, which also means—crucially—a love of errors, a certain class of errors. Antifragility has a singular property of allowing us to deal with the unknown, to do things without understanding them—and do them well." (Taleb, 2012: 21–22).

ii.     *robustness* and *resilience* together in the middle ("neither harm, nor gain");

iii.    *antifragile* on the opposite extreme ("possibility of gain").

But another way to arrange the four terms is to observe that, from the outside where the perturbation takes place, the objects we are classifying may appear either static (irresponsive, passive) or dynamic, endowed with some internal mechanisms of reaction. If we intersect the two dimensions (harm vs. gain and static vs. dynamic), as in Figure 1., we may derive some noteworthy insights for our subsequent discussion.

**Harm-gain dimension**

*Possibility of gain (antifragile)* — Antifragile bets, contracts, ...; Lindy effect

*No harm, no gain (robust / resilient)* — Robust objects, bets, contracts, heuristics... (A)

*Possibility of harm (fragile)* — Fragile objects, bets, contracts, heuristics...

Antifragile systems (B)

Resilient systems

Fragile systems (systemic failure)

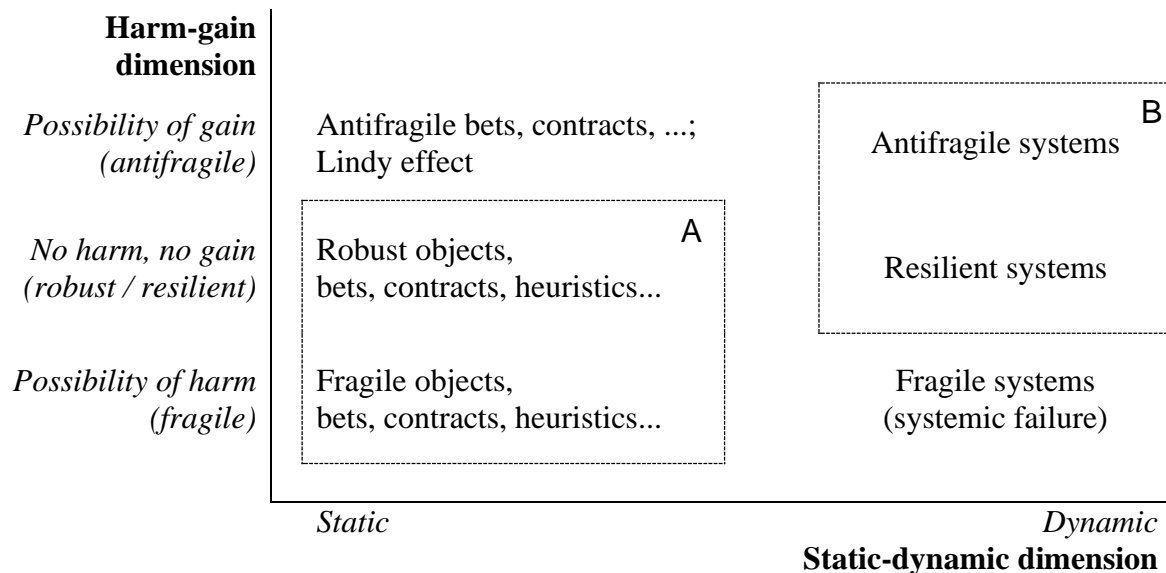*Static* — *Dynamic*

**Static-dynamic dimension**

Fig. 1. Response (gain-harm) - Responsivity (static-dynamic) Matrix

The scheme in Figure 1. helps to observe that robustness is the neighbour of fragility (box A), while resilience is the neighbour of antifragility (box B). Specifically:

i.      *robustness is the limit case of fragility*: both are internally static, but with different thresholds of intensity of perturbation for harm;

ii.     while *resilient systems are the limit case of antifragile systems*: both are internally dynamic, but with different possible gain from perturbations: none or only small for resilient, possibly large for antifragile systems.

Furthermore, the scheme helps to clarify that things Taleb calls antifragile may be of different nature from our static vs. dynamic perspective. A system endowed with an internal dynamic and operating mechanisms may be antifragile. But some internally "static" objects (e.g. contracts, bets, heuristics, etc.) may also be said to be antifragile. Indeed, Taleb offers many examples of both kinds[2]. So, the scheme clarifies that not everything

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[2] An interesting example of antifragility – relevant for the survivability of cities, neighborhoods and buildings (Blečić and Cecchini, 2017; Brand, 1994) - is the phenomenon of "anti-aging", the so called Lindy Effect (Goldman, 1964; Mandelbrot, 1982; Taleb, 2012). The idea of Lindy Effect is that the future life expectancy of a non-senescent thing

antifragile is necessarily internally dynamic nor complex, but also that not everything complex is necessarily antifragile. In the case of urban systems we are of course dealing with the second column, their potential antifragility rooted in their complexity (Blečić and Cecchini, 2017).

## 3. Antifragility vs. Resilience in Planning

For planning, the usefulness of the conceptual triad fragile-robust/resilient-antifragile goes beyond its analytical relevance and offers also some operational guidance we want to explore. The problem of efficacy in classical planning arises, among others, out of its overly demiurgic reliance on *hard* predictions (Hilier, 2012; Moroni, 2015a), that is, on the ambition to predict with accuracy and precision what will and has to happen, when, where, with what intensity, as a consequence of what planning action, often to produce "teleocratic" outcomes (Alexander et al., 2012). If, in the light of the redoubled complexity of urban systems, *hard* predictions are indeed hard, must we not instead settle for something less? Taleb's triad points at such a different possible attitude in the planning practice: rather than aspiring to obtain hard predictions, we can, and cannot but, settle for something we could call *soft predictions*, *where the point is not to accurately and precisely predict what will happen, when and where, as a consequence of what planning action; rather the point is to examine what are the system's possible responses to perturbations, volatility, even low-probability events, in other words to detect its fragility, robustness, resilience or antifragility, and to explore what makes it such*. To decision makers, and thus by extension to planning practitioners, such a *soft prediction* is, as Taleb rather convincingly lays out, more accessible a practice than making hard prediction.

