MASTERPLANNING FOR CHANGE: LESSONS AND DIRECTIONS

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Abstract

Unprecedented worldwide urbanisation, financial instability, climate change and emerging new lifestyles are challenging the capacity of cities to attract and retain people and activities. Particularly, as many masterplan-driven developments realised from the second half of last Century have been criticised for their inability to cope with changing needs and uncertainty of future outcomes and for their incongruity with native physical, socio-economic and environmental contexts, the need to reform conventional approaches to masterplanning is now pressing. As cities competitiveness and success depends on their capacity to meet these manifold challenges, a new generation of masterplans has emerged over the recent years to respond more clearly to the sustainability agenda.

However as we become increasingly aware that cities are inherently unstable and prone to unpredictable change over time, to complement the concern for sustainability, resilience as applied in the field of system-ecology needs now consideration.

The paper argues that re-evaluating masterplanning against the theoretical framework of resilience would help defining a reformed approach, referred to as "Masterplan for Change"*, more openly aimed at giving strategic direction and spatial quality to places, while accommodating modification over time. However the role of resilience in guiding urban design and masterplanning is still marginal. Hence, the fundamental link between sustainability and resilience is clarified and a preliminary list of guiding principles of* "Masterplan for Change"*, emerged from combination between urban design sustainability and socio-ecological resilience principles, suggested.*

1. Introduction and Background

Over the last half-century, urban and population growth were largely managed through centralised control in the implementation and coordination of transformations in the built environment. This reflected the need to give rational foundation to urban planning and management and the belief that acquisition of complete and certain knowledge on future outcomes would allow to scientifically pursue the public interest (Alexander, 1984, Thwaites et al., 2007, Batty, 2013b). Masterplans were seen elective tools capable to translate this knowledge into space through detailed and prescriptive spatial visions on the future asset of an area over a long period of time (Firley and Grön, 2014). Once implemented, they would bring about wealth, civic uplift and physical order into society (Hall, 1988). However increasingly from the 1960s these top-down masterplans were systematically accused of physical determinism and short-sightedness as they advocated an ideal final state that was often unrealistic (Jacobs, 1961, Bullivant, 2012) and underestimated the irrational, unpredictable and complex dynamics taking place once the masterplan was realised (Portugali, 2011, Verebes, 2013).

Today, the unprecedented changes the world is facing are uncovering even more the shortcomings of this approach to designing cities (Tachieva, 2010, Verebes, 2013, Mehaffy et al., 2011). In a world inhabited by 7 billion people, 50% now live in cities. By 2050, this number will spike to 70%, and 87% of these new urbanites will live in today's developing countries (UN-HABITAT, 2012). The impact of human activities has, for the first time in history, reached global dimension, ushering a new geologic epoch earth scientists referred to as *"Anthropocene"* (Ellis et al., 2013). The disproportionate detrimental role cities carry on the global ecosystem is most visible in the sharp increase in frequency and severity of natural disasters (Adger et al., 2013). These, far from being merely environmental issues, have major social-economic implications, affecting people's livelihoods and health (UN-HABITAT, 2009).

The 2008 global recession radically reduced financial availability and government effectiveness (Collier et al., 2013), highlighting the frailty of our urban development strategies to economic instability (Tachieva, 2010), with masterplans, acting as inflexible, overly prescriptive and static tool of spatial planning (UN-HABITAT, 2009). On one hand many large-scale state-led projects realized across Europe in the post-war years are endemically affected by economic inactivity, lack of community cohesion and social stigmatization (Rudlin and Falk, 2009). On the other, the neo-liberal urban planning model practised in the height of market-led development of early 1990s and relying on the private sector did not manage to better stand the recent collapse of the property market (Watson, 2009). In both cases repair strategies are economically demanding, as the overly-rigid structure of their form and pattern of ownership make them unable to recover quickly after unexpected shocks (Tachieva, 2010, Dunham-Jones and Williamson, 2011). This apparent inability of recent additions to our cities to cope with changing conditions is particularly worrying considering that over the next 100 years much of the buildings and infrastructure of the developed world will need to be reconfigured, replaced or even rebuilt, while even more will be needed to host and service the rapidly expanding cities of the developing world (Novotny et al., 2010).

Simultaneously, the socio-economic profile of urban population is also changing. Particularly in more developed countries, living, working, socialising and consuming patterns do not longer comply with the traditional models of nuclear family that drove urban planning over the last 100 years (Rudlin and Falk, 2009, Dunham-Jones and Williamson, 2011). Today's ascending generation, the so-called Millennials[1], is drastically reshaping housing trends and requirements of the built environment. Enabled by new forms of communication and powered by technological innovation, they move frequently location and occupation, rent rather than owning, chase opportunities that better respond to career aspiration or to employment instability and engage in flexible and mobile forms of work. At the same time the increasingly ageing population is challenging the services cities are able to offer in terms of accessibility, mobility, housing, facilities and healthcare. Shrinking, diversified and unconventional household types are further diversifying housing demand. This all calls for greater flexibility and quality in living and working environments and fairer access to opportunities within cities (Bernheimer et al., 2014, Litman, 2012). Matching these demands is the key for many cities competiveness and equity and opens up new largely unforeseen scenarios to urban development (Rudlin and Falk, 2009).

Aware of these manifold issues, over the last 20 years many countries are experiencing important reforms in their planning systems to deregulate land development and stimulate economic growth (Davoudi and Madanipour, 2015). This often implies decentralising governance, devolving responsibilities locally, implementing cross-tier collaborations, bottom-up participatory approaches and engaging innovatively with private sector actors (Bentley and Pugalis, 2013). In England, the Localism Act 2011 (House of Commons, 2011) introduced Neighbourhood Development Plans and Neighbourhood Development Orders, granting communities the right to pursue development they deemed desirable. This shift marks, at the very least and despite shortcomings (Davoudi and Madanipour, 2015, Ludwig and Ludwig, 2014) the trend of a retrenching State that envisions a more directly involved civil society and acknowledges the right of citizens to shape their own future. The Netherland, where traditionally municipalities hold a degree of autonomy in creating and implementing policy, is becoming an exemplar case of innovation in small-scale and bottom-up strategies to urban development, particularly in relation to the self-build agenda and the active involvement of municipalities (Lloyd et al., 2015). While the economic recession has slowed down construction everywhere, the legal power of Dutch municipalities in supplying land, providing for basic urban infrastructure and serviced land is playing a major role in ensuring architectural quality, social equity and economic viability in urban development during this transitional period (Tarbatt, 2013).

[1] *individuals aged between18-34 (Bernheimer et al., 2014)*

The need to update approaches also extended to masterplanning, whose role re-emerged in professional practice and academic research (Tarbatt, 2012, Firley and Grön, 2014, Bullivant, 2012). As a matter of fact, despite the growing criticism for conventional masterplanning approaches, masterplans remain central in many parts of the world as "*one of the principal urban design activities engaged in by urban designers and architects alike"* (Tarbatt, 2012: p. 20), both in public and private sectors (Watson, 2009, Bullivant, 2012). They are embedded in legislation and urban design guidance in many countries where they enable local authorities to turn policy, aspirations and objectives in three-dimension through an established range of mechanisms for commissioning, negotiation and delivery (Watson, 2009). Masterplans are by no means modern urban planning. Some of the most loved, successful and sought after parts of our cities, were built centuries ago through the implementation of clear, well-conceived masterplans which achieved character, coherence and flexibility, as in 1760's Edinburgh of James Craig, 1850's Paris of Haussmann and Barcelona of Ildefons Cerdà. Despite their ability to continuously and seamlessly regenerate over time these are generated very much by design, codes and regulations (Kostof, 1991, Hakim, 2014).

Hence, driven by the desire to address changing and new urban needs and rediscover the timeless quality of responsive and flexible urban structures, many experimental urban design projects are underway, particularly across Europe (Bullivant, 2012, Rudlin and Falk, 2009), supported by innovative commissioning, implementation and management methods and by new evidence-base knowledge of urban dynamics (Batty, 2013a, Bettencourt, 2013).

The possibility to assess the different performance and success over time of both recent masterplan and *historical* masterplans provides a real opportunity to systematically re-evaluate the role of masterplanning in dealing with change and uncertainty and in delivering more resilient and sustainable urban environments. This consideration is at the basis of the current research work, carried out at the Urban Design Studies Unit at the University of Strathclyde.

1.2 Urban design, sustainability and resilience

Since the issue of the report "*Our Common Future*" (Burton, 1987), the concept of sustainability gained momentum in different disciplinary fields, particularly in architecture and urban design. However, in the last decade, something has changed in how scholars and scientists look at sustainability (Batty, 2013b). Unpredictable disturbances as natural and artificial catastrophes (i.e. flooding, fires, building crises, economic booms and crashes) prevent any attempt to achieve long-term stability (Ahern, 2011), as future outcomes are largely beyond our ability to make predictions and, consequently, to make plans (Schön, 1987). Accordingly, sustainability must embed a transitional dimension and be interpreted as an on-going process rather than an ultimate goal (Novotny et al., 2010, Wu and Wu, 2013).

In the field of system ecology the property of a system to persist in the face of future change is called *resilience* (Holling, 1973). In natural ecosystems, it is described as the capacity of a system to respond to disturbance without changing its basic states and relationships, even when change is sudden and unexpected (Walker and Salt, 2012). Work in complexity theory (Batty, 2013b) and system ecology (Walker and Salt, 2012, Marcus and Colding, 2014) advanced the idea, now largely accepted, that not unlike natural ecosystems, cities are complex adaptive systems (Garcia, 2013), constantly unstable, inherently variable and prone to change over time. Therefore the adoption of the theoretical framework of resilience seems particularly powerful in addressing to uncertainty, variability and change in the urban environment. Indeed, according to Anderies (2014) resilience theory *"can provide some theoretical perspectives for addressing design challenges for built environment* […] *in the extremely challenging design environment of the Anthropocene"* (p. 130).

In particular, two concepts integral to resilience appear important in relation to cities (Novotny et al., 2010, Sharifi and Yamagata, 2014, Godschalk, 2003):

- *Robustness,* or the ability to withstand stress without significant structural or functional change, and

- *Adaptability*, or the ability to adjust to changing external conditions without radically departing from previous conditions

In cities, the ability to persist during periods of turbulence and preserve core identity, character and fundamental morphological structure (i.e. plots, blocks, streets and public spaces) are trademarks of most successful and memorable places (Carmona, 2010). Simultaneously such places also have the ability to change gradually and incrementally (i.e. through land-use conversion, small alteration in layout and arrangement of buildings and spaces, re-organisation of activities) though a self-organising mechanism that prevents them from getting *'locked-in'* in inefficient paths (Novotny et al., 2010) and spares them from the need of more radical interventions (Tachieva, 2010). Applied to masterplanning, resilience theory would stress the importance of conceiving, designing and assessing urban form in terms of its probabilities of maintaining its basic identity while continuously and gradually evolving.

