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Negative Space and Positive Environment: Mapping Opportunities for Urban Resilience

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1 ABSTRACT

Cities have long held a fascination for people – as they grow and develop, there is a desire to know and understand the intricate interplay of elements that makes cities 'live'. In part, this is a need for even greater efficiency in urban centres, yet the underlying quest is for a sustainable urban form. In order to make sense of the complex entities that we recognise cities to be, they have been compared to buildings, organisms and more recently machines. However the search for better and more elegant urban centres is hardly new, healthier and more efficient settlements were the aim of Modernism's rational sub-division of functions, which has been translated into horizontal distribution through zoning, or vertical organisation thought high-rise developments.

However both of these approaches have been found to be unsustainable, as too many resources are required to maintain this kind or urbanisation and social consequences of either horizontal or vertical isolation must also be considered. From being absolute consumers of resources, of energy and of technology, cities need to change, to become sustainable in order to be more resilient and more efficient in supporting culture, society as well as economy. Our urban centres need to be re-imagined, re-conceptualised and re-defined, to match our changing society.

One approach is to re-examine the compartmentalised, mono-functional approach of urban Modernism and to begin to investigate cities like ecologies, where every element supports and incorporates another, fulfilling more than just one function. This manner of seeing the city suggests a framework to guide the re-mixing of urban settlements. Beginning to understand the relationships between supporting elements and the nature of the connecting 'web' offers an invitation to investigate the often ignored, remnant spaces of cities. This 'negative space' is the residual from which space and place are carved out in the Contemporary city, providing the link between elements of urban settlement.

Like all successful ecosystems, cities need to evolve and change over time in order to effectively respond to different lifestyles, development in culture and society as well as to meet environmental challenges. This paper seeks to investigate the role that negative space could have in the reorganisation of the re-mixed city. The space 'in-between' is analysed as an opportunity for infill development or re-development which provides to the urban settlement the variety that is a pre-requisite for ecosystem resilience. An analysis of the urban form is suggested as an empirical tool to map the opportunities already present in the urban environment and negative space is evaluated as a key element in achieving a positive development able to distribute diverse environmental and social facilities in the city.

2 INTRODUCTION

2.1 Background

Cities have long held a fascination for people – the appeal of the melting pot of cultures, lifestyles and opportunities has drawn humanity to create ever more complex iterations of urban centres teeming with life, movement and energy (Karp, Stone, & Yoels, 1991). Yet the demands of cities are growing even now – the pace of life, the demands of new technology, resultant social changes and perhaps most urgently, the growing awareness of environmental consequences of Western lifestyles are causing cities to draw more, consume more and become more (Zukin, 2010).

Complexity is one of the main characteristics of a consolidated urban environment; mixed uses, social heterogeneity, sensory stimulation at multiple levels, economic transactions and cultural exchange are all variables that contribute to the development of a town's own complexity, a town's own identity (Allen, 2004; Tung, 2001). The balance between these different components has been assumed as a key element in the success of an urban environment based on demographic and population growth (Mumford, 1989). Several approaches have attempted to explain urban complexity and especially its contradictions; cities have always been less healthy than the countryside and historically their citizens have always had a shorter life

expectancy; nevertheless for the last 200 years people have been leaving villages in rural areas to cluster in slums, generate suburban sprawls and engage with the persistent urban congestion (Hall, 1998).

2.2 Understanding Cities

Cities have been evolving and adapting to changes in lifestyle, economy and production processes from their beginning. Elements which were central during a historic phase and that have required consistent investment in order to be built, like city walls, have been quickly demolished when more than keeping enemies out they were restraining the growth of the bourgeois society (Benevolo, 1980). Palaces and temples have been built, promoted as cultural icons of civic identity and then torn down; activities which were keeping town centres alive were removed, isolated or segregated on the outskirt of the urban stage (Norberg-Schulz, 1979).

Traditional methods of introducing urban changes have tended to fall into three categories: razing the city in order to start again; annexing new areas beyond existing city boundaries; and the more moderate approach of 'change from within' making use of infill opportunities to slowly upgrade the urban system to meet new requirements, whether social or economic (Kowalik & Guaralda). Given the small number of new cities constructed globally, and understanding the intense resource consumption of urban construction as well as more general environmental concerns, it is reasonable to suggest that the means implementing urban change has been narrowed down to the third option in the vast majority of cases (Allen, 2004).

2.2.1 Approaches to the Urban Environment

Cities have been described as over-scaled residential buildings, an analogy pointing out how the different components of urban life mirror that of dwellings; a room to sleep, one to work, and one to meet people became districts to live, work, shop and relax in. In other cases towns have been compared to forests or gardens (Patetta, 1986). Perfect designs have been proposed to celebrate princely power, divine intervention or social structures. In order to make cities more efficient they have been compared to machines and they have been reinvented as a rational system where every component has a specific role, every activity a specific space (Kostof, 1991).

A different approach has proposed the study of cities as organism, with a defined centre of control, green lungs, veins to move people and goods; every element in a close relationship with each other, every element contributing to the good health of the system (Hough, 1984). This comparison to organisms is still central in popular culture and cities are diagnosed with several diseases which affect the social fabric, the structure of the economy and especially the health of citizens as well as the environment (Blakely & Ellin, 1997).

While these approaches have typically been aimed at improving efficiency of urban centres and streamlining processes of delivery of urban services, there now exists a different motivation for the better understanding of urban behaviour (Newman & Jennings, 2008). Growing awareness and concern over the environmental cost of cities (Girardet, 2008) has become a driver of new urban theories and models (International New Town Institute, 2009). Recognising that on the whole, we are unlikely to abandon the city in order to pursue simpler and "more sustainable" lives, concern has shifted to the issue of urban sustainability.

2.2.2 Urban Sustainability

Sustainability, as a concept, has changed and developed in the last 40 years moving from being the priority of a minority to one at the centre of debate in every political arena at every level. The building industry and cities in general have been recognised as the major pollution factors which are compromising the fragile ecosystem of our planet. Several solutions to environmental issues have been proposed; being green is the new trademark of commercial companies and local governments, however the exact means of implementing large scale sustainable solutions without adverse effects is not clear (J. Birkeland, 2008); cities are inherently complex, layering meaning, history and cultural memory (Tung, 2001). As manifestations of shared cultural values they do not allow a 'tabula rasa' approach of blanket solutions (I. Birkeland, 2008).

Being sustainable is a priority, but being sustainable just means containing the damages, not repairing damage done in the past. A relatively recent attempt to counter this sustainability fault, is the theory of Positive Development by Janis Birkeland (2008). To sum up, the theory puts forth the argument that the built environment needs to have an overall net positive impact, essentially returning land to a level of ecological health that was present prior to urbanisation. Arguing that current ideas regarding sustainable development are based on a negative presumption that damage to the environment is unavoidable and

therefore 'standard' and acceptable, it calls for a paradigm shift in the planning, design, retrofitting and management of the built environment. Rather than accepting the damage that the built environment causes and believing that the best we are capable of is to remediate or restore 'inevitable' environmental degradation, Positive Development (J. Birkeland, 2008) advocates a shift to a design-based (positive) approach in our built environment. Ecological remediation, restoration and regeneration are considered to be insufficient as we have already exceeded the Earth's ecological carrying capacity; and offsetting ecological losses with social gains, typically unrealised in the final design, is a zero-sum game. Arguing that development which does not 'pay its own way' ecologically is no longer acceptable, Positive Development (J. Birkeland, 2008) calls for a built environment which has a net positive ecological and social impact. In practical terms, it argues for the retrofitting urban sites to increase the net ecological carrying capacity as well as natural and social capital, expanding both the ecological base and the public estate of cities. New buildings need to reverse the damage caused by previous development in absolute terms (J. Birkeland, 2008).

The positive development theory then, aims not only to minimise built environment impact, but also to improve the general condition of the environment (J. Birkeland, 2008), where buildings are proposed as agents to modify the context in order to provide a gain at the multiple levels that urban complexity requires: social, cultural, economic and environmental. The way this theory could be implemented in the actual design process is still debated, but this approach suggests a different way to look at cities.

2.2.3 Cities as Ecosystems

In the XXI century cities could be discussed as ecosystems (Chiesura, 2004); ecosystems allow a dynamic approach and the different components change in response to interactions with the others and the general context (Fuller et al., 2010). In a machine or in an organisms some elements are assumed to be central and not subject to alteration or modification, but this has been proved erroneous in the case of urban complexity, where functions move, areas grow and shrink, and shared memories and values morph (Hough, 1984). The ecological value of some urban elements, mainly green spaces, is expansively debated in literature (Smith & Levermore, 2008). Planted areas have a recognised value for the environment, contributing to absorb pollutants, mitigate the heat island effect and increase carbon sequestration (Smith & Levermore, 2008). The role of vegetation has also been discussed in terms of social structure; green areas affect the perception of the environment and also human behaviours; from the ecological point of view they support biodiversity (Fuller, et al., 2010). Vegetated areas affect the economy through impact on real estate values (Bowman, Thompson, & Colletti, 2009), but also in terms of welfare; it is recognised that an active lifestyle has a role in reducing the Government's investment in healthcare (Willis & Crabtree, 2011). Current studies are investigating how the provision of parks and gardens relates to active lifestyles of residents (Willis & Crabtree, 2011). Additionally, the growing number of dwellings in urban centres adds import to the creation and maintenance of urban retreats in the form of parks and green space (Phillips, 2003). Enhancing this connection to nature through the creation of urban habitat for native wildlife contributes to humanise the overwhelming scale of the city (Hoevan, 2006).

Approaching to the city as an ecosystem is still fragmented and focused on the provision of singular elements or defined corridors between green spaces (Pickett & Cadenasso, 2008). On the other hand sustainable buildings are proposed to respond the local environment, but usually these do not address the problem of the wider city (J. Birkeland, 2008); green roofs, green walls or other green elements to reduce the impact of new construction on the environment do not relate to the city in terms of a system, just in terms of local a environment. Looking at cities like ecosystems means that every new development could be a cluster which contributes in some way to the general positive performance; buildings, parks, and street plantings can all be seen as biotopes that interact in a dynamic way. Buildings could be developed not as isolated elements, but as 'cells' providing an environmental function to the wider ecosystem; negative space could be designed not as an in-between medium, but as the tissue connecting the different cells. Through a negative space connective tissue, buildings in urban centres could 'spread the load' and 'share the gain' simultaneously. Individual positioning and design of buildings presents a range of possible opportunities for retrofitting a myriad of environmental solutions to existing building stock. These solutions already exist and offer opportunities for energy generation, air and water filtration, carbon sequestration and food production (Birkeland, 2002). For example: equatorial facing elevations of high-rises could harness solar energy in a collective grid and 'share' it amongst the city, lessening the overall energy burden of the city. Retrofitting a

series of green roofs and walls can create wildlife corridors which would be 'safe' from human degradation without any loss of valuable urban land. This approach suggests the possibility of the city as a whole becoming a 'living' system, allowing a non-linear shift of the whole city into a new state (Newman & Jennings, 2008). The interaction of the various building 'cells', each with a shared communal social or environmental function, may result in an emergent state of urban sustainability. This proposed strategy could also suggest possible alternative developments to the recent visions of new eco-cities, which while solving some of the recent environmental issues, do not solve the question of the existing urban environment and how to retrofit it (Kowalik & Guaralda).

3 MAPPING NEGATIVE SPACE

In order to promote this vision, an initial step is proposed of the mapping of opportunities in the urban environment (Holt-Damant & Wyeld, 2005). Studies on the green space or on the blue space are consolidated in urban design and planning, what is suggested in this paper is that this kind of mapping also includes the opportunities offered by urban development in implementing the vision of cities as ecosystems (Cho, Poudyal, & Roberts, 2008). Traditionally open spaces are recorded on the basis of their use or presence of greeneries (Varon, 1998a). Parks are programmed within the urban environment to provide retreats for local residents or as main recreational precincts for the city users (Shaftoe, 2008). The planning approach takes into consideration the distribution of green areas as the provision of facilities, not in terms of an ecological system. In particular situations, especially alongside creeks and rivers, corridors are maintained; in some cases there are environmental principles behind the protection of these kinds of spaces, more often consideration of floods risk or difficulties in the development of these landscapes are the real factors which force their preservation (Hough, 1990). In some instances also the space of creeks has been urbanised, cities in Italy, Brazil and Spain made the decision to cover or channelize water bodies, having then to pay damages in the case of overload of these systems (Pavia, 1996).

In parallel to the functional or economical study of open space, a typological one has been proposed by Varon (1998b) who initiated a possible categorisation of these urban areas on the basis of their character, closely related to the one of the surrounding elements. The proposed methodology is not limited to publicly accessible areas, but has a more holistic approach taking into consideration private gardens streetscape. The studies of Varon are based on the development of pedestrian networks, potentially using open spaces within blocks to gain missing connections (Varon, 2004). On the other hand ecological studies promote the creation of interconnected systems where natural areas are connected through corridors in order to allow the movement of fauna and the creation of complex biological networks (Allen, 2004). Merging these two theories is proposed in order to create an urban system operating as an ecosystem, where all the elements can contribute to the positive development of the urban area. For this kind of approach the typological element is not central, but clearly the possibility of interconnections has to be taken into consideration.