In comparing antifragility with resilience, it is beyond our scope here to explore with greater detail what makes systems antifragile in general. Both antifragility and resilience are richer in meanings, implications and uses, and there are still notable theoretical and operational issues to the application of resilience in planning (Davoudi et al., 2013; Davoudi and Porter, 2012; Meerow et al., 2016) and in public policy in general (Duit, 2016). However, the essential property of "gaining from disorder" in antifragility, absent from resilience, should be consequential enough to let us lay out the argument that antifragility is a contentful goal for planning, distinct from resilience.

To be clear at the outset, we share the view that resilience *is* a justifiable policy goal. Kolers (2016) has persuasively shown that resilience can and should be incorporated as a necessary condition of legitimacy and justice of public policy. So urban planning as a field of public policy should incorporate resilience into both methodology and content.

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(e.g. an idea, a book, a technology), is positively correlated to – in a stricter variant is proportional to or obeys a power law of – its age, so that any additional period of survival extends its future survivability. For example, an out-of-print book published 10 years ago will hardly be read in 10 years from now: it will not survive. Instead, a book published 50 years ago and still printed and read has good chances to be read in another 50 years. Following this principle, if you had to place your bets on the survival of books, it is advisable that you put your money on Jane Jacobs's run for at least another 50 years, on Dostoyevsky for 150, on Descartes for 500 and on The New Testament for at least another 2000 years.

Our first point on antifragility *vis-à-vis* resilience *in planning* is a plea for greater terminological precision. It is often the case things get called resilient without them being cases of resilience. It may be a question of nuances, and after all everyone is free to choose the words to use, and to come to an agreement with others on their meaning. However, it should make one pause a moment when often one notices the need to supplement the term resilience with certain adjectives – such as "adaptive", "transformative", "evolutionary" (Davoudi et al., 2013; Davoudi and Porter, 2012) – which strictly speaking pertain to antifragility. We already mentioned this distinction between a "strict" and an "extensive" use of resilience. There indeed seems to be a significant overlap between what in the current planning literature is understood planning for resilience on one hand, and what we propose to call antifragile planning on the other. So, should we dismiss this distinction as just a nominalist squabble, a sterile pedantry, so that we better throw in the towel, drop antifragility and embrace the extensive meaning of resilience?

It though does seem to us appropriate to advance a modest plea to sharpen up our common conceptual apparatuses, if only to enrich our lexicon and make a more perspicuous use of it, and to start employing the term "antifragile" when we essentially talk about antifragility, and "resilient" when we talk about resilience. There are of course many worthwhile nuances, but we hold that *the guiding principle to settle the distinction should be that resilience proper be understood as a limit case of antifragility*, as we suggested above.

This, to some extent, may also be a way to "save" resilience from the danger of becoming an empty buzzword, so voracious that after swallowing everything it means nothing. As Devoudi and Porter (2012: 329) have already observed, "resilience appears to be fast replacing sustainability as the buzzword of the moment. It may well follow a similar fate and become a hollow concept for planning: an empty signifier which can be filled to justify almost any ends. […] Anything that is uncritically and easily accommodated into our lexicon demands close investigation to clarify what ends it is serving." In this sense, for instance, it seems to us more productive to frame "evolutionary resilience" (Davoudi et al., 2013; Simmie and Martin, 2010) as antifragility. If, following Devoudi, "evolutionary resilience" is characterised by (*i*) persistence (being robust), (*ii*) preparedness (learning capacity), (*iii*) adaptability (being flexible), and (*iv*) transformability (being innovative), the last three terms clearly refer to salient features of antifragility, that "building capacity for envisaging and embracing transformation through creativity and imagination at institutional, community and individual levels and thus cultivate flexibility, resourcefulness and cooperative networks at various scales" (Davoudi et al., 2013: 319).

This hope for greater terminological clarity leads us to our second and more substantial claim on antifragility *vis-à-vis* resilience. To point out one fundamental difference between antifragility and resilience we want to put focus on one core property of antifragility: *optionality*. It is the property of having options (possibilities, rights, entitlements, capabilities to do, to have, to become, to change the course of action, to reverse prior decisions, etc.), but not obligations. The greater the optionality embedded in a course of action, the larger the possibility of a favourable asymmetry between the action's upsides

and downsides. Optionality is an essential property of antifragility because having options, also after undertaking a course of action, allows to benefit from unpredicted and unpredictable opportunities, while limiting the possible harm arising from threats.

Optionality draws a watershed between antifragility and resilience: while at the core of antifragility, optionality *in the strong sense* is absent in resilience. We say in the strong sense to more carefully define the distinction. Indeed, the goal of resilience may be pursued for institutions, services, infrastructures, environmental systems, that are valuable also for providing certain optionality to people. A public transit system quite obviously increases the optionality to move and reach different parts of a city, and the availability of nearby natural environments offer options for recreation. But in this weak sense, resilience at its face value does not contemplate the possibility that these institutions, services, infrastructures, systems evolve, improve and gain, even in terms of their purpose of providing optionality, *specifically* from the unexpected opportunities with time. For that, the goal of antifragility must be put to work.

Let us further clarify the distinction with an example. There is one notable piece of "planning theory" which we hold helps to mark the difference between resilience and antifragility. When, in her prodigious masterpiece *The Life and Death of Great American Cities*, Jane Jacobs (1961) presents the conditions for vibrant and safe neighbourhoods and examines the cases which possess these conditions, she goes on cautioning us against possible jeopardies, and suggests defensive measures in order to preserve the neighbourhoods as vibrant, lively and safe. In other words, she advises us on how to pursue a goal of resilience.

But when Jacobs recommends on building new neighbourhoods and on unslumming the existing ones, and suggests how to increase the chances of getting there, she is reasoning in terms of antifragility. In fact, she proposes a repertoire of measures[3] for creating favourable conditions so that autonomous individual and collective actions may have the greatest possible chances to bring about the evolution in the desirable direction (Cozzolino, 2018). If the aim is to have such-and-such neighbourhoods, we need to build in resilience in the neighbourhoods that are already such-and-such, and we need to build in antifragility if they yet need to evolve and become such-and-such.

But to that, we need to add an additional, normative layer also present in Jacobs' argument. She does not only tell us how to make neighbourhoods vibrant, but also why we would want them vibrant in the first place. Afar from just creating hip, cappuccino-sipping *Stadtluft* for the sake of it, Jacobs tells us such neighbourhoods are generators of diversity, innovation, business opportunities and culture. Places where new things, fostered by the encounter of diverse urban populations and by entrepreneurial and social experimentation, are more likely to emerge, to be experimented, and to flourish. In this sense, such neighbourhoods are engines of antifragility.