However, the current debate on urban resilience mainly focuses on post-disaster emergency planning and on vulnerability to sudden and catastrophic events at the expense of smaller, progressive and incremental change (Davoudi et al., 2012). Additionally, whilst few system ecologists tried to translate the theoretical framework of resilience into spatial form (Marcus and Colding, 2014), in the vocabulary of urban designers the term is still a buzzword (Stumpp, 2013). Therefore its potential to operatively inform urban design practice remains largely untapped, a rather important gap given that design intervention on the urban environment are always mediated via the spatial form.

Within this broader framework, the current paper takes on the argument that embedding a resilience framework into urban design may help designers and policy makers to create places able to endure culturally, socially and environmentally as well as to dynamically adapt to contextual conditions and evolve. Accordingly, it is advocated the role of a reformed approach to masterplanning, referred to as *"Masterplan for Change"*, in giving strategic direction and spatial quality to places, by building in them enough resilience to accommodate modification over time. Recent masterplanning experiences and models have been driven by sustainability principles in shaping the form of new urban development. At the same time, literature has suggested for a number of years (Wu and Wu, 2013, Marcus and Colding, 2014) how the framework of socio-ecological resilience shares many commonalities with the sustainability agenda. Hence, to set the grounds for the hypothesis here presented, following pages clarify the fundamental link between sustainability and resilience and distil fundamental principles of *"Masterplanning for Change"*, achieved by integrating and combining urban design sustainability principles with principles of socio-ecological resilience.

2. Method for reviewing and combining principles of urban design sustainability and socio-ecological resilience

As the current paper aims to stress the appropriateness of a resilience framework in guiding the conception and assessment of masterplans, literature on urban design sustainability and socio-ecological resilience are used to generalize principles of *resilient* masterplanning or "*Masterplanning for Change"*. The two-stepped methodology presented in this paper consists in: 1) the identification of key principles of urban design sustainability and socio-ecological resilience and 2) the integration of the principles emerging from the two fields into principles of *"Masterplanning for Change";*

Review of key principles of socio-ecological resilience was conducted using the SCOPUS search engine including all publications in English[2] dating between 1978 and March 2015 referring to principles, characteristics or proprieties of resilient systems. After applying additional thematic restrictions to target the search, including the wider body of publications of the top 10 most active investigators reported and scanning the references section of most relevant publications, a total of 50 publications were selected to distil resilience-related criteria, from an initial of 758 documents.

Regarding urban design sustainability principles, much of the literature is summarized in the work of Carmona (2010) and Luederitz et al. (2013). To ensure the comprehensiveness of the list and a degree

[2] Since English publications accounted for 95.7% of all entries, this was considered acceptable.

of agreement upon it, this was integrated with other academic and non-academic publications as planning guidance (The Scottish Government, 2008, DETR, 2000), consultancy agencies statements (Roger Evans Associates Ltd, 2013), tested on textual statements associated with recent examples of masterplans randomly sampled from journals, books and websites and discussed with selected urban design practitioners, academics and policy makers (i.e. Glasgow Housing Association, Academy of Urbanism, Prince's Foundation). Although the list seemed to adequately reflect academic literature and professional practice, given the open-ended nature of this search, omissions, additions or modification are possible. These principles appear in the majority of cases described as physical properties having social-economic and environmental repercussions, hence their specification across these three aspects in the table below

13 principles were derived from literature on socio-ecological resilience (Table 1) and 10 from literature on urban design sustainability (Table 2).

Table 2. Thirteen principles of socio-ecological resilience

Principle	Definition
Self-organisation	Small-scales interaction and bottom-up rules produce macro-scale patterns at larger scales.
Autonomy	Ability of systems and subsystems to maintain some independence from outside control.
Coherence	Ability to function as unitary structures while composed by various elements and sub-systems by virtue of connectedness and integration at higher scale.
Interdependency	Reliance on mutual support and synergy within systems (components, sub-systems) and across different systems.
Flexibility	Ability to enact small, gradual adjustments in component and subsystem to respond to changing conditions and evolve.
Responsiveness/ Resourcefulness	Ability to timely identify problems, establish priorities act and re-organize function, structure, and basic order ahead and following disruptive events or failures maintaining key functions fit for purpose or minimising disruptions
Feedback	dynamic continuous process of trial and error that relies on experience, knowledge and memory of previous failure or success to effectively respond to context
Creativity/ Innovation	Ability to transform change into the opportunity to achieve a more advanced state by gradually tested and eventually mainstreaming innovative strategies
Diversity	Coexistence of many functionally different components providing a variety of services combined and distributed within and across scales/time, in a way that is efficient spatially and economically and thus avoiding reliance on a single solution.
Redundancy	Coexistence of many functionally similar components fulfilling the same, similar or backup function in several different ways, implying functional replication, internal variation and a degree of buffer capacity, so that failure of one component does not stall the whole system.
Modularity	Presence of small-scale, relatively autonomous and poorly-specialised modules. Whilst highly distributed and decentralized, modules can aggregate to form higher-level coherent systems, enabling contextual responses and decreasing spread of failure
Scale-free connectivity/ Scale hierarchy	Networks organised via few long-range connections and many tight short-range connections, with focal nodes connecting lower and higher scales together, where every scale is simultaneously connected to the others and all systems are mutually interactive, with no connective scale dominating the others. Hence, failure of a substantial number of links rarely affecting the network as a whole.
Balance/ efficiency	Capacity to guarantee performances in resource-limited settings, in the short and in the medium-to-long term by balancing inputs and outputs of resources and energy.

Adapted from, among others, Sharifi and Yamagata, 2014; Dovey, 2012; Galderisi, 2014; Novotny et al., 2010; Moench, 2014; Collier et al., 2013; Ahern, 2011; Cloete, 2012; Da Silva et al., 2012; Wu and Wu, 2013.

Table 2. Ten principles of Urban design Sustainability

Principle	Definition
Diversity	**Urban form:** mix of uses within buildings, blocks, streets; variety of buildings appearance, age and type; provision of a wide choice in mobility; **Socio-economic**: mix household types, age groups, income bases; variety of tenure options and employment and entrepreneurial opportunities. **Biological:** sustenance and enhancement of fertile and self-supporting habitats and a diversity of plants and animals through provision of diverse green spaces.
Connectivity	**Urban form:** permeable street and transport networks; fine-grain and accessible street layout and uses; physical and visual integration with their surroundings. **Socio-economic:** support and socialisation networks; face-to-face interaction opportunities. **Landscape:** interconnected ecological network, accessible for both people and wildlife.
Concentration	**Urban form:** efficient match between density, building typology, land use distribution, street and transport network and focal nodes and public spaces. **Socio-economic:** support of urban living, economic viability of transport and facilities. **Landscape:** reduction of land intake and ecological footprint; preservation of greenfield.
Distinctiveness	**Urban form and environment:** character result of unique geographic, morphologic and cultural circumstances; preservation and valorisation of built and natural heritage against pressures towards homogenisation; integration and response to setting and context. **Socio-economic:** awareness of local assets and economies; sense of pride and ownership; sense of identity and belonging.
Human needs	**Urban form:** facilities, services and spaces scaled to the needs of individuals and community and locally accessible; legible and well maintained places and buildings. **Socio-economic:** enhancement of psychological and physical health; sense of safety; comfortable human-scale environment; psychologically restorative connection with nature **Landscape:** Integration of natural resources within the built environment; balance between natural and man-made environment.
Efficiency	**Urban form:** efficient and innovative building design; reuse of existing fabric and infrastructure; integration of transport options; efficient land-use and street layout. **Socio-economic:** reduced incidence of cost of fuel; equitable distribution of costs and benefits of development. **Environment:** minimisation of energy deployed in building life-cycle; use of; reduction of waste emissions; use of services provided by ecosystem and renewable natural resources
Adaptability and Durability.	**Urban form:** places, buildings and infrastructure capable to upgrade, cater for overlapping functions, overcome obsolescence and adapt to technology, lifestyles, demography, uses. **Socio-economic:** places able to follow and adapt to people's life-cycle; flexible grass-roots management of properties and public spaces; preservation and reuse of community asset to foster sense of belonging and identity; **Environment:** long-term view on energy and environment; focus on non-environmental destructive uses, materials, resources.
Self-sufficiency.	**Urban form:** provision of basic needs locally and means local access to mobility options; reduced need for commuting; locally available community infrastructure. **Socio-economic:** self-sustaining and viable local economy; availability of local employment options; strong social capital; locally managed public spaces. **Environment:** local production of food, energy generation and waste disposal.
Stewardship	**Urban form and environment:** well-maintained public and green spaces; fine grained and diversified land division to enable different forms of management. **Socio-economic**: long-term commitment of community, stake-holders and local authority in management and governance;

Adapted from, among others, Carmona, 2010; Tarbatt, 2012; Barton et al., 2010; Luederitz et al., 2013; Thwaites et al., 22005.013; Farr, 201; Roger Evans Associates Ltd, 2013; Bullen, 2007; DETR, 2000; Rudlin and Falk, 200; Porta and Romice 2013; Thwaites et al. 2005.

The following section combines the two sets of principles based on evident agreement/analogy in literature into 12 principles of *"Masterplanning for Change"*. Eventually, this list will be functional to the selection of compatible masterplanning case studies and of relevant metrics to analyse them. Analysis of case studies will help verifying whether masterplans responding - or conceived according to - urban design sustainability principles and compatible with principles of resilient systems, display themselves resilience in their resulting urban form and use. This, however, is not the object of the current paper as is currently being investigated.

3. Defining principles of Masterplan for Change: linking urban design sustainability and socio-ecological resilience.

During both reviews it was noted that identified principles of urban design sustainability and socio-ecological resilience bear no distinction between structural characteristics and (i.e. modularity, diversity) and behaviours (i.e. self-sufficiency, distinctiveness) of the system/place. This, however, becomes particularly important in urban design and masterplanning, as clearly some of these properties (i.e. modularity) can be embedded from the outset in the physical design of a space (i.e. through fine-grained division of ownership into small plots) while others cannot be produced by design (i.e. self-organisation) and can only be indirectly encouraged or potentially enabled to evolve over time by many factors, forms being one (i.e. through setting looser frameworks and rules and leaving room for institutions to emerge and consolidate). Therefore in combining the two sets of principles these where structured in a) behaviours of resilient cities (i.e. how a resilient urban system operates) and b) structural characteristics (what structure is associated with these behaviours).

The final list includes 12 principles, 5 of which related to the *structural characteristics*, 7 to the *behaviours* of resilient urban systems (fig.1). The division in structural characteristics and behaviours is reflected in the structure of the next section. Each principle starts with a general definition. Structural characteristics focus on geometric and physical properties of the urban fabric and landscape. Behaviours, on the other hand, focus on capabilities and how, whenever possible, these are declined in the physical, socio-economic and environmental dimensions. For these, a link with the underlying urban structure is presented.

3.1 Structural characteristics of resilient urban systems

Diversity. Diversity has many dimensions - physical socio-economic and biological (Ahern, 2011).
Spatially, density entails presence of a variety of functions simultaneously or hourly/daily/weekly intertwiningly, both horizontally (i.e. in different buildings in close proximity) and vertically (i.e. in one same building) (Ahern 2010; Tarbatt, 2012) in a cost-effective way. Hence it requires intensification of uses, services and densities at focal points of the urban spatial network (i.e. transit hubs, main streets) in order to maximise accessibility and reach. Diversity also refers to modal variety (i.e. use of public transport and other non-motorized commuting such as cycling and walking).
Up to some extent socio-cultural diversity plays a role in establishing building a coherent identity and is related to generation and exchange of knowledge and diffusion of innovation and creativity (Wood and Dovey, 2015). Biological diversity, whilst contributing to sustain and enhance wildlife also caters for a variety of human needs and produces psychological wellbeing (Ahern, 2011)

Redundancy. In urban systems redundancy focuses on the multiplicity options to choose from (Folke, 2006) and the multiple paths that can be taken to perform or get access to the same function or to fulfil the same need (Salat and Bourdic, 2012). Redundant transport networks offer the possibility to choose between overlapping modal options to move across a same area or across the city. Similarly in a redundant street network people have plenty of option to choose from in selecting a preferred path. In the built fabric, redundancy complements diversity, by increasing and combining the range of small, medium, sized uses (i.e. houses, business activities, and shops), boosting user's choice. In all cases, local damage or failure can be overcome easily as flow can be re-routed and individual components easily substituted. In biological systems, the presence of a great number of species performing a similar function but responding differently to disturbance (i.e. natural predators, climatic

variation, pollution levels) ensures continuity of the services provided by the ecosystem and preservation of habitat integrity and richness over a wider range of conditions (Ahern, 2011).

Modularity. Urban systems possessing a modular structure are spatially and organizationally conceived as progressive assemblages of smaller independent but interacting units aggregating at different scales (Batty, 2013b). In the urban fabric, the plot is the smallest and most basic land-use unit (Panerai et al., 2004). Indeed plots are individually independent (each driven by the development and management strategy of its owner) with roughly similar in size, non-specialised but, within certain limits, able to accommodate a wide range of functions. Plots can aggregate into wholes to form higher-order element (blocks, districts, settlements) or to disaggregate according to needs. Scale is also crucial as the larger are the units at the outset (i.e. blocks, super-blocks), the harder is for them to be modified or downscaled (Panerai et al., 2004). Additionally, in a fine-grained plot-based spatial structure, failure (i.e. demolition) has reduced impact and is more easily amendable. Hence, plot-based parcelling of land works with diversity and redundancy to increase complexity of the urban system, increasing its capacity to adapt to context, to test diverse strategies and to gradually change (Porta and Romice, 2010, Panerai et al., 2004, Tarbatt, 2012). Finally, modularity is a fundamental landscape property, particularly in their integration in the urban structure, where every small coherent unit or *patch*, can create a system of smaller spaces that can aggregate into larger wholes (Novotny et al., 2010). When woven into the fabric of cities to its ecological value is added an important restorative role for people (Thwaites et al., 2013).

Scale-free connectivity and scale hierarchy. Resilient urban systems many geometric and functional connections structured in a scale-free manner, following a scale hierarchy (Batty, 2013b, Salat and Bourdic, 2012), that implies the presence of a large pool of ordinary, frequently interspersed uses/elements countered by progressively less frequent, rarer and larger ones. Networks lacking connectivity at a given scale, as for strictly hierarchically organised street layouts, remain poorly connected and vulnerable to component failure despite spatial closeness of their elements, as they require upward and downward mobility to be navigated and only one or few paths (Salat and Bourdic, 2012). Cross-scale connectivity is fundamental for the emergence of focal points where different scales meet (i.e. transport hubs, busy street intersections) and where interaction and activity are most intense. This property is linked together with the three previous ones (diversity, redundancy, modularity), and together they help responding to a more diversified demand at many scales. This property extends to different aspect of the urban structure. In terms of mobility, networks structured so to include few fast links outreaching the wider metropolitan or regional context and many human-scale walkable and dense local streets are better connected both internally and across scales. In the ecological network, the presence of many small-scale frequent green areas (i.e. small private gardens), less frequent medium-scale green areas (i.e. neighbourhood parks) and occasional large portions of green space (i.e. county parks, natural reserves) highly interconnected at different scales via corridors (i.e. linear parks, tree-lined boulevards, rivers basins), cater for multi-habitat species and represent valuable basins of biodiversity, and offer important restorative benefits and services (Thwaites et al., 2013).