3.1 Mapping Opportunities

Based on the studies on typologies of open space, ecological systems as well as urban planning, the following elements are suggested as a framework to map positive development opportunities:

3.1.1 Public Parks

These elements usually play a central role in providing cities with a social space as well as environmental relief (Vapaa, 2002). Larger parks can accommodate leisure facilities and can be key elements in the identity of a city, for example being located in strategic areas or hosting high profile festivals (Platt., 2006).

3.1.2 Gardens

These these are not always publicly accessible, but can be taken in consideration in the creation of an ecological network. These elements have an important social role providing a personal sanctuary where to rejuvenate within the busy urban environment (Griswold, 1996)

3.1.3 Pedestrian Areas

The role of walkable networks is extensively discussed in literature for their social importance, especially in terms of public health (Guaralda, 2006). Apart from being a significant element for a sustainable lifestyle, pedestrian areas are usually the outcome of a process of refurbishment of the urban environment (Newman &

Jennings, 2008). These spaces could provide opportunities to include sustainable technologies for the production of electricity or gathering of water, as well as to manage weather extremes. Some greenways projects have been including this kind of elements alongside artworks or shelters.

3.1.4 Street Planting

The provision of trees in the urban environment is discussed as a potential elements to improve the local environment in terms of air quality and climate control (Lee, Jang, Wang, & Namgung, 2009). Plants in the urban environment can also support a variety of life forms, provide biodiversity to the urban environment and also mitigate the presence of pest (Cowan & Steward, 2007). Cities are an ideal habitat for this kind of biotopes, especially because they do not provide space for their natural predators (Fuller, et al., 2010)

3.1.5 Laneways

The potential of laneways in building pedestrian networks is quite widely recognised in literature (Varon, 2004). These urban spaces can be vibrant social places, but also provide informal connections between different kinds of more structured elements, like private gardens or main streets.

3.1.6 Accessory Spaces

Driveways, accessways, internal manoeuvre spaces or commercial courtyards are spaces often used temporarily during the day or the week (Varon, 1997). Management of this temporality can provide different social uses and the introduction of elements to set up different kinds of urban networks.

3.1.7 Carparks

The need for car space is a central issues in contemporary cities. Large areas are devoted for provisional parking even entire structures are built for this use. In the case of accessible areas, the recognisable pattern is that of busy areas in the daytime, on weekdays and desolated wasteland at nighttime or weekends (Groth, 2005). Also in this case the management of the temporarily of use can allocate different social functions in these spaces as well as the inclusion of environmental mitigation elements (Rawlinson & Guaralda).

3.1.8 Infrastructures and Lost Space

Railway networks as well as motorways and road viaducts generate spaces which in some cases are not accessible or which are socially dangerous (Edwards, 2011). These elements, on the other hand, could play an interesting role providing ecological corridors or including elements for positive development of the urban environment.

3.1.9 Vacant blocks and Redevelopment Sites

Cities are ever-changing systems, mapping areas which are underdeveloped; under redevelopment or due for refurbishment can help in setting an ecological system which goes beyond the unbuilt environment. Green technologies are currently available and are already included in some new buildings (Keeler, 2009), the connection of these elements with the ones in the negative space has the potential to implement the proposed vision of cities as ecological systems.

In parallel to the planning of economic functions, cities could investigate environmental functions to be distributed in the urban fabric and interconnected by the considered design of negative space. Through this approach cities could evolve into Marshall's 'corporate entities' made up of complementary component parts which work together to reinforce and support the function of the city itself (Marshall, 2009). Distributing energy generation, air and water filtration, carbon sequestration and food production (known as 'eco-services') (J. Birkeland, 2008) throughout the wider city fabric, would see the city function as a collective whole in order to achieve a more sustainable state. Over time, as buildings are progressively either retrofitted or replaced, the entire city could generate surplus environmental services. Although composed of independently functioning elements, actively using negative space to connect these discrete environmental cells, the net result would be a city operating as a single self-sustaining unit regardless of any incremental and individual changes – a 'corporate entity' (Marshall, 2009). Identifying and using negative space in a systemic manner to drive sustainable functioning through urban infill development or redevelopment, could help meet urban environmental goals. Temporal activation of negative space could play a key role in enhancing the social interaction which is increasingly becoming 24/7 and meet evolving cultural changes

(Lofland, 1998). This approach would allow the city to evolve and change over time to effectively respond to developments in culture and society; and to progressively take advantage of technological advancements.