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[3] For example, through gradual processes aimed at a deliberate increase of diversity, density, people's attachment to places; and through investment of "gradual" instead of "cataclysmic money".

So antifragility in Jacobs shows up at two levels. On one level, to create new neighbourhoods or to unslum the existing ones, she recommends we proceed by strengthening their antifragility, their ability to gain from the unpredictable, from the spontaneous individual actions and self-organising. On the second, normative level, if we indeed need to work in the direction of making successful neighbourhoods resilient, by protecting their vibrancy against the jeopardy of specialisation and loss of diversity due to their very "success", it is in view of that antifragility of successful neighbourhoods at the second level, of them being engines of antifragility.

In our view, Jacobs does not only clearly envision cities in terms of antifragility, but also maintains the distinction, we are attempting to bring to fore, of antifragility and resilience being two different objectives. In general, antifragility is promoted by whatever opens and increases the possibility of local experimentation and tinkering, of new combination of uses in relation to new demands and pressures, of learning from trial-and-error, without introducing the threats of systemic risks from failure, when this experimenting is not just a natural random process but due to actions of individuals who are themselves risk-takers. Conversely, whatever reduces such possibilities, either through prohibitions, regulations, or due to the lack of diversity and of a sufficiently granular plurality of uses and practice on the ground, can be said to fragilise neighbourhoods and cities.

In Table 1. we attempt to summarise the distinction between resilience and antifragility by contrasting some key concepts, phenomena and practices we mentioned, or drawn from Taleb.

|  | **Resilience** | **Antifragility** |
|---|---|---|
| General | "No harm, no gain from disorder" (bounces back to prior equilibrium or a functional equivalent) | "Gains (sometimes) from disorder" |
|  | Provides no optionality (in the strong sense) | Provides optionality (in the strong sense) |
|  | Redundancy* | Functional redundancy (degeneracy in biology)* |
|  | Phoenix (mythology)* | Hydra (mythology)* |
| Examples in planning | Persistence, Preparedness, Reactive adaptation | Transformative, Evolutionary, Proactive adaptation, Innovation |
|  | Jane Jacobs's "defensive measures" against jeopardies to urban diversity | Jane Jacob's unslumming strategy |
|  | Restoration of buildings | Exaptation of buildings |
|  | Participatory design | Tactical urbanism |
|  | Consensus building | Agonistic pluralism |

Tab. 1. Resilience vs. Antifragility (* from Taleb, 2012: Tab. 1)

# 4. Towards an Antifragile Planning

Our Jane Jacobs example should suffice to make it clear we do not claim there is a new, yet unseen mode of governing urban systems we should dub "antifragile planning". Rather, our claim is that antifragility, and its distinction from resilience, offers a valuable conceptual framework. In this sense, its role is similar to that Swanstrom (2008) assigns to the concept of resilience itself: "more than a metaphor but less than a theory. At best it is a conceptual framework." Indeed, many existing planning practices and theoretical proposals, on different spatial scales, implicitly practice antifragility. So, altogether, our proposition is more modest, to assess the usefulness of the concept for the debate on planning under uncertainty, and to suggest it as an umbrella term embracing parts of different proposals which in our view on at least some accounts pursue the goal of antifragility. These go from some formulations of strategic planning (e.g. Albrechts, 2010; Albrechts and Balducci, 2013), to evolutionary resilience (Davoudi et al., 2013; Davoudi and Porter, 2012; Meerow et al., 2016), to adaptive planning (Ahern, 2011; Kato and Ahern, 2008; Rauws, 2017; Skrimizea et al., 2018), to tactical urbanism (Silva, 2016;

Wohl, 2018), to those which explicitly reference antifragility (Fusco et al., 2017; Las Casas and Scorza, 2017; Roggema, 2019).

Let us attempt to delineate some essential properties of an antifragile planning[4]. The goal of antifragility in planning could have two different meanings. One is to understand it as pursuing antifragility for the *object of planning*. In this sense an antifragile planning would mean to do planning to make urban systems more antifragile, and to avoid making them more fragile. We may call this way of understanding antifragile planning "planning for antifragility".

The second way of understanding antifragile planning is to think of pursuing the goal of antifragility for the *planning itself*, for its practices and outputs. In this second sense, the pursuit would be to make urban planning decisions, their decision-making processes, procedures, policies, regulations, management, and spatial plans, themselves more antifragile and less fragile. We may call this second way of understanding antifragile planning "antifragility for planning".

The two meanings are not functionally unrelated. An antifragile planning policy – designed sufficiently open-ended and flexible, and embedding enough optionality, in order to embrace and benefit from opportunities, spontaneous social energies, entrepreneurship, and from yet unpredictable, or low-probability, circumstances – could both advance the goal of antifragility of the urban system it "acts upon", while being itself antifragile. Therefore, while the distinction may be analytically useful, and there could be separation between operational criteria for "planning for antifragility" on one hand, and for "antifragility for planning" on the other, what we propose to call antifragile planning should be antifragile in both senses. Conversely, a "fragile planning" is fragile in both these senses: it fragilises the urban systems it acts upon, and its processes, outputs and actions are themselves fragile.

## 4.1 Fragilisers

Since other than what to do, antifragile planning is much about what better avoid doing, we want to begin from a set of attitudes and practices of intervening on social systems in general, and on urban systems in particular, which may fragilise them. Here is a non-exhaustive repertoire of such *fragilisers*, largely known in planning and public policy literature.

1. *Plans and policies based on fragile predictions.* This is a category of fragilisers implicit in many of the more specific ones that follow. This category of fragilisers are due to the idea that the purpose and the task of planning is to strongly determine *specific* spatial and social arrangements and outcomes, and therefore requires *hard* predictions of what the city will be like and how it will evolve and react to planning interventions on the mid- to long-run. Given that urban systems are in many aspects intrinsically unpredictable, should the efficacy of planning decisions hinge on *hard*

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[4] For a more extensive treatment, see Blečić and Cecchini (2016).

and hence fragile predictions (Batty, 2007; Moroni, 2015a)[5], the decisions would be themselves fragile, in both senses we have given it above.

