On the history and potentials of evolutionary metaphors in urban planning

Abid Mehmood

Global Urban Research Unit, School of Architecture, Planning and Landscape, Newcastle University

Abstract

This paper looks at the history of evolutionary thought in urban planning. It classifies the use of evolutionary metaphors in three broad theoretical streams. The first stream of thought considers the existence of vital forces and energy flows (vitalism) in an urban form. The second stream provides a holistic-organic (organicism) perspective to the city. The third (and contemporarily very popular stream in social sciences) is based on the natural evolutionary theories of Lamarck and Darwin to look at urban dynamics. It is suggested that the flexible-adaptive and self-regulatory nature of evolutionary metaphors can support a holistic-integrative perspective to urban and regional planning.

Keywords

Chicago School, Darwinism, evolutionary economics, spatial planning,

1. Why should planning be considered in evolutionary terms?

Planning can be defined in both procedural and technical terms (a profession, a government activity, a deliberative act) as well as by more collaborative and communicative aspects (a field of prospects and complexities, a social movement, a set of ideas and practices) as projected by Healey (1997; 2006). It can also be defined through various 'empty signifiers', such as sustainability, multiculturalism, etc (Gunder and Hillier, 2009). However, looking at planning in a wider view as a 'field of ideas' (Hillier and Healey, 2008), we discover that it inherits social, cultural, economic and political processes and discursive moments as well as environmental concerns and potentials (de Roo and Miller, 2004). It reflects a continuing process of change (Faludi, 2004), both from top down (structure) and bottom up (agency). This is what makes planning a complex system (Churchman, 1968; Innes and Booher, 1999a; 1999b) in close affinity to evolutionary analogies to help resolve the critical issues in terms of collaboration, adaptation, negotiation, contingencies, change and implication (Khalil and Boulding, 1996; Bertolini, 2007).[1] What the evolutionary theories provide in return is an array of elements that help us understand these processes by looking at reproduction and change dynamics, selection, complexity, variation and transformation, especially through interaction with the environment (Steward and Murphy, 1977; Ho and Fox, 1988; Lambooy and Moulaert, 1996; Bamforth, 2002).

Looking at the perceptions about evolutionary metaphors, we discover that from its nineteenth century usage, evolutionism has been generally considered in various scientific disciplines as an intrinsic part of biology, or vice versa. This presumption prompted many scholars to put their trust in evolutionary biology as a link between

the natural, material and social sciences.[2] However, extensive dependence on 'biological' rather than 'evolutionary' metaphors can often be problematic and may lead to a number of ontological and epistemological conflicts that demand clear positioning of evolutionary metaphors in social science (Sahlins, 1977; Mehmood, 2008). Within the particular focus of urban planning this demonstrates the need for a more expansive concept of the term 'evolution'.

A quick look at its history reveals that the use of the term and concepts of evolution have not always been the sole prerogative of biology. Historically there have been at least two basic usages of the term 'evolution': the first is the literal meaning in the physical sense, as used since the seventeenth century in development biology (Fothergill, 1962); the other has prevailed as a figurative philosophy for many centuries in one way or another (Boyd and Richerson, 2004). In contemporary social science literature, 'evolution' is often identified with 'development' or 'dynamics' (Doreian and Stokman, 1997), whereas in reality it encompasses a wider set of diverse approaches, as identified in evolutionary anthropology (Murdock, 1959), archaeology (Bamforth, 2002), sociology (Sanderson and Alderson, 2005), cultural studies (Sahlins, 1960) and economics (Hodgson, 1994). *Hence present day semantics make evolution a multidisciplinary theme of study with a variety of meanings and applications across various fields.* This aspect particularly enables it to explain the relationships between agency and structure. However, this does not mean that the contributions of biology should be disregarded, although biology was itself an integral part of a larger scientific body until science was categorised into various natural, physical, and social disciplines in the second half of the nineteenth century (Moulaert and Mehmood, 2009).

In social sciences, the existing literature on evolutionary metaphors can be categorised into three types of approaches. The first type mobilises selected evolutionary theories literally adapted from biology (e.g. the 'Sociobiology' of Wilson, 1980); this kind of metaphor often ends up in normative and biased consequences, since explaining social behaviour in terms of biological principles undermines the rich contributions from other disciplines, such as anthropology, and of evolutionary theory itself (Murdock, 1959). For example, it may confuse the role of hegemony with that of nature (Sahlins, 1987). The second approach combines biological ideas with social-cultural thought (e.g. the 'theory of memetics' by Richard Dawkins (1976) who defines the 'meme' as a unit of cultural trait, a behavioural pattern comparable to a gene in biology, which is passed on by imitation and memory). Although effective, these metaphors have limited implications as they tend to explain everything from within a narrow range of perspectives, sometimes missing out on the concerns of empirical inference. The third approach builds social, economic and cultural evolutionary theories within a social science logic (e.g. the concepts of 'general' and 'specific' evolution by Sahlins and Service, 1960). These theories consider the multidimensional role of agency, interactions and change, examining the aspects of selection, transformation and diversification in the context of historical interrelations. Within the scope of this paper, the last two approaches will be privileged by building on contributions from evolutionary elements in European and Anglo-American literature, which have so far largely influenced the practices and debates in urban planning.

In the field of urban planning and design, one of the major attempts for looking at the evolutionary nature of urban form was made by Patrick Geddes in his *Cities in evolution* (Geddes, 1915). He developed an organic approach to human-nature interaction in town-planning in terms of individual well-being, social renewal and

productive efficiency (p.4). Opposing mechanistic[3] points of view, Geddes warned about potential mechanistic interpretations (such as competition) of the evolutionary approaches themselves in social and economic phenomena. In the latter half of the twentieth century, Jane Jacobs (1961; 1969) gave prominence to the role of individual agency in defining the social and economic complexity in a city as an organic whole while rejecting the mechanistic approaches of dealing with the city as one unit. Subsequently, an organic world view re-emerged in the works of Christopher Alexander with his search for complex geometrical patterns in nature and their relationship with human beings (Alexander et al, 1977; Alexander, 2002). Alexander particularly related the spatio-temporal nature of cities to the complexity of urban forms and their interconnectedness (Marshall, 2008). There has also been some criticism of the biological orientation of the organic metaphors. Kevin Lynch (1984) in his analysis of organic metaphors, generally views the organic approach as a normative model. He particularly looks at Wilson's socio-biological perspectives that describe the city as "an autonomous individual" distinct from the "living creatures and machines" (p.89). Criticising such an analogy, Lynch refutes any mechanical and biological semblances. However, he approves the holistic notion of organic approaches which view settlements as consisting of numerous roles and functions, and suggests incorporating the issues of learning, purpose and culