The Road to Masterplanning for Change and the Design of Resilient Places

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1. Introduction

Knowing what to design is the foresight that tomorrow's cities need more than anything. This paper presents the Urban Design Studies Unit of the University of Strathclyde in Glasgow's coordinated approach to research in different areas of urbanism, and how we used such approach in evidence-based masterplanning. To explain what is unarguably a complex approach to the design of the city, this paper will start with an overview into our group's point of view on cities, and continue with a short summary of our journey to learn some aspects of how cities are. We will touch upon a few milestones only, but hopefully enough to explain the questions that have led us to what we call 'Masterplanning for Change', our normative approach to city design.

To us, cities are the cumulative effort of millions of actions constantly evolving in time, owned by none and belonging to all, affording unique possibilities under certain complex conditions and causing inequality, alienation and disfunctionality under others (Romice et al 2016a). This seems to suggest an inherent contradiction: cities need design, but are at the same time too complex to be designed. Such contradiction, however, is only apparent: if we look at the most successful historical parts of our cities we will find that most of them, though by no means all, had been masterplanned at least to some degree, at some point in time, and yet have evolved constantly and restlessly, adapting to changing conditions and new opportunities along the way. This proves two things: a) cities do not necessarily need design to adapt and thrive; b) if designed at all, which is the rule more than the exception, they can nevertheless adapt and thrive as well, if not better. Differently from other complex systems in nature, society and technology, comprehensive centralized design appears to be much more the pre-condition for self-organization than the alternative to it in most of our successful urban places. On the other hand, we also can easily observe that urban areas masterplanned after WWII have in fact repetitively turned out into rigid containers of separated and over-scaled features, often ending up in failures spanning across too many interconnected aspects of their functioning to be recovered (Romice & Paul, 2015). In short, the issue does not appear to be one of design vs. complexity, but rather one of "blueprint" design vs. design for change. Or, from the point of view of the type of knowledge involved, one of design against the city

(that implies an ideology of what cities ought to be, of which we have plenty) vs. design with the city (that requires a science of what cities are, which we don't have, as yet). Our key interest is therefore the design of adaptable resilient cities, what it implies, how it is done and by whom. We want to understand how to help give character and soul to cities (Jacobs, 1961, Alexander, 1965) so that soul and character can be pursued by their users over time through innumerable uncoordinated actions along a line of informal participation to change.

In urban matters, what we know and can learn about cities is practically infinite, with dramatic recent peaks thanks to new technologies and ways to acquire and map data. When some of the authors started working over 20 years ago we were gathering new information in different areas: urban form, housing and neighbourhoods, sustainable transportation, complex spatial networks, human behavior, decision making, the impact of space on people's images and views on place. We didn't have a coordinated plan; we were not working as a team yet and yet we shared the same passion; some of us had not even entered the field! Getting together in the mid 2005 on a shared book project (Thwaites et al, 2007) was the catalyst to make the point on the state of the art in urbanism and gather diverse interests into complementary strands. The first question that we started asking in this book was if we, as city-makers, are equipped for the challenges that tomorrow's cities are confronting us with. Standing on a few giant's shoulders, we begun to understand places as constantly subject to circumstances of different nature (social, economic, institutional, cultural, environmental) and therefore in a state of continuous change, with many demands upon them. This was a perfect starting point to structure and guide our following years of work.

The step to form the current UDSU team was then both fortuitous and somehow a given: we knew we needed an intellectual home for our then developing perspectives. Once UDSU was re-grouped at Strathclyde after the departure of the founder, Dr Hildebrand Frey, we needed to set rules on what pieces of knowledge we would be seeking and which should become priorities. We had at the time a newly established Masters in Urban Design attracting students from a variety of built environment and other backgrounds, also joined by numerous students in their final year in architecture, and several requests from local authorities to provide concrete ideas for strategic areas in the city, at a time when investment in infrastructure was critical. The research group was small (Porta and Romice, a handful of PhD students and vising researchers), and the potential offered by Masters students was great, hence the decision to tie teaching and research, thus making the learning path of Masters students exciting as they would see their contribution shape new knowledge, and ensuring precious material to base observation and develop ideas on (Romice et al, 2012). Many of such students are those that in time have become key members of our research team.

Furthermore, all keen travellers, we also brought to the table a vast collection of experiences of successful and less so places around the world, places that have evolved consistently with their original design, and are still cared for, with their simple splendor enriched and expanded in time, and others that have been changed beyond recognition, or demolished times and times again, tarred and vandalized. As urban designers, we wanted to know how cities work, the impact they have on quality of life, efficiency and justice, but ultimately we wanted to know how to design them. Our second question was then what determines this different fate? This was a difficult question indeed, which we unpacked into many more – how have different urban forms held up in time? Are there certain forms more likely to succeed in time than others, and if so, what properties make them perform differently when faced by unforeseeable challenges? Are these properties always and only context specific or is there something, at a basic level, "universal", "structural" about them? And if so, what part of this structure is actually spatial in nature, so that we can design it?

The ideas, events, experiences and questions cited above are what has shaped our research efforts into three broad parallel areas, which hold obviously many overlaps.

1 – *the **form** of cities, studied across space and time, as complex systems.* Through this strand of investigation, which is in the field of urban morphology and touches the physics of complex spatial networks and the ecology of space, we wanted to establish if, and at what level, cities of different historic and cultural origin share physical features; if urban elements at various scales link in consistent, predictable patterns of form, and if combinations of physical forms and uses are linked. Furthermore, we wanted to understand if these relationships were the outcome of formal planning or the simple outcome of need, logic and life overall. The study of cities as complex systems focused instead on street networks, their form and behavior in relation to intensity of use.

2 – *the **impac**t of cities on their inhabitants.* Here we wanted to establish how use, perception and behavior are linked to urban form, at large and small scales. To do so, we used lessons learned in morphology and applied to the observation of cities. For example, work on street networks (referred below as street centrality) has helped us understand the relationships between the properties of such networks (of our cities and their parts), and the social potential of space, suggesting that the structure of the network itself can affect the social and economic performance of places. Work on networks and street fronts has allowed us to observe gentrification in relation to the structure of places, and historic comparisons on the changing morphology of urban plots in different areas in Glasgow has allowed us to observe variations in the social and economic profile of these areas.

3 – *the **form and design** of sustainable and resilient cities, as complex systems.* How do we help shape places that will remain in time, be adapted and maintained, that will foster attachment and generate a sense of identity, that will be efficient and effective? The issue of urban resilience drives this normative aspect of our work and aims to embed all fundamental aspects resilience in the design urban form, when we design for an uncertain future. The link between resilience and urban form is by no means straightforward, and has implied a deep dive into the study of ecological systems, to understand how to break resilience down into manageable elements, to study through correlations with urban form. This work is again heavily based on urban morphology, to understand what different effects have different forms had on the resilience of place in time.

The combination of these three stands has defined our normative approach to urban design into a *process* of *shaping* the spatial structure that creates opportunities and sets limits to the development of places, by enabling or discouraging change to take place (Porta & Romice 2014; Romice et al 2016b; Feliciotti et al 2016). The key question here is: which features of urban form constitute the *structure* of places (that must be designed), and which don't (that must be left to self-organization)? Concepts such as *time, unpredictability, change, resilience, social sustainability* (next to environmental sustainability), are at the heart of the generation of quality in space and the foundational environment of place evolution, not just goals to pursue. The difference is immense, and sets our approach apart from others.
The following 4 sections in this paper will illustrate the context of our work, as a justification for the search for this new approach to designing cities, and some elements of the three research strands. A full account of individual pieces of work is listed in the bibliography. To ensure methodological rigor, the studies mentioned in the next sections focus on common morphological elements and measurements, across a range of scales, from the metropolitan to the very local. Some of our work has identified, defined and studied such elements in their forms, geometries and relationships to each other; others have observed the relationships of these elements (or their combinations) to other aspects of urban life – social, economic and behavioural. Overall, these elements represent both

the objective ground on which our research is built (science of cities), and the ingredients of our *normative* approach to the design of cities, as the following sections will show.

2.The context of urban design, and a change in mindset

We are well into the century of urbanisation. Recent OECD predictions set urban population to reach the 9 billion mark by 2100, representing around 85% of the total world population (OECD, 2015). In the span of 150 years, from 1950 to 2100, we will have experienced a net growth of 8 billion people. At first predominantly in the West and North hemisphere, this wave of urbanization has more recently targeted the "Global South" (U. N. H. S. P. UN-Habitat, 2013), putting cities under a strain hard to conceive. The issues that cities pose today and for the future are consequently very different from what they were in the past; and so are the geographies of such issues, with very different patterns of growth across the continents.

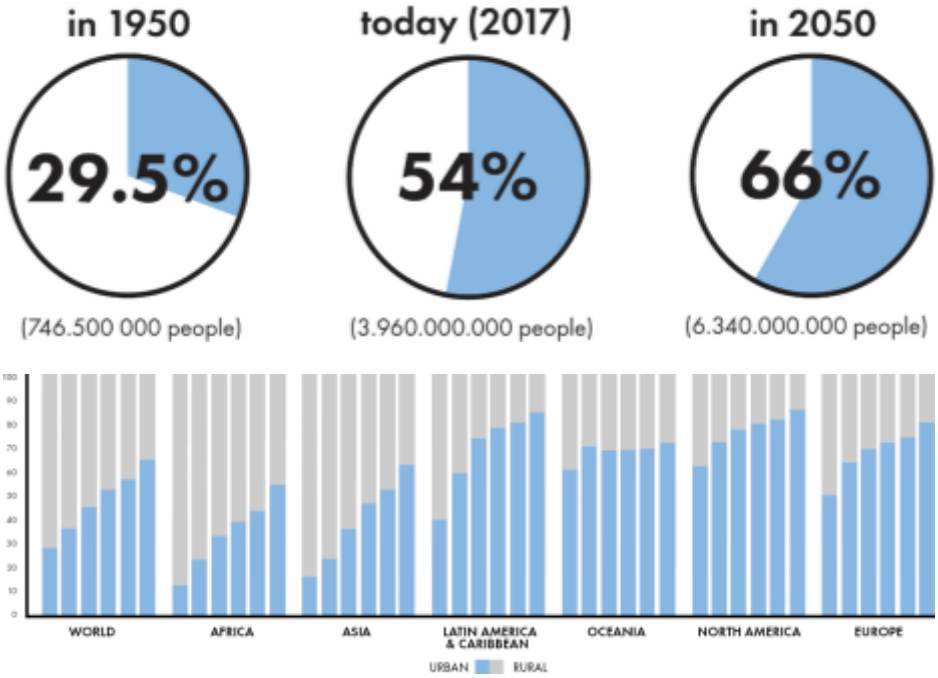


Fig. 1. Percentage of world population living in urban areas at select.

Having already been through two periods of Industrialisation, the first causing the sudden and rapid creation of urban centres and the second the equally rapid transformation of such centres, and having survived them, should we worry about a third world-wide period? A recent article by Steffen (2015) argues that the last 150-200 years of population growth and industrial development have had such a significant impact on the land that for the first time in history, Earth's most fundamental natural forces are affected, climate change being an example. According to them, the magnitude of this pattern is such that we have entered a new geologic epoch, named "Anthropocene", with metrics of this global dynamic increasing particularly after the Second World War ("The Great Acceleration"). The current process of urbanization is one face of such Great Acceleration, and the task of shaping tomorrow's cities is a very different challenge from what we have had to address to date, hence our questions and our search for a new normative approach to designing cities.

3. City forms and urban theories

Cities are a product of human culture. Human beings have been a cultural species for about 50,000 years, but cities are a late product of such human cultural evolution, coming to be only about 6-7,000 years ago. Urban planning and design though, as we know it, only emerged around 100 years ago, when what we call Professional Theories of Urban Design (Porta et al, 2014) were

developed and discussed publicly within a fully defined disciplinary context, to address the first wave of urbanisation. Historic cities, built before and after 'professional theories' are very different (Porta & Romice, 2014), across a number of indicators, social, economic, and physical. What, in their form, differs, at what scales and how so? And could this knowledge explain the variable longevity and fortunes of places built under different circumstances?

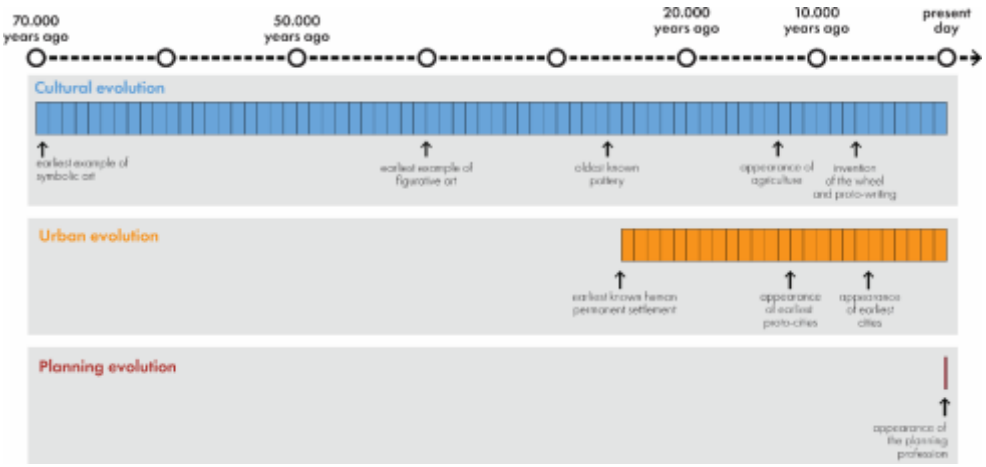


Fig. 2. Evolution of urban planning as a discipline, Cities and human culture: co-scalar comparison

As complex spatial entities, cities have traits that can be described with a high degree of precision. These, like the "phenotypic" traits of living organisms, differ between individual cases, being linked to the origin and the driving ideological principles, local customs and cultural evolution, which together shape the form of the city, and yet similarities can be found between places with similar historical origins (Dibble et al, 2016).

Because networks of streets shape the overall structure of our cities (Kostof, 1991), most of our work starts at their scale. Our initial research (Mehaffy et al., 2010) introduced the notion of '400 mt rule', i.e. that historic cites have evolved through time around urban networks whereby main streets were laid at rather regular intervals of about 400mts or less, bounding rather *uniform* portions of territory named "sanctuary areas". This suggestion was initially based on a few cases of diverse but equally historic urban layouts. If on the other hand we could observe the same behaviour in a much larger diversity of cases, we could assume that the '400' mt rule was actually a precise, utilitarian, efficient dimension used by different cultures in different contexts independently. In urbanism, 400 mt is also associated to a 5 minutes walk, which ties well with the street pattern observed. Comparing the road layout of equal portions of over 100 cities of different historic origin through the use of Google Maps, we discovered both temporal and geographic consistencies in road networks and, importantly, a significant sudden 'revolution' which affected the most diverse centres in the last 100 years or so (Porta et al, 2014). This prompted our conclusion that until intentionally set by our planning and design profession, main streets were laid at rather regular intervals of about 400mts or less. After that, when professional theories came to stage, the pace between main streets increased remarkably, with implications on use and movement. Interestingly, informal settlements in developing countries that are contemporary but have not been informed by professional planning theories, seem to share the "historic" 400mts pattern. The '400 mt rule' and the concept of sanctuary area constitute the first *two ingredients* of our normative approach, representing respectively persistent, consistent and uniformly developed subdivisions of urban territory.

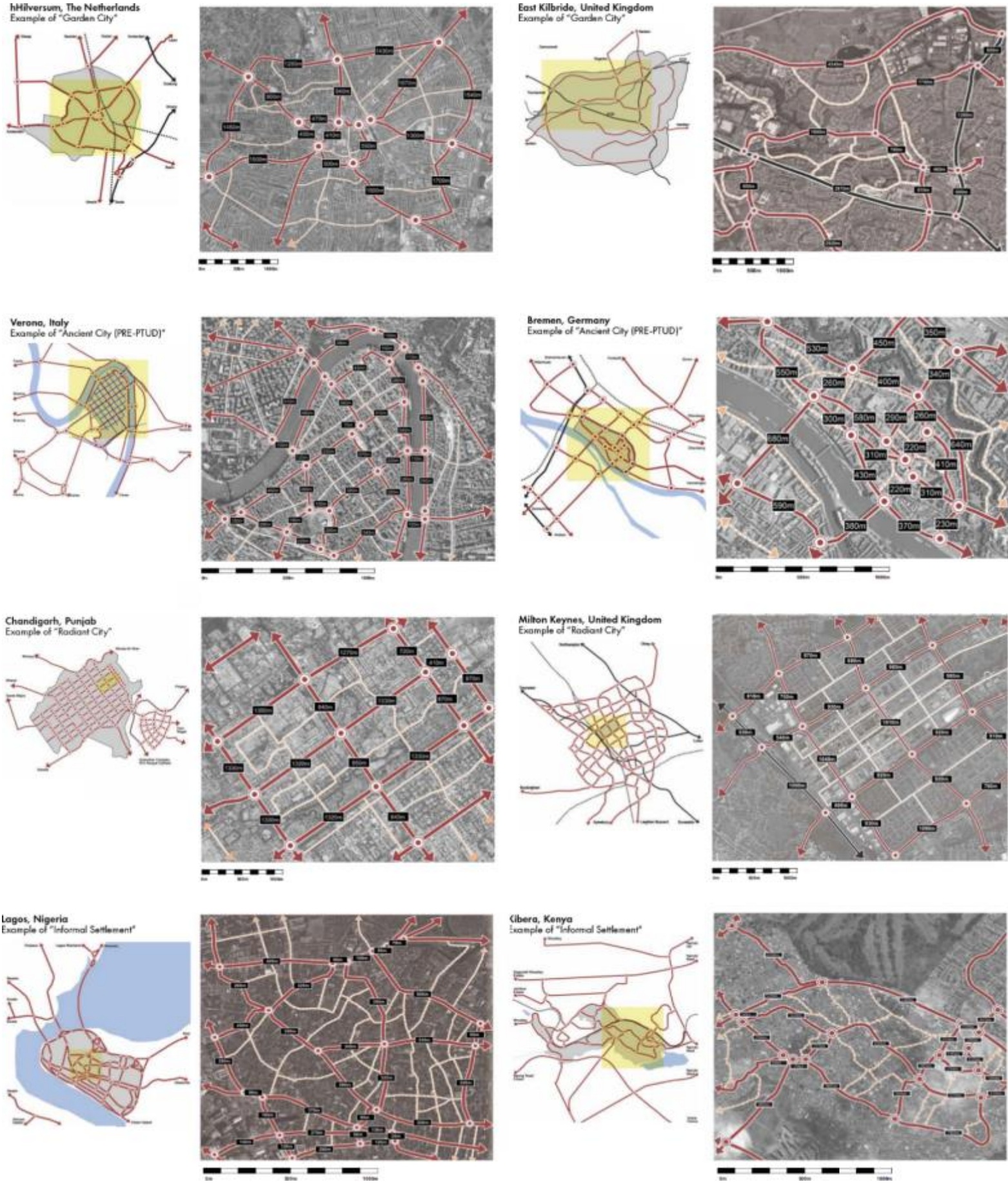


Fig. 3. The '400m' rule as it appears across different types of cities in urban history. Source: Baird et al., 2010.

KEYNOTE SPEECH

Our next quest then, was about finding any further consistency, persistency and uniformity of behaviour within sanctuary areas of different historic origins. Unlike the Alterations in Scale comparison, which was conducted over 100 samples around the world, this second study focussed on 40 samples within the UK only, for the simple reason that it entailed the study of over 200 measurable characters of the urban form each. This work revealed that fundamentally, the patterns and coherence we found at the main street level both historically and geographically, can be traced down key levels of urban scale, from 'sanctuary areas', to street fronts, blocks, plots and the built form. In particular, the relationship between built form, street types and their shapes, and open space is consistent, historically and typologically (Dibble et al, 2015). Nothing is incidental, and the consequentiality between scales is either dictated by principles of efficiency (historic examples) or determined by design (modern examples). This principle of consequentiality is a key organisational rule of our normative approach to design, and our *fourth ingredient* of our normative approach. Statistical work conducted on all 207 characteristics that describe the key levels of urban form, has confirmed that just 9 of these can distinguish between or relate together different forms, suggesting that they are dominant in determining the character of place. They are therefore the *fourth* (set of) *ingredients* for our normative approach to design.

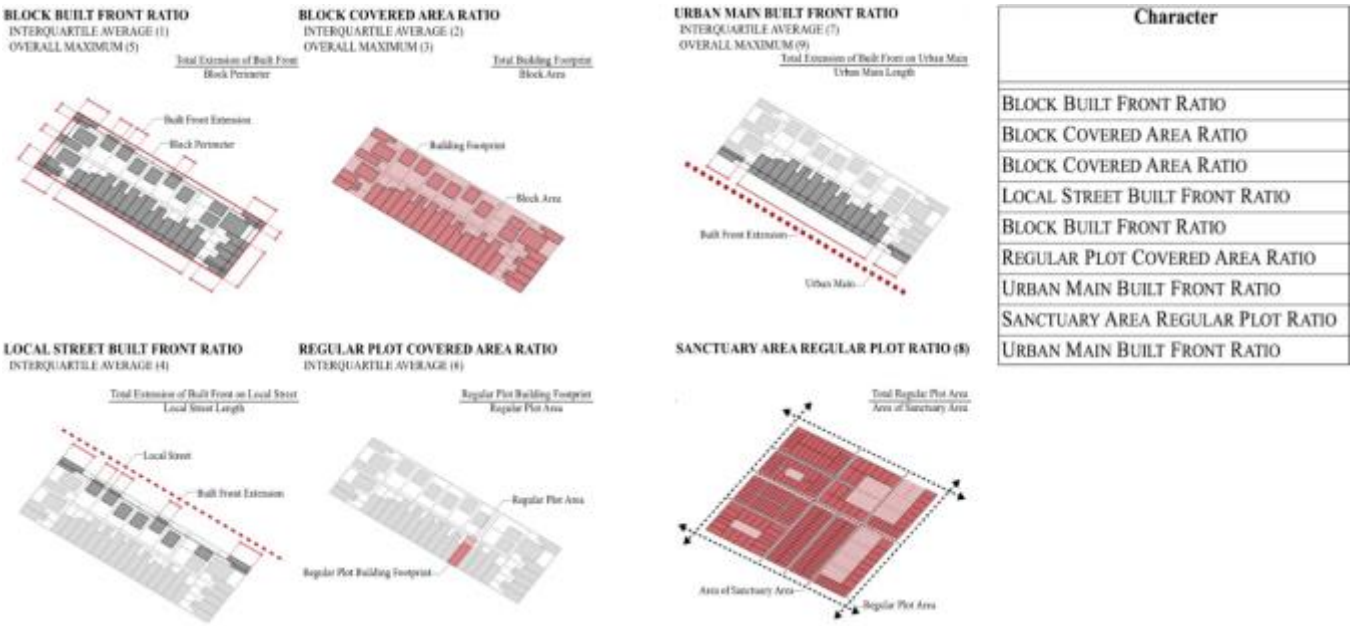


Fig. 4. The nine most discriminatory variables that, alone, seem to capture the distinct identity of urban forms: these reflect three characteristics: 1) block perimeterness, or the way buildings define the street-edge; 2) building coverage, or the way buildings cover the land; and 3) regular plot coverage, or the extent to which blocks are made of plots that have main access from a street. Source: Dibble et al., 2016).

Taken together, these two main areas of research have led us to the following observations: historic street patterns are complex and highly interconnected, having grown on evolving demands in time (Porta et al, 2014), and yet main streets appear to be surprisingly stable in time (Strano et al., 2012). The relationship between a street type, the plot structure and the built fronts on such street types (the essential elements of city character) are intimately connected, showing a significant 'bifurcation' of urban form in evolutionary terms from pre-modern to modern cities (Dibble et al., 2015). In particular, modern street patters show reduced complexity and interconnectedness, and a completely subverted relationship between street type and built form (Dibble et al, 2016), which confirms previous studies (Salat, 2012). The consequent character, uses and possibilities afforded vary in the two (historic and modern) instances, and these variations can be observed. Therefore, form a purely physical, measurable point of view, and leaving aside cultural and ideological discussions of merit and value, we suggest that on the data we have collected, historic cities tend to offer to greater extent a particular quality that works for people, individually and collectively. We may call this quality resilience. Because historic cities have never been fully designed at the scale we are used to nowadays, certainly not as

wholes, we suggest a second conclusion: that this “quality without a name”, or “beauty” as Alexander would call it, does not come by design per se, but by use, life and time; in short, it is an evolutionary product generated by the hands and values of many (Porta et al., 2016).

4. The impact of cities on their users

The effect of the street network’s configuration on cities filters from their overall structure (macroscopic scale) down to all their smaller elements and uses – from movement and circulation, to the location and access to services, down to the built and open forms they bound – thus playing a key role in how we live and use places. Then the question here is how? What is it exactly that streets do to cities that exerts on their form as well as their life such a profound influence? We invested a considerable amount of research on this matter, and found out that, essentially, everything here comes down to what we have indicated as one of the major evolutionary forces in cities: *centrality* (Porta et al., 2010). Inspired by previous research developed at UCL London (Hillier and Hanson, 1984; Hillier, 1996) and directly built on several decades of studies in the physics of complex spatial networks, our Multiple Centrality Assessment (MCA) mapping tool allows a quick and reliable visual investigation of centrality over networks of urban streets and intersections (Porta et al., 2006). Understandings developed in this area have deeply informed our successive research as well as our normative approach to masterplanning. They helped to identify the portions of street networks to use as case studies in Alterations in Scale, then the Sanctuary areas in research on neighbourhoods and the spatial indicators in Urban Morphometrics (Dibble et al, 2016; Venerandi et al, 2016). In essence, MCA visualizes the extent to which a street (or a space) is *cen*tral within the system of all the streets (or spaces) to which it is connected. It mainly uses three indices of centrality, namely closeness, straightness and betweenness, each of which is calculated differently to capture characters of the space that appear to be linked to human behaviour. For example, “betweenness” captures the extent to which a street sits on the shortest paths linking each street in the system to each other or, in short, its “ability” to stand “in the middle” of all other spaces. A street with high “betweenness” is more *likely* than one with low “betweenness” to be traversed by passers-by moving from their point of origin to their destination.

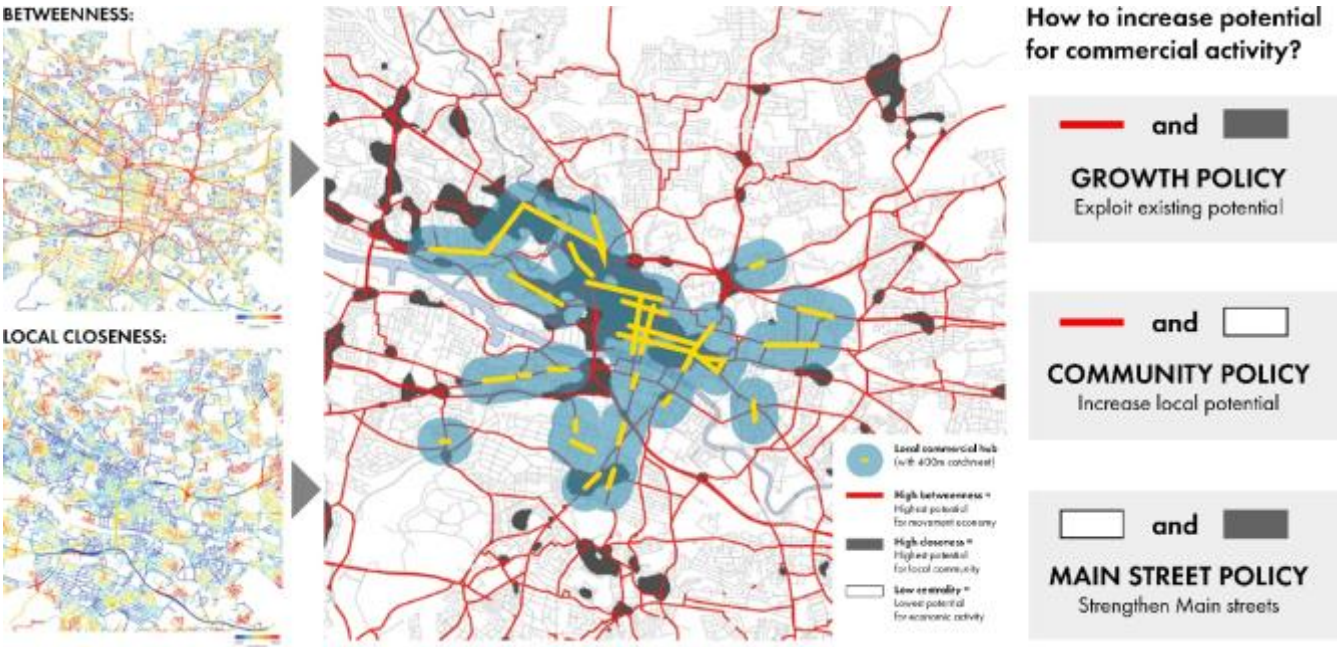


Fig. 5. Street centrality as a primary environmental driver in both urban evolution and the master planning process. Source: work conducted in UDSU design studio (Johanna Roswall; Anges Sandstedt, 2014-15).

We have used MCA to confirm an association between street network and the strength of socio-economic phenomena around it, as in a complex system. In particular, we have observed patterns of correlation of street centrality with location and type of services (Porta et al., 2012; Porta et al., 2009), street quality and life (Remali et al, 2016), land values (Pasino, 2016), land-use intensity (Wang et al., 2011) and building density and scale (Dibble et al., 2015). We also recently used MCA (combined with morphological studies at smaller scales) to find consistencies between the form of several London neighbourhoods which underwent gentrification, to ascertain if gentrification as a socio-economic process has *parallels in the types* of urban forms in which it occurs (Venerandi et al, 2016). Summing up, MCA offers an important base of evidence to inform decision-making in masterplanning, suggesting by fine-tuning strategically the spatial distribution of centrality that we can exert a measurable environmental pressure on the evolution of a number of dynamics that are in fact crucial to urban life, such as prosperity, safety and attractiveness. This knowledge is extremely valuable in taking strategic decisions in relation to the distribution of resources and urban densities in the city: it therefore constitutes our *fifth set of ingredients/principles.*