2. *Excess of centralisation*-cum-*micromanagement*. Centralisation increases the risk of blow-ups, catastrophic failures and jeopardies to the survival: one bad decision applying to all can wreak havoc on the entire system. This also applies to large investments and megaprojects (Flyvbjerg, 2017; Flyvbjerg et al., 2003), where holds that "big is fragile" (Ansar et al., 2017). Instead, decentralised decision-making may lead to only local errors which in principle are harder to propagate to provoke systemic failures. Furthermore, decentralised decisions favour greater experimentation and tinkering and foster innovation through learning by trials-and-errors (Taleb, 2012). To be clear, a policy preference may make centralisation justifiable for the efficacy and expediency of pursuing certain policy goals, for example equity or uniformity of conditions, opportunities or outcomes, or due to large scale economies, network effects and fixed costs of investment. It however threats to fragilise the system and to jeopardise its antifragility, especially when the centralised action aims not only to design a general frame of reference for individual and local action, to grant rights, to provide universal public goods, and to solve collective action problems in the case of infrastructures with large network effects, but also to micromanage the detailed workings of the system, in all its parts.

3. *Efficiency* and *optimisation*. There are cases where it is worthwhile and possible to pursue efficiency and optimisation of certain sub-systems, services and processes. But this is an uncontroversial effort *only if* the following three conditions are simultaneously satisfied: (*i*) the general purpose of these sub-systems, services and processes to optimise and make efficient is uncontroversial (*uncontroversial purpose*); (*ii*) their relevant performance is measurable on only a single criterion (*mono-criterion performance*); and (*iii*) the outcomes of the effort to optimise and make them efficient are predictable (*outcome predictability*). Even letting aside the condition of *outcome predictability*, is such a simplifying teleology, grounded on uncontroversial purpose and mono-criterion performance, a meaningful and feasible pursuit in the case of urban systems in general? Urban systems are rather a common platform for the "heterogony of ends", a shared spatial, social, cultural and economic context within which different agents choose and pursue their ends and life plans, by means of encounter of the human agency with the multiplicity of opportunities offered by the urban system, by its physical fabric, by the way in which it is organised, designed and regulated, and by the social practices of use of space. The fragilising power behind the thrust for efficiency and optimisation arises especially when it is focused only on the immediate first-order effects, because such efforts may trim down the optionality, remove safeguards and protective redundancies, reduce the opportunities of exaptation (Johnson, 2010), and thus shrink the possibility of evolutionary adaptations, of change of uses, of embracing the multi-

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[5] Predictions that have to be obtained through models that purport to provide specific rather than generic outcomes (Batty, 2007), "explanation of detail" rather than "explanation of the principle" (Moroni, 2015a, following Hayek's distinction) are *highly sensitive* to parameters, calibration, and to large availability of data. So, predictions based on such models cannot but be fragile.

plicity and heterogeneity of ends and needs – present and future (Zellner and Campbell, 2015).

4. *Specialisation*. Excess of specialisation is a special case of trimming down the optionality, for it makes the system fragile to external perturbations and reduces its capacity to adapt and evolve with the changes in the environment. This has long been pointed out by Jane Jacobs (Ellerman, 2005). Examples of one-company towns or places with tourism monocultures come so mind. The case of the historical city of Venice overran by tourism, functioning less and less as a city and more and more as a one big open-air amusement park, is an exemplary contemporary cautionary tale.

5. *"Extractive" (rather than inclusive) political and economic institutions*, and the *crumbling of the "cement of society"*. The first fragiliser (Acemoglu and Robinson, 2012) removes the conditions for political and economic participation, does not provide incentives for investment and innovation, and violates the principles of accountability and publicity (Rawls, 1996). The second is a fragiliser of social cohesion, by which we do not mean a stationary state of "harmony", but a dynamic, ultimately precarious, outcome of conflicts, reciprocal accommodations, and partisan mutual adjustments. An example of such a fragiliser is when excessive economic inequality, coupled with particular institutional arrangements, spills over into the inequality of real opportunities, capabilities, and possibility to meaningfully participate in the democratic political process, undermining the social cohesion from within (Sandel, 2012).

## 4.2. The three planes of antifragile planning

The perspective of antifragility allows us to distinguish three operational planes for the planning practice: (i) the *via negativa*, (ii) the shared vision and the "coordination by means of future", and (iii) the space of the projects. We envision the three operational planes operating on different time, spatial and institutional scales, from long-run and high-level (regional and above) of the *via negativa*, to short-term and strictly local of the space of the projects.

### 4.2.1 *Via negativa*

Building on Taleb, by *via negativa* in planning we mean a set of mainly negative general rules providing "external" restrictions and prohibitions delimiting the space of possible actions. Largely nomocratic in nature (Alexander et al., 2012; Moroni, 2010), they follow the logic of *via negativa* insofar as they provide proscriptive rather than prescriptive rules (Hakim, 2014), do not directly predetermine the outcomes, do not impose performative behaviours, do not indicate what to do and what should be done, do not tell what should happen, but mainly what is forbidden, what should not be done. But the concept of *via negativa* also refers to the removal of what could be harmful and of the superfluous which wastes social and human energies (Moroni, 2015b), from counterproductive constraints to procedural and normative superfetation.

A *prima facie* content of such a *via negativa* in planning is to be looked for in avoiding fragilisers we described before, and in embracing the "coding turn" in planning (Alfasi, 2018). For that, the *via negativa* constitutes a core of what it takes to have an antifragile planning, and its political legitimacy may be, at least partially, independent from mere policy preferences.

However, under the tenet of *via negativa* there is also place for policy options subject to democratic deliberation. The idea of *via negativa* does not imply a withdrawal into a planning night-watchman state or the maintenance of the status quo in the legal and institutional settings. As long and the regulation observes principles of generality, and retract from short-term contingencies and conveniences, the *via negativa* does not exclude the possibility of structural transitions and "changes of regime" if that removes the sources of fragility. In other words, if we are operating through general and abstract rules – without the pretence to bridle, over-control and micro-manage the dynamicity of the system, its capacity of self-organisation, and the capability of agents for dynamic adaptation – different policy options become admissible. For example, a different regime of the *ius aedificandi* and land property rights, or the introduction of fiscal tools for land value capture (Ingram et al., 2012).