Balance/efficiency. The concept of efficiency it is rather controversial in resilience. While it is listed as important by many (da Silva et al., 2012), others (Novotny et al., 2010) state that resilience and efficiency are often incompatible. Indeed, when efficiency is framed in a short-term perspective, it tends to focus on optimization or maximization/minimization, at the expenses of redundancy (ibid.). Yet, as in a complex system there is no optimal state (Holling, 1973), efficiency must be framed into a long-term perspective of dynamic balance between energy and resources supplied and delivered (Godschalk, 2003). Hence efficiency describes an urban system, its places and buildings which provide means for human needs satisfaction, in a resource-limited setting, minimising negative impacts on the economy, the people and the environment (Cloete, 2012).

Spatially, according to Salat and Bourdic (2012) efficiency relates to structural properties of the urban system, as scale hierarchy, modularity, redundancy and interconnectedness of uses, networks, in that they fair distribution and access to places, resources and services. Efficiency does not rely only on

energetic performance but refers to the appropriateness of strategies to fulfil people needs (i.e. food, shelter) and provide fundamental services (i.e. public transport), in a way that is environmentally sound, socially equitable and economically viable.

3.2 Behaviours of a resilient urban system

Coherence/Identity. In the urban form, the concept of coherence refers to the capacity of various individually distinguished urban elements to achieve a sense of large-scale consistency and to behave as a whole (i, streets organise into a street network etc.).
Coherence does not entail a *"general plan"* or any particular form of spatial regularity and cannot be deterministically achieved. However, the spatial configuration of places and landscapes has an important role in supporting the formation of a complex form of order, an own identity and properties. More specifically, it relies, both in the built environment and in the ecological network, on fine-grained diversity, concentration and variability of complementary but not identical elements (i.e. plots, patches) tightly interacting at many different levels of scale both within and outwith the system (i.e. connected through network of streets or landscape corridors), similar in scale and size but progressively aggregating to higher scales (i.e. plots organise on street to shape urban blocks, patches connect to form continuous habitats) (Salingaros, 2000). Hence, coherence is strongly related to diversity, redundancy, scale-free connectivity, modularity and scale hierarchy.
Coherence in urban form is a trademark of the most cherished and successful cities and places (Salingaros, 2000, Barton et al., 2010) as adds distinctiveness and uniqueness (Salat and Bourdic, 2012). In ecological terms, coherence ensures habitat integrity, fundamental for the protection of and enhancement of biodiversity (Thwaites et al., 2005). Finally, coherence intended as identity is also an important social construct essential to create vital, liveable, well-loved human environments able to bring people together (Carmona, 2010).

Interdependency/Synergy. In the urban context interdependency involves stimulating synergy between spatial elements, agents and uses so that they are more than simply compatible but mutually enhancing (Sharifi and Yamagata, 2014). In the urban this implies, among other things, matching infrastructure and transport nodes with higher concentration of uses (i.e. increasing mix) and densities (i.e. through more compact building types), to support economic activity and urban living, to extend accessibility across different parts of the city, to reduce overall energy consumption and ecological footprint and to provide more opportunities for social interactions. From an environmental perspective, the synergistic relationship between different elements and functions of the ecosystem helps delivering a series of service within the urban environment to the advantage of urban communities and wildlife (Novotny et al., 2010). From a social perspective, collaboration between individuals, households, community groups, stakeholders and local authorities improves decision-making and governance (Godschalk, 2003), increases the possibility to access resources in a variety of circumstances, gather knowledge and learn.

Autonomy/Self-sufficiency. Self-sufficiency is the capacity of urban systems to exercise greater local control over essential assets (Carmona, 2010, Galderisi, 2014) hence reducing vulnerability to economic fluctuations and resource scarcity (Galderisi, 2014). As it requires addressing locally a range of functions associated to urban living (from community infrastructure, shops and businesses to public transport), diversity becomes crucial. From an ecological perspective, achieving self-sufficiency implies managing locally urban processes and resources and decentralising energy systems (Novotny et al., 2010). Socially it stimulates commitment to places, social capital formation, pro-active involvement and empowerment of local communities in urban management, ultimately fostering higher quality of life, and local knowledge (Crabtree, 2006, Roger Evans Associates Ltd, 2013).

Flexibility/Adaptability. Flexibility refers to the potential of the urban system and its components to accommodate foreseeable or unforeseeable future environmental, social, economic and technological requirements, through gradual and non-traumatic adjustments. Spatially, a diverse and modular urban structure enables quick, relatively inexpensive and immediate adaptations or replacement (i.e. improvements, upgrades and conversion, plot subdivision/aggregations). Building flexibility requires

a shift from a short-term mind-set that privileges specialised single-use buildings to a long-term strategy focused on durability and adaptability (Carmona, 2010) and allowing for easy re-organisation, conversion and reuse (Moench, 2014). Socially, flexible places and buildings are more inclusive and more likely to accommodate various lifestyles, households types (i.e. families, empty-nesters, cohabiting students), income bases, tenure/ownership models, employment preferences (i.e. live-work units, flexible working). They are less economically demanding are positively perceived by local communities. From an ecological perspective, flexibility prevents wasteful processes and lowers the load of the built environment on the ecosystem. (Carmona, 2010, Bullen, 2007)

Self-organisation. Resilient urban systems evolve from countless actions and decisions taken routinely by independent agents (i.e. individuals, households, communities), without awareness on cross-scale consequences (Portugali, 2000, Anderies, 2014) but that, nevertheless, have important cumulative effects on the overall system (Cloete, 2012). Natural ecosystems are prime examples of self-organizing systems, whereas independent elements at local scales interact through generative behaviours. While cities are also shaped by decisions taken by centralised institutions and top-down rules (i.e. building regulations, religious codes) (Kostof, 1991, Davoudi et al., 2012), vibrant and liveable cities have developed in large part through progressive self-organising processes (Anderies, 2012; Hakim, 2014). In fact, the built fabric is a significant enabler or impediment to self-organisation. Porta et al. 2013 reflects on how patterns of use, control and ownership of places affects processes of self-organisation in the built environment. The more people have unified control over these aspects, the higher their freedom to implement flexible and responsive changes (Liao). Hence fine-grained modular urban structures seem better suited to promote self-organisation because they are highly decentralised and autonomous. In turn, places that can be managed locally without need of central control, report higher overall maintenance (Porta). From a social perspective, Ostrom (xx in xx, xx) reported how people, given the possibility, can effectively organise and mobilise to deal with complex issues without any centralised governance structure. Additionally, demanding local management to locals promotes cooperation and stewardship (Sanoff, 2000), favours emergence of local distinctiveness against homogenising trends (Carmona, 2010). With this regard, Folke (2006) stressed how non-prescriptive management and regulation characterised by a degree of openness empowers people, according them greater margin of control and negotiation.

Resourcefulness/Responsiveness. Resourcefulness and responsiveness in urban environments are related to the ability of people and institution to mobilise effectively assets (financial, environmental, human, technological) and to meet established priorities (da Silva et al., 2012) to better and faster respond to stress and to achieve durable recovery (Moench, 2014). The availability and accessibility of tangible resources – physical, natural, social, human and cultural - is fundamental as it is the capacity to learn from experience, self-organise and establish networks (i.e. information and support), cooperate and innovate (Galderisi, 2014, da Silva et al., 2012).
Resourcefulness and responsiveness stress the role of the local scale to take action on the basis of a realistic understanding of priories and resources, as opposed to meet imposed requirements and externally set standards (Collier et al., 2013) and addresses local issues of inequality in distribution of resources, access to knowledge and material infrastructure that tend to penalise low-income and marginal groups. As resourcefulness is also an organisational capacity, it also requires establishing and maintaining relational links across space and scales. Therefore, in cities, the capacity of organizations (i.e. community groups) and public authorities (i.e. municipality, the State) are also crucial for coordinating local efforts.

Learning and innovation capacity. Resilient cities internalise and operationalize information, memory and experience as fundamental learning mechanism that enables them to avoid repeated failures and to innovate and improve performance (Galderisi, 2014).
Learning capacity is key for improving ability to anticipate, foresee and cope with change (Folke, 2006). Spatial effects of learning processes are generally context specific and tailored to local challenges and resources. Hence they contribute to distinctiveness and character.
Capacity to innovate helps transforming external pressures into opportunities betterment (Galderisi, 2014). Also the urban form learns through adaptation that also depends on the flexibility and

organisational capacity of its physical structure (Porta and Romice, 2010). Innovation implies failure, urban system that have enough autonomy at the smaller scales make it possible to initially test innovation through minor, gradual and fail-safe experiments. Then, in case of success, innovation can be more safely spread across wider urban system (Ahern, 2011). Socially, community learning is a basic ingredient of resourcefulness and responsiveness, and is further enabled synergy at different scales between people with different experiences, skills, and knowledge.