4 CASE STUDY

To examine the possibilities of negative space, an initial case study mapping has been carried out of Brisbane, Australia. Brisbane is Australia's third largest city and the capital of the state of Queensland with a population of 1,067,300 people. Formed around the Brisbane River it is a sprawling car-centric city with a light and mid-grained urban fabric. The mapping was carried out on the denser Central Business District which has an increasing city centre population due to a growing number of mixed use commercial and residential towers.

The initial Nolli map of Brisbane was supplemented with the use of high-resolution aerial photographs to broadly identify existing infrastructure, parks, laneways and pedestrian areas. Location visits were used to further refine the initial mapping and identify accessory spaces such as private lanes to rear parking lots.

4.1 Figure Ground

The city centre outlines a dense core which become less dense towards the rive edge. On the South-West side of the city, the connections between the urban environment and the river system is interrupted by a motorway. On the North-East side, the view from the city to the river is often blocked by high-rise buildings which follow a different settling rule in respect to the rest of the urban fabric. The figureground also shows an articulated system on open spaces.

Fig. 1: Figure ground - Brisbane, Australia.The location of infrastructure elements is shown in dark purple.

4.2 Green Space

Overlaying parks, gardens and street planting it is possible to underline a preliminary ecological network through the negative space. The pattern of green spaces is discontinuous and there are several missing links in the potential network. A connection to the river is partially regained.

Fig. 2: Green Space - Brisbane, Australia

4.3 Pedestrian Space

The inclusion of the actual and potential pedestrian areas makes evident how the system, although concentrated in the negative space, could be denser. The refurbishments of public spaces with positive technologies could implement a system which radiates from the main parks deep into the built fabric through laneways and service spaces.

Fig. 4: Pedestrian Space - Brisbane, Australia. Light purple indicates pedestrian plazas along with laneways (in yellow) and accessory spaces (orange)

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4.4 Redevelopment or Refurbishment Opportunities

Areas under redevelopment or refurbishment make clear how punctual elements could be nodes in the restructuring of the city as a positive ecosystem. In some cases new connections could be gained and the existing system in the negative space could be used to distribute the eventual benefit of sustainable elements included in new buildings.

Fig. 5: Complete Mapping – showing existing figure ground (black), vacant and development sites (apricot and red, respectively) green space (green), infrastructure (dark purple), pedestrian areas (light purple) and lost space (dark blue).

5 FUTURE RESEARCH

The proposed mapping is an initial approach to the investigation of cities as ecosystems (Kaika, 2005); further developments of this tool could include the recognition of elements fixed in the development of cities, such as heritage listed buildings. In some cases these cannot be heavily modified and their technological contribution to the system could be limited; however they play a key role in the social sustainability of the urban system concentrating shared memories and representing the common values of the local urban society.

Further, dismissed services, such as tunnels, old aqueducts or sewer systems could also be taken into consideration to intensify the network of connections (Coutard, Hanley, & Zimmerman, 2005). A further level of complexity could be gained introducing a time based mapping of uses and functions in order to

establish how facilities, infrastructure and spaces could be used in different ways throughout the day, optimising resources and also providing new spaces for communities (Varon, 2004).

Additionally this tool could be used to identify the best positional opportunities for retrofitting specific environmental functions in the city. Contextually appropriate technology which relies on particular environmental conditions, such as food production or energy generation, could be plotted onto the map and adjacent negative space appropriately activated. A framework for allocating suitable retrofits would need to be developed and applied.

6 CONCLUSION

Cities today are changing at fast pace and redevelopment or conversions of dilapidated areas is a common approache to the redefinition of the urban environment. These processes offer opportunities to include in our cities sustainable nodes; however mapping the available residual space from which the urban form has been created, offers an opportunity to perceive and understand the existing connecting 'web' of negative space. It is possible to then offer a structure that positively directs the progress of the urban fabric.

Cities have been oversimplified in the last 60 years, in order to regain the complexity which used to be their characteristic; the built environment should not be read as separated functional clusters, but as an integrated technological network. More than activities, planning could take in consideration opportunities; more than extreme interventions of redevelopment, urban design could work on the creation of complex ecological systems staged in time, following the pace of the urban change.

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