### 4.2.2. Shared vision and "the coordination by means of future"

A planning firmly tied to hard predictions is fragile, but a planning which does not "tend towards future" and does not "create future" is a contradiction in terms. It is reasonable to expect a political community would care for its future collective outcomes, at least on a time horizon accessible to one's imagination and circuit of care of three to four generations.

For this, there is space for deliberation on a *reasonably shared vision* of desirable futures and of those to avoid, through a strategic decision (Albrechts, 2010; Albrechts and Balducci, 2013). Such a shared vision is a concrete declination, in a precise historic moment, based on available resources, of the set of different freedoms which compose the right to the city. To define such freedoms, we hold that the Senian capability approach (Sen, 2009) can provide a theoretically and practically feasible normative focus, compatible with the goal of antifragility. That is so because extending capabilities provides space for actions and projects by economic and social agents and by the public institutions, thus making urban systems more antifragile, without with that fragilising individuals, indeed expanding their optionality. This shift from outcome-oriented to a capability-oriented planning could be operationalised through the idea of "urban capabilities" (Basta, 2016; Blečić et al., 2013, 2018). Besides providing a framework to cast into the normative content of an antifragile planning, we argue in the next section how the capability approach can also play the pivotal role in providing the basis for the legitimacy of antifragility in planning.

For the deliberation on the *shared vision*, the practice of construction of future scenarios may prove useful. To clarify how one could devise the purpose of "imaginary" future scenarios if the future is in principle unpredictable, we reiterate the proposition

(Blečić, 2013) that *the practice of construction* of future scenarios is something different from future scenarios in themselves: the purpose of *the practice* of construction of scenarios is not only, nor primarily, to predict, but rather the construction of meaning and shared knowledge of possible futures, which the agents participating in the process of scenario construction can appropriate, in order to mobilise for action and for collective coordination (Godet, 2001). The exceptionality of social systems resides in the unavoidable orientation towards future of the agents operating within those systems. Only in social systems there may exist an idea of future "operating" on agents in the present, since agents react to expectations and incorporate them into their behaviours and plans of action. This "causal retroaction" of an idea of future (Dupuy, 2014) is indeed typical of social systems, and which purely mechanical complex systems are entirely devoid of. By means of that idea of future agents can effectively coordinate, sometimes spontaneously, to make that future possible. So, even if future is unpredictable in the strong sense, it remains the essential means of coordination among agents. In this sense, the effectiveness of a future scenario constructed as a shared vision hinges on its capacity to successfully incorporate its impact on the agents, while avoiding "prediction paradoxes" of planning (Alfasi and Portugali, 2007: 169; Portugali, 2008). This possibility of "coordination by means of future" (Dupuy, 2014) is, on close reflection, the essential condition of possibility and efficacy of any planning[6].

### 4.2.3. The space of the projects

Finally, there is a flexible plane for actions and projects of the public planning and of individuals in the social forms they decide to choose. At the level of this plane resides the possibility of coordination along the backbone of the *via negativa* and the *shared vision*. Since the *via negativa* is not meant to pursue "positive" goals possibly established by the *shared vision*, this tension towards positive objectives is offered by what we call the space of the projects, a flexible space with stable boundaries and constraints for the individual action and for public intervention. A space which combines top-down with bottom-up, short and medium-term, possibly reversible, modular, even ephemeral, actions. *This "space of the project" is, as it were, a sort of* via positiva*, a space for action* (i) *constrained by the via negativa, and* (ii) *compatible with the shared vision.* Such space contemplates private transformations, public planning (Moroni and Cozzolino, 2019), private-public partnerships, but also embraces bottom-up practices of self-management, of temporary uses, and of tactical interventions (Silva, 2016).

## 5. On Legitimacy of an Antifragile Planning: Antifragility of What to What?

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[6] The idea of *coordination by means of future* was well expressed by the French economist Pierre Massé, a founder of the economic planning under the umbrella of the *Commissariat Général du Plan*, whose aim, according to Massé, was "achieving by concerted deliberation and study an image of the future that is sufficiently optimistic to be desirable and sufficiently credible to give rise to actions that will bring about its own realization" (cited in Dupuy, 2014: 57).

Before concluding, we want to examine the question of legitimacy of antifragility as a public policy goal. We especially want to address this question in response to Kolers' (2016). While making the case for resilience as a condition of legitimacy and justice of public policy, Kolers denies this status to antifragility. His proposition that antifragility is illiberal is grounded on the fact that antifragility is not just contextual but also level-relative: "The citizens' affairs cannot *all* be anti-fragile, because in many cases the anti-fragility of some involves capitalizing on the fragility of others. And the state or community cannot i*tself* be anti-fragile because part of its function is to absorb some of its citizens' fragility. As a state aim, anti-fragility is therefore illiberal" (Kolers, 2016: 95).

Kolers is correct to point out, as Taleb makes it explicit, that antifragility on the aggregate systemic level often emerges at the expense of fragility at the individual level. In such cases, the system benefits from the fragility (i.e. exposition to harm) of the individuals. For example, in biological evolution the source of antifragility of a species, and more so of an ecosystem, and more so of the entire ecosphere, largely depends on the relative fragility of individual organisms. This indeed is an essential feature of the mechanisms of natural selection. Closer to social systems, this condition is similar to Schumpeter's (1942) reflections on "creative destruction" through entrepreneurship and innovation in industrial-entrepreneurial districts, and in capitalism in general. So indeed, a system is antifragile if it gains from the fragility of its components. Such antifragility is obtained because in this way the system incorporates mechanisms of learning, it advances through trials-and-errors, it improves through tinkering, local experimentations and failures. Here Kolers is right to raise the core issue with antifragility as a political ideal, since in social systems some of those low-level components are humans and social groups, whose fragility can be a legitimate concern of the state, and whose treatment, liberties, well-being, and security are valuable goals, not on an unconstrained disposal for being fragilised, let alone right off sacrificed, for the sake of "the greatest antifragility for the greatest number".

In the case of urban systems, one could wonder if their antifragility may be at the expense of the fragility and survival of some individuals and social groups. We can offer two answers. The first is that that sometimes happens: in the evolution of cities social groups, functions, and economic activities disappear, get transformed, change their nature, and there could be limits to what a public policy can and is admissible to do about it. The second answer, though, is that a city without its people does not exist, and that people are citizens, a fact with a series of implications in terms of individual rights, social justice and public policy.