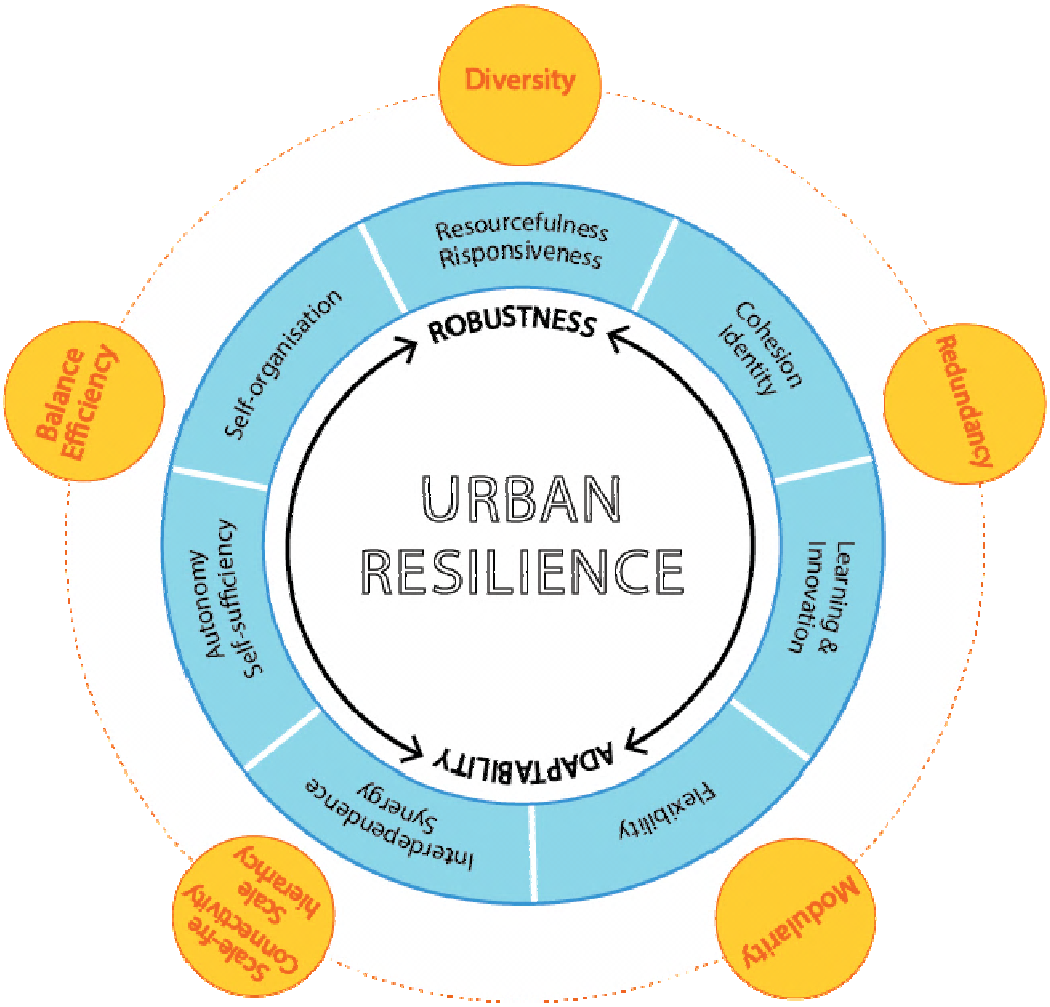

Figure 1. Urban resilience principles for Masterplan for Change, divided in structural properties (the outer circle) and behaviours (the inner circle).

5. Conclusions

In the face of future challenges, embedding a resilience framework into urban design and masterplanning can potentially help designers and policy makers create places able to perform culturally, socially and environmentally as well as to adapt to dynamic contextual conditions and evolve over time (Verebes, 2013). The current work preliminarily explored the possibility to reform masterplanning in a way that makes it fit to give strategic direction and spatial quality to places, by building in them enough resilience to accommodate change, even when unforeseen. Over the last 15-20 years, masterplanning experiences have sought to embed, with varied degree of success, sustainability principles in shaping the form of new urban development. The framework of socio-ecological resilience shares many commonalities with the sustainability agenda, as recognised in much literature (Wu and Wu, 2013, Marcus and Colding, 2014). Hence integrating and combining urban design sustainability principles with principles of socio-ecological resilience, made possible to list a series of structural characteristics and behaviours that any resilient urban system should possess

and that urban design and masterplanning should aim to achieve. This work, while still at an early stage, is also meant to give further definition to the very concept of *"Masterplanning for Change*", in parallel carried out by the Urban Design Studies Unit at Strathclyde as an operative and practical approach to masterplanning. The identified principles are intended as complementary and mutually reinforcing. Their aim is to illustrate general properties of resilience as manifested in the urban form across several socio-economic and environmental processes. However they do not provide technical specifications. No claim is made, particularly at this stage, about the possibility exhaustively determine all possible interrelations driving resilient urban systems, as this would mean incurring in the same form of over-simplification and determinism that we seek to overcome.

As the discourse on resilience of complex adaptive systems shows, the practice of urban design is not free from producing unintended and unattended consequences on form, society and the environment, nor should it try to be. Nonetheless, taking on the challenge of uncertainty and designing places capable respond to it and evolve remains crucial. Innovation brings inherent potential of failure. By learning from past and recent failures and successes of masterplans, the chance is to shift more deeply the focus of place-making on durability and adaptability and find again the quality of our most successful cities so deeply cherished.

What will be the final shape of this *"Masterplan for Change"* is still under development by UDSU. It will consist in *"planning without deciding too much"* (Hamdi, 2013, p.117), addressing to physical change integrating long-term goals and short term initiatives, thinking smaller and at smaller scales and linking these to wider and progressive large-scale change in a way which is self-adjusting, harnessing potential of innovation and creativity while remaining place-based and locally relevant, being flexible, open and inclusive and embedding community involvement and political will.

6. Next Steps

The list of principles of "Masterplanning for Change" is functional to the selection of masterplan case studies; this is based on compatibility with the principles and on observations on the ground of achieved spatial, environmental and socio-economic performance as suggested in literature. Analysis of case studies seeks to verify if masterplans complying with principles associated with resilient systems display themselves resilience in their resulting urban form.

At the current stage, two sets of masterplan case studies have been considered. The first set includes masterplans dating from the early 1990s, selected as illustrating innovative approaches to commissioning, implementation and governance. The second set, dating back to 1800s, provides some lessons on long-term adaptive quality and identity, visible in their formal spatial outcomes. Jointly they provide a cross-section of different masterplanning approaches and outcomes. Currently 10 case studies from the first and 3 from the second set have been shortlisted for further analysis. The geographic focus of the selection is international, but concentrated, with few exceptions, in Northern Europe and the United Kingdom. A pilot case study, the masterplan for Homeruskwartier in Almere, (Netherland) was selected to perform initial analysis. At the time of writing, analysis on the pilot is not at a stage where results can be presented, but hopefully will be object of discussion in occasion of the forthcoming AESOP Conference in July 2015.

7. Outcomes for planning and design

The current research seeks to inform scholars, professionals, users and policy-makers, locally and internationally, with the results of the research. The work presented should be taken as a work in progress and will be constantly revised, tested and refined. As part of a larger PhD research that stems and benefits from on-going work carried out by the Urban Design Studies Unit at the University of Strathclyde, the current work contributes to the creation of a more comprehensive urban design manual that embeds the result of research on *"Masterplanning for Change"*. This manual will be made available to practitioners, students, and community groups to guide design, delivery, management and monitoring of urban developments, as well as to assess proposed or implemented plans.

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