Less focused on morphological analysis, but on existing evidence of effect between space and human activity, we include in this section a detailed review of work in the area of environmental psychology, where urban scales (metropolitan, neighbourhood and local) have been studied in relation to personal, social and material effects (Romice et al 2016), to illustrate the important impact that single and combined (cross-scale) physical elements will have on the use and life of urban space. Read in combination with the researches cited in Point 3, we obtained a rich array of design tools for our normative approach to design. Linked to this review, through comparative historic work on housing development in Glasgow we studied the links between land ownership (size and ownership of plots) and models of housing development between mid 1800 to today, and observed the related changes in the complexity of urban form of two key areas in the city (Barbour et al, 2016). From these two latter works, we identified the issue of relative control that users can exercise on space, as an important thermometer of the relationships that will be established with such space, closely following Akbar's work on the relationship control-ownership-occupation (Akbar, 1988). Control can be exercised at different scales, and is linked to urban form, limiting or enhancing user informal participation in the design and management of place; it is therefore the *sixth ingredient of our approach.*

The work presented in the latter two paragraphs on morphology, at different scales, geographies and periods is our contribution to a descriptive science of cities, and has added evidence to Jane Jacob's proposal that the complexity of urban systems is 'organised complexity', not random and unpredictable. Such complexity is generated through life over time unless, of course, alternative orders are imposed. And yet, whilst 'beauty' is a quality that comes with time, design needs to happen to allow such beauty to occur, though spatial *rules* and principles that combine the morphological elements we have studied, through principles of justice, efficiency and change. In response to the new challenges posed by the recent waves of urbanisation, we suggest that planning and design must be substantially re-defined to understand, shape and manage cities as complex systems (ibid.).

5. A normative approach

Urban systems are complex by virtue of the relationship between their constituting components (Holling & Goldberg, 1971). Changes at each level of the morphological scale affect the others in non-linear and non-predictable ways (ibid; Romice et al forthcoming). This goes both ways, large to small, and small to large, echoing quite significantly the form of the cross-scalar process of change characteristic of all complex adaptive systems, as described under the name of "Panarchy" (Gunderson and Holling, 2002).

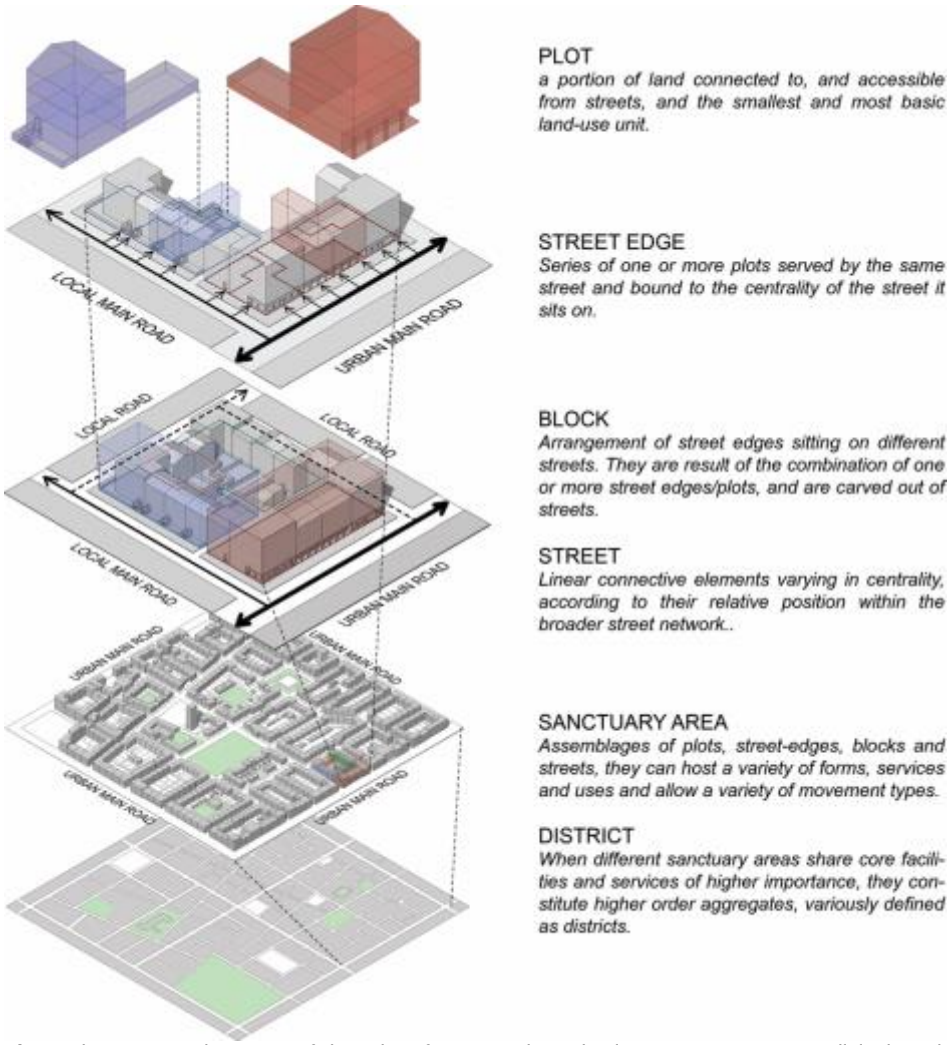
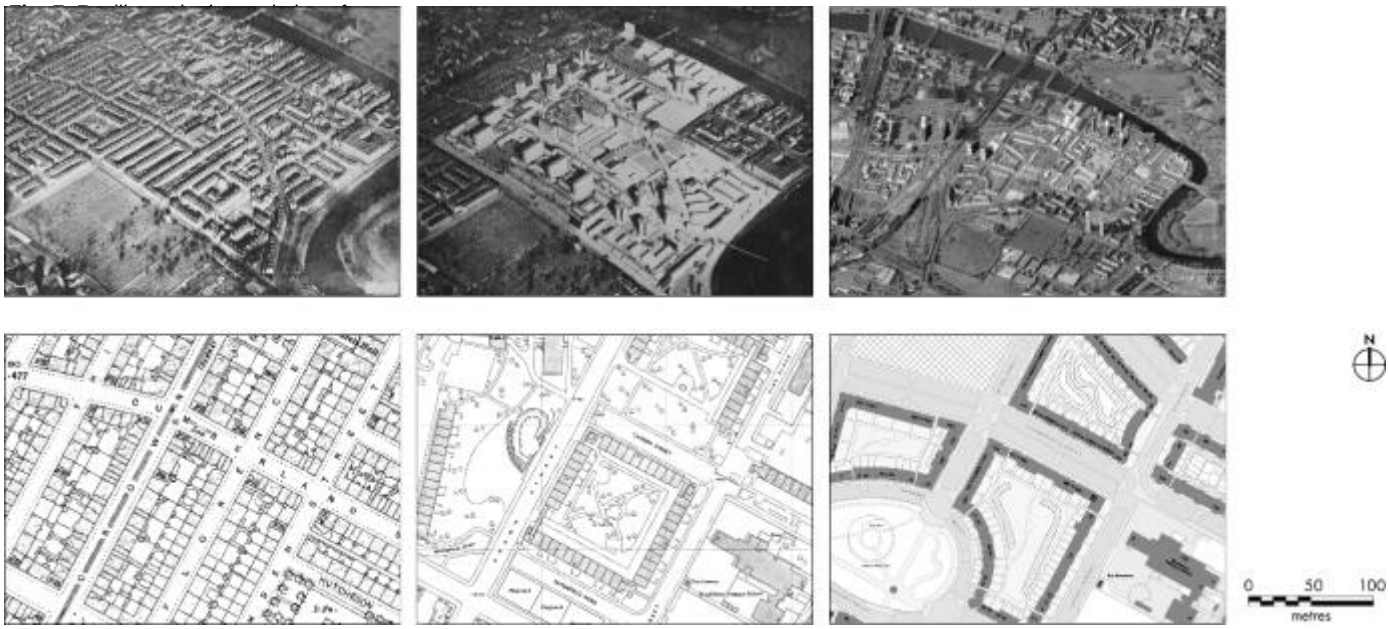


Fig.6. The cross-scale nature of the urban form complex adaptive system. Source: Feliciotti et al, 2016.

Concentrating on one single component and trying to optimize its individual performance therefore, does not guarantee anything about how the rest of the systems will respond, especially at different scales and in the medium-long term. As each and every level of the morphological scale matters, intervention on cities ought to understand the links between scales and be able to acquire knowledge and adapt its tools to the requirements of each such scales. The manifestations of problems may be very different, but the approach should be consistent, and be centered around the idea of change, and the capacity of a system to respond to change in a positive way. With this in mind we have started investigating the concept of resilience The concept was born in system ecology, but was recently identified as a promising way to understand and engage with a changing world and is increasingly used in urban studies as crucial to help creating places better suited to endure and adapt over time to socio-economic, political and environmental fluctuations. Applied to placemaking, resilience highlights the need to incorporate explicitly the element of change and the dimension of time in the understanding of, and intervention on, the form of cities. In this sense, sustainability remains the goal of placemaking, but intended not as a static goal, rather as a moving target whose path cannot be charted in advance. Resilience, or *"the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks"* (Walker et al, 2004:4), as applied to urban form, is the capacity of places to progressively retune and redirect their trajectory as the target moves in time. Whilst well understood in system ecology, resilience is still a vague term when it comes to cities. This suggested us the need for a much

closers look at the actual form of cities in search of their *model of change*. Our previous research and experience have in fact at numerous points suggested that the form of cities – at all scales - plays an important role in their resilience.

From a detailed literature review we have identified a number of characteristics, namely modularity, redundancy, diversity, efficiency, connectivity (Feliciotti et al., 2016), that have been recognised as significant enablers or inhibiters of resilience and that are clearly recognisable in the urban form across the same scales. We combined these characteristics to the form of cities, hence extending our cross-scale approach to morphological analysis. These scales correspond to the same morphological elements that we found as interlinked in previously mentioned studies on main streets and urban morphometrics studies (street network, sanctuary area, blocks, fronts, plots). A detailed historical comparison of a neighbourhood in Glasgow (Gorbals) over three periods (historic, modern, post modern), also corresponding to the historic classification used in Alterations in Scale, has compared morphological properties at all scales, with socio and economic data available for the three periods, revealing a very clear correspondence between physical, social and economic diversity (Feliciotti et al. forthcoming). Whilst it is not possible to draw conclusions as to what forms and their combinations can determine greater or lesser degrees of resilience in urban form, the study has illustrated how modularity, redundancy, diversity, efficiency, connectivity are important measures of resilience and embedded in urban form across scales. This set constitutes the *seventh ingredient* of our approach to design.



On all this combined knowledge and findings, we went back to our considerations on many of our contemporary and historic places. We felt that so many, all in fact, of the weaknesses showed by otherwise positive place-making initiatives, including lack of adaptability, persistent gigantism, low place-attachment despite community engagement and routine or purely administrative community participation practices, could be attributed to a lack of attention to the factor of time in place-making.

Hence the decision that the overarching objective of our work should shift from the design of a good place to the design of the spatial conditions under which change can initiate and sustain its development appropriately, through dynamics of self-organization (Romice et al 2016b). The goal of urban designers should be to build the “environment” for the city to develop and flourish, rather than building the city itself. The prerequisite for this, is a good knowledge of what shall be

designed and, fundamentally, what we shall not design. The ingredients, and the relationships that tie them together in design, are the accumulated knowledge we gained through our descriptive work. The design of cities becomes structural and enabling rather then defined and per-parts.

We have named this call for 'less but better' planning, Masterplanning for Change. The decision to maintain the masterplan at the core of this new approach is deliberate: it is after all what distinguishes our profession, holding therefore a symbolic and societal value. We have nevertheless turned around its aims: a masterplan is not about realizing a finalized product, but about establishing possibilities for progressive completion.