But perhaps Kolers' assessment of antifragility is too hasty. Taleb does not actually attempt, nor was that his aim in *Antifragile*, to work out a feasible political theory. But even if he were to lay out one with excessive shades of social Darwinism, up to jeopardising essential liberal principles, we wouldn't be bounded to be fundamentalist Talebians, nor would that be the only possible, let alone the most productive theory. In essence, we object that the level-relative nature of antifragility poses an insurmountable obstacle to the construction of a workable legitimisation of antifragility as a political ideal.

In general, political theory is not unfamiliar with dealing with level-relative concerns. For instance, the two-tier structure of Rawls' principles of justice operates with such concerns in mind, when the priority of the liberty over the difference principle wards off certain treatments on the "lower" level (i.e. violation of equal right to individual liberties) at the expense of the performance on the "higher" level (i.e. maximisation of the benefit of the least-advantaged members of society). In the context of planning theory, Moroni (2019) has convincingly argued that the distinction between such level-relative concerns is not only possible, but unavoidable and necessary.

So, rather than following Kolers to altogether dismiss antifragility as illiberal, we claim that we need to examine what kind of antifragility may be legitimate to pursue, and, considering its inevitable level-dependency, at what level should it be pursued. To paraphrase the question others have asked about resilience itself (Carpenter et al., 2001; Davoudi and Porter, 2012), the point is to ask "antifragility of what to what?" Indeed, the desirability of resilience depends on how one answers the question "resilience of what to what?" (Carpenter et al., 2001): it depends if the system to be made resilient is functional and valuable as-is and what its permanent disruption would bring about. If the status quo is undesirable, making is resilient may not be a valuable goal. To justify resilience as a legitimate political goal, Kolers' answers the question of "resilience of what to what" by clarifying that it should regard "the resilience of reasonably just social systems to disruptions that could significantly reduce quality of life and undermine democracy, [and therefore the resilience of such systems] would seem to be of important moral concern" (Kolers, 2016).

Now, taking into consideration our previous point on optionality in antifragility, similar argument may also be made for antifragility: the goal of antifragility can be pursued for valuable systems, by endowing them with optionality and asymmetry of gains versus harms, in order to increase the chances for them to evolve favourably, as long as acceptable trade-offs with regard to potential individual fragility can be stipulated. Under this condition antifragility can become a legitimate normative goal.

When thinking about stipulating such trade-offs starting from the minimal definition of antifragility as possibility of "gain from disorder", the core controversial question in public policy and planning becomes what should be elected as the informational focus to define and measure that "gain". This question can have a descriptive variant (what gain? at what level does the gain show up?, who gains?, at the expenses of whom or of what?), and a normative variant (who should gain? at what level should the gain show up?).

Here, for both variants of the question, we hold that the capability approach can fruitfully come to assistance and provide the adequate informational focus to define and measure the "gain" (Sen, 2009). First, capabilities are tightly related to the idea of optionality: to extend someone's capabilities is to extend one's options to be able to choose, among those attainable, those functionings one values the most. Second, the capability approach points to a possible way to answer the question of "antifragility of what to what", by working it out in a certain analogy with Rawls' two principles of justice:

1. First principle: to the classical liberal individual rights and protections (which better be robust/resilient), we should add individual capabilities (whose extension better be antifragile);
2. Second principle: to pursue the goal of systemic antifragility compatible with the first principle.

Since with this the system is made antifragile through extending capabilities by endowing individuals with optionality, this in part means to make individuals themselves antifragile. Overall, it seems to us possible to acknowledge that there is a favourable terrain for synergies, constructive interaction, positive feedbacks, and ultimately beneficial trade-offs between our two principles.

We must admit there is a limit to such a Rawlsian analogy. Given that capabilities are differentiated and purpose-oriented, they are in principle not as universal as the basic rights and are not as purpose-neutral as the Rawlsian conception of the primary goods[7]. So, there may arise the need to stipulate operational trade-offs when defining the relevant set of capabilities and, if necessary, which capabilities should be prioritised over which, and over what systemic antifragility. Indeed. But this observation pertains to the objections raised to the capability approach in general, so be we allowed not to wage this debate here (Brighouse and Robeyns, 2010), other than suggesting that these trade-offs may in planning be the proper object of the plane of the *shared vision*, subject to public debate and democratic deliberation.

Ultimately, the need to stipulate level-relative trade-offs and to define relevant capabilities brings us to our claim that antifragility is only a *partial* goal for planning. We here follow Dupuy's distinction between the objective analysis of the self-organising structure of social systems and the value judgment of what they do to individuals (Dupuy, 2014: 15). That in our case means to acknowledge that the question "what fragilises or antifragilises an urban system" is *not* the same question as "what is just and what is unjust". The second, normative question cannot be addressed and settled as a mere problem of expediency of action and policy under uncertainty and complexity. But although two different question, they should not be answered independently. *It is our core claim that the two questions in planning need to be addressed jointly, in order to make the answers we give to these questions normatively and operationally compatible one with the other.*

# 6. Conclusions

We have sketched out what an antifragile planning could mean and discussed how its legitimacy as a public policy goal may be constructed.

Before ending, we want to ward off any exclusivism or fundamentalism of antifragility. From all we say does not follow that cities should only be made of antifragile

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[7] Here we would express some reserves on Basta's (2016) attempt to reconcile the two by trying to frame capabilities as "only" an extension of Rawls' primary goods. For an extended discussion on this point, see the debate in Brighourse and Robeyns (2010).

things and subsystems. Urban systems are composed of many components and subsystems: some fragile, some robust, some resilient and some antifragile. There are many sufficient and efficient reasons for that to be so, so antifragility is not the goal to pursue *for everything, in every case and at any cost*. There are fragile components and subsystems which at least in part own their *raison d'être*, value, importance or beauty, to their fragility; sometimes fragility is pursued for the charm and allure of the delicate, ephemeral, frangible, weak. Then there are objects and systems which are robust, and they better be designed and built that way, for reasons of functionality, economy, durability and simplicity. Then there are resilient systems, altogether functioning satisfactorily: in the strict sense, urban resilience is a desirable feature of valuable systems in response to adverse events, infrastructure failures, environmental disasters, and social crises (Pickett et al., 2004). All in all, there are many objects and subsystems within urban systems which are fragile, robust, resilient and antifragile, and as such they are necessary and useful for their survival and functioning, and for human well-being.

That being said, we hold that antifragility can be elected as a more general and superordinate principle for an urban system as a whole, and that then the system can and should within it include many components and subsystems which are, from case to case, made resilient, robust, fragile, antifragile. In our view, antifragility, like resilience, is an attempt to organically introduce within public policy the idea of complexity and of the ineliminable uncertainty of future coupled with care for future collective outcomes. In this sense, the two goals can coexist. Taking notice that the desirability of resilience and of antifragility may apply to different systems and scopes, it is of course valuable to pursue resilience of systems to disruptions that could significantly reduce quality of life and undermine democracy. But in general, also in the light of our core claim that resilience is a limit case of antifragility, for urban systems, we submit, antifragility is a more general and superordinate principle, and thus a worthwhile political goal.

There is perhaps one lingering question we need to address. Would antifragility of urban systems be possible without planning, without some form of governing or collective management of spatial transformations? The answer is, in a sense possibly yes: we cannot exclude that an unmitigated anarchy or purely market-based mechanisms would not at the end exhibit some form of antifragility at the systemic level. But ultimately, the answer to the question must be no, if we want to address Kolers' preoccupation for the level-relative outcomes, for the antifragility of some capitalising on the fragility of others. In this sense, planning cannot avoid politico-ethical concerns. Only, our point is, it has to incorporate the awareness of complexity and uncertainty, and thus the goal of antifragility. So, we are returning here to our previous point of "what is antifragile" and "what is just" being two different questions. Two different questions that in planning need to be *jointly and simultaneously* addressed, so that the answers we ultimately give to these questions are compatible one with the other.

By discussing the notion of antifragility and comparing it with resilience, our primary purpose here was to point towards a way to broaden the general coordinates of the debate on planning under complexity and uncertainty. We hope we laid out at least parts of the groundwork necessary to claim that antifragility is a contentful and legitimate

partial goal for planning, and that therefore planning ought to incorporate antifragility into both theory and practice. We acknowledge that much theoretical and empirical groundwork has yet to be covered, especially on the contextualisation and application of the conceptual framework to different planning problems and trade-offs, for ours to ultimately prove to be a valuable contribution to the debate.

# References

Acemoglu D and Robinson JA (2012) *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. New York: Crown Publishing Group.

Ahern J (2011) From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. *Landscape and Urban Planning* 100(4). Landscape and Urban Planning at 100: 341–343.

Albrechts L (2010) More of the same is not enough! How could strategic spatial planning be instrumental in dealing with the challenges ahead? *Environment and Planning B: Planning and Design* 37(6): 1115–1127.

Albrechts L and Balducci A (2013) Practicing Strategic Planning: In Search of Critical Features to Explain the Strategic Character of Plans. *disP - The Planning Review* 49(3): 16–27.

Alexander ER, Mazza L and Moroni S (2012) Planning without plans? Nomocracy or teleocracy for social-spatial ordering. *Progress in Planning* 77(2): 37–87.

Alfasi N (2018) The coding turn in urban planning: Could it remedy the essential drawbacks of planning? *Planning Theory* 17(3): 375–395.

Alfasi N and Portugali J (2007) Planning rules for a self-planned city. *Planning Theory* 6(2): 164–182.

Anderson PW (1972) More Is Different. *Science* 177(4047): 393–396.

Ansar A, Flyvbjerg B, Budzier A, et al. (2017) Big Is Fragile. In: Flyvbjerg B (ed.) *The Oxford Handbook of Megaproject Management*. Oxford: Oxford University Press, pp. 60–95.

Basta C (2016) From justice *in* planning toward planning *for* justice: A capability approach. *Planning Theory* 15(2): 190–212.

Batty M (2007) *Cities and Complexity: Understanding Cities with Cellular Automata, Agent-Based Models, and Fractals*. Cambridge, MA: MIT Press.

Blečić I (2013) *Costruzione degli scenari per la pianificazione*. Milan: FrancoAngeli.

Blečić I and Cecchini A (2016) *Verso Una Pianificazione Antifragile. Come Pensare al Futuro Senza Prevederlo*. Milan: FrancoAngeli.

Blečić I and Cecchini A (2017) On the antifragility of cities and of their buildings. *City, Territory and Architecture* 4(1).

Blečić I, Cecchini A and Talu V (2013) *The Capability Approach in Urban Quality of Life and Urban Policies: Towards a Conceptual Framework*.

Blečić I, Cecchini A and Talu V (2018) Capability approach and urban planning. Fertile urban capabilities and quality of urban life of the most disadvantaged inhabitants. *Archivio di Studi Urbani e Regionali* 48(122): 34–52.

Brand S (1994) *How Buildings Learn: What Happens After They're Built*. New York: Viking Press.

Brighouse H and Robeyns I (2010) *Measuring Justice: Primary Goods and Capabilities*. Cambridge, UK: Cambridge University Press.

Carpenter S, Walker B, Anderies JM, et al. (2001) From Metaphor to Measurement: Resilience of What to What? *Ecosystems* 4(8): 765–781.

Chettiparamb A (2019) Responding to a complex world: Explorations in spatial planning. *Planning Theory*: 1473095218820554.

Cozzolino S (2018) Reconsidering Urban Spontaneity and Flexibility after Jane Jacobs: How do they work under different kinds of planning conditions? *Cosmos + Taxis* 5(3): 12.

Davoudi S and Porter L (eds) (2012) Applying the Resilience Perspective to Planning: Critical Thoughts from Theory and Practice. *Planning Theory & Practice* 13(2): 299–333.

Davoudi S, Brooks E and Mehmood A (2013) Evolutionary Resilience and Strategies for Climate Adaptation. *Planning Practice and Research* 28(3): 307–322.

De Roo G and Hillier J (2012) *Complexity and Planning: Systems, Assemblages and Simulations*. London: Routledge.

Duit A (2016) Resilience Thinking: Lessons for Public Administration. *Public Administration* 94(2): 364–380.

Dupuy J-P (2014) *Economy and the Future: A Crisis of Faith*. East Lansing: MSU Press.