The 'masterplanning for change' approach then is funded on the ingredients listed and principles:

- City *structure* is made of Street Centrality, Sanctuary Areas, Street Edges, Plots, Buildings Types. They are linked together by a set of spatial and functional *relationships* to create the key unit of development, which is for us the Street Edge (not the block, which is generally considered the building block of our cities - as a unit the block in fact does not possess enough flexibility to respond to different street conditions unless conceived as independent fronts).
- The *relationships* that tie all elements of the city structure together as a system, should be learned from history, as they evolved in time.
- *Plots* should be small; history has taught us that this grants the deriving system greater resilience overall.
- There should be *coherence* between plots and the street they abut on, in terms of density, the choice of building types, the orientation of the plot.
- We should follow the *400-Meters* rule, i.e. main streets should be spaced around 400mts apart.
- We should set in place a structure which allows *disjointed development* to take place, that is each individual plot should be implemented independently from each other.
- This will grant a more significant role to *informal participation* which has historically proven to be more important for the success and longevity of places than formal participation, as it extends to the management and adaptation of place. As a consequence, development regulations must be elementary, comprehensible and, short.

On these principles, we devised an approach to urban development that is deployed through a series of interconnected steps. These tie infrastructure, densities, services, to give spatial substance to local aspirations and formal planning decisions.

At the start of the paper the paper we cited a particularly challenging context of current and future urbanisation, implying that the effects of poor development would put our resources under too much strain for recovery. The *challenge* consists in the scale of growth; the *risk* in the cost of remediation if tomorrow's cities lack the capacity to reinvent themselves, displaying the necessary resilience to pursue new sustainable goals and aspirations.
Masterplanning for change is a scientific approach that aims to enable this process when dealing with urban development, where we propose to *reduce risks* by learning to design from evidence of what has worked in history and what has proven capable of re-tuning itself to changing circumstances, to be more safe-to-fail and less fail-safe, thus reducing the impact of all those economic, social and environmental costs associated with repair and reconstructions in case of failure. We *propose to respond to the challenge* of growth by implementing sound structures that *can* grow, following precise rules and relationships.

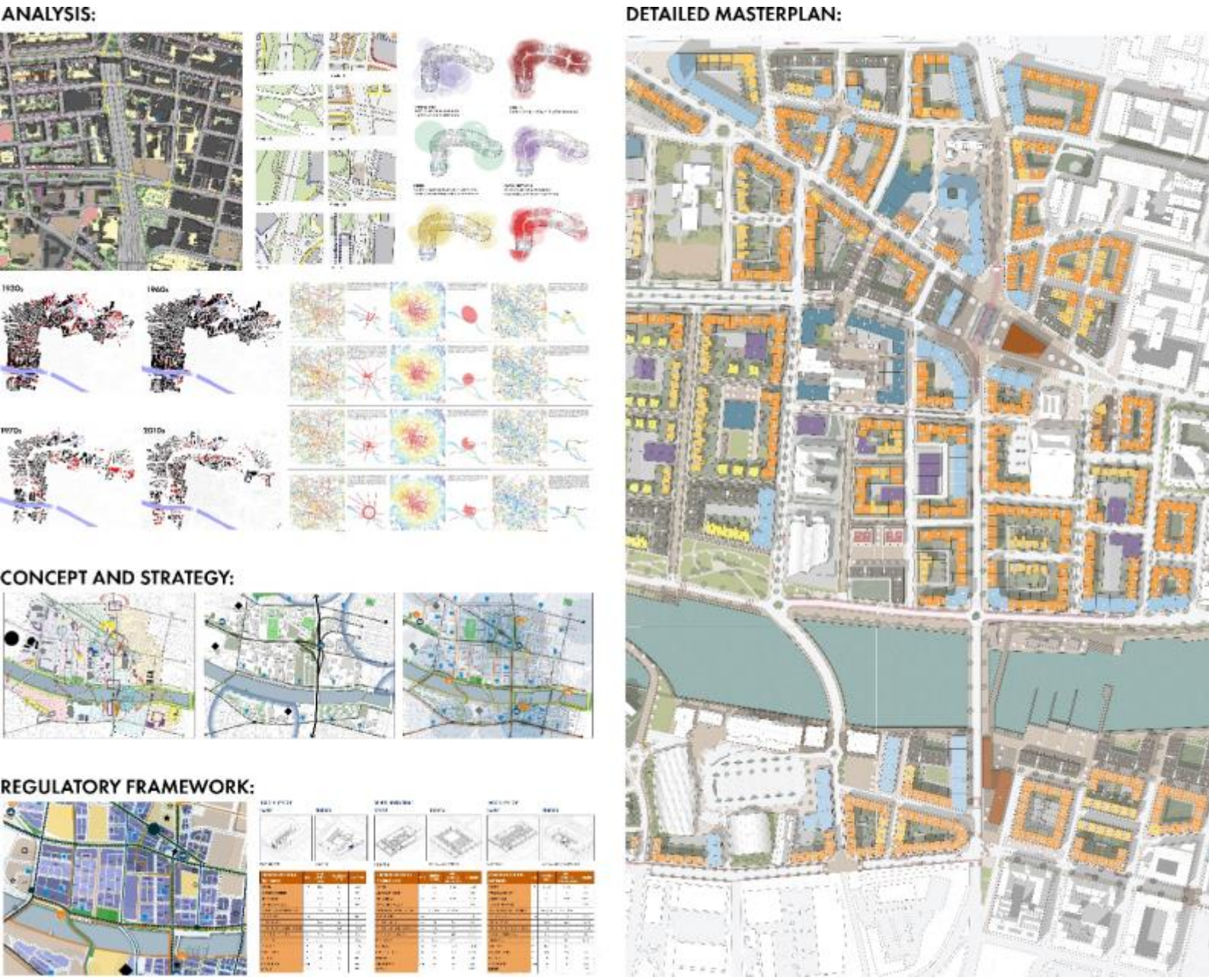


Fig.8. A typical set of graphical products in the Masterplanning for Change process. Source: work conducted in UDSU design studio (various students, 2011-2012).

Masterplanning for Change is now well-rehearsed approach we have used several years in both teaching and consultancy. We are currently working to make it operational by the public sector – the city authority or for profit social housing provider - taking on the enabling role of infrastructure and rules provider (Romice et al, 2011), and establishing an intervening process between large vacant sites and small-scale housing providers.

The key is the planning of land subdivision down to the level of the individual plot, which triggers the opportunity for small-scale development within a coherent urban structure. If this land subdivision is right, and supported by light touch design codes, we can capture the power of small-scale enterprise to develop new housing, a big challenge for all governments.

A full operative manual for Masterplanning for Change and its step-by-step application will be available in Summer 2017. All work by the Urban Design Studies Unit can be found online at: www.udsu-strath.com.

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