Ellerman D (2005) How Do We Grow? : Jane Jacobs on Diversification and Specialization. *Challenge* 48(3): 50–83.

Flyvbjerg B (ed.) (2017) *The Oxford Handbook of Megaproject Management*. Oxford Handbooks. Oxford: Oxford University Press.

Flyvbjerg B, Flyvbjerg BP and C of MPMB, Bruzelius N, et al. (2003) *Megaprojects and Risk: An Anatomy of Ambition*. Cambridge: Cambridge University Press.

Fusco G, Caglioni M, Emsellem K, et al. (2017) Questions of uncertainty in geography. *Environment and Planning A: Economy and Space* 49(10): 2261–2280.

Godet M (2001) *Creating Futures: Scenario Planning as a Strategic Management Tool*. Washington, DC: Brookings Institution Press.

Goldman A (1964) Lindy's Law. *The New Republic*, 13 June. 150th ed.

Hakim BS (2014) *Mediterranean Urbanism: Historic Urban / Building Rules and Processes*. Berlin: Springer.

Hilier J (2012) Baroque complexity: 'If Things were Simple, Word Would Have Gotten Round'. In: *Complexity and Planning: Systems, Assemblages and Simulations*. London: Routledge, pp. 37–73.

Ingram GK, Hong Y, Lincoln Institute of Land Policy, et al. (eds) (2012) *Value Capture and Land Policies: Proceedings of the 2011 Land Policy Conference*. Cambridge, MA: Lincoln Inst. of Land Policy.

Innes JE, Booher DE and Booher DE (2010) *Planning with Complexity: An Introduction to Collaborative Rationality for Public Policy*. London: Routledge.

Jacobs J (1961) *The Death and Life of Great American Cities*. New York: Random House.

Johnson S (2010) *Where Good Ideas Come From*. New York: Riverhead Books.

Kato S and Ahern J (2008) 'Learning by doing': adaptive planning as a strategy to address uncertainty in planning. *Journal of Environmental Planning and Management* 51(4): 543–559.

Kolers A (2016) Resilience as a Political Ideal. *Ethics, Policy and Environment* 19(1): 91–107.

Las Casas G and Scorza F (2017) A Renewed Rational Approach from Liquid Society Towards Anti-fragile Planning. In: *Computational Science and Its Applications – ICCSA 2017* (eds O Gervasi, B Murgante, S Misra, et al.), 2017, pp. 517–526. Lecture Notes in Computer Science. Springer International Publishing.

Mandelbrot B (1982) *The Fractal Geometry of Nature*. New York: W. H. Freeman and Company.

Meerow S, Newell JP and Stults M (2016) Defining urban resilience: A review. *Landscape and Urban Planning* 147: 38–49.

Moroni S (2010) Rethinking the theory and practice of land-use regulation: Towards nomocracy. *Planning Theory* 9(2): 137–155.

Moroni S (2015a) Complexity and the inherent limits of explanation and prediction: Urban codes for self-organising cities. *Planning Theory* 14(3): 248–267.

Moroni S (2015b) *Libertà e innovazione nella città sostenibile: ridurre lo spreco di energie umane*. Carocci.

Moroni S (2019) Constitutional and post-constitutional problems: Reconsidering the issues of public interest, agonistic pluralism and private property in planning. *Planning Theory* 18(1): 5–23.

Moroni S and Cozzolino S (2019) Action and the city. Emergence, complexity, planning. *Cities* 90: 42–51.

Pickett STA, Cadenasso ML and Grove JM (2004) Resilient cities: meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms. *Landscape and Urban Planning* 69(4): 369–384.

Portugali J (2000) *Self-Organization and the City*. Springer Series in Synergetics. Berlin Heidelberg: Springer-Verlag.

Portugali J (2006) Complexity Theory as a Link between Space and Place. *Environment and Planning A* 38(4). SAGE PublicationsSage UK: London, England: 647–664.

Portugali J (2008) Learning from paradoxes about prediction and planning in self-organizing cities. *Planning Theory* 7(3): 248–262.

Portugali J (2012) Complexity theories of cities: Achievements, criticism and potentials. In: *Complexity Theories of Cities Have Come of Age*. Berlin: Springer, pp. 47–62.

Portugali J, Meyer H, Stolk E, et al. (eds) (2012) *Complexity Theories of Cities Have Come of Age: An Overview with Implications to Urban Planning and Design*. Berlin Heidelberg: Springer-Verlag.

Rauws W (2017) Embracing Uncertainty Without Abandoning Planning. *disP - The Planning Review* 53(1). Routledge: 32–45.

Rawls J (1996) *Political Liberalism*. New York: Columbia University Press.

Roggema R (2019) Design for Disruption: Creating Anti-Fragile Urban Delta Landscapes. *Urban Planning* 4(1): 113–122.

Sandel MJ (2012) *What Money Can't Buy: The Moral Limits of Markets*. London: Macmillan.

Schumpeter JA (1942) *Capitalism, Socialism, and Democracy*. New York: Harper & Brothers.

Sen A (2009) *The Idea of Justice*. Harvard, MA: Harvard University Press.

Silva P (2016) Tactical urbanism: Towards an evolutionary cities' approach? *Environment and Planning B: Planning and Design* 43(6). SAGE PublicationsSage UK: London, England: 1040–1051.

Simmie J and Martin R (2010) The economic resilience of regions: towards an evolutionary approach. *Cambridge Journal of Regions, Economy and Society* 3(1): 27–43.

Skrimizea E, Haniotou H and Parra C (2018) On the 'complexity turn' in planning: An adaptive rationale to navigate spaces and times of uncertainty. *Planning Theory*, 7 June.

Swanstrom T (2008) *Regional Resilience: A Critical Examination of the Ecological Framework*. Working Paper 2008,07. Berkeley, CA: University of California, Institute of Urban and Regional Development (IURD).

Taleb NN (2012) *Antifragile: Things That Gain from Disorder*. 1. ed. New York: Random House.

Wohl S (2018) Tactical urbanism as a means of testing relational processes in space: A complex systems perspective. *Planning Theory* 17(4): 472–493.

Zellner M and Campbell SD (2015) Planning for deep-rooted problems: What can we learn from aligning complex systems and wicked problems? *Planning Theory & Practice* 16(4): 457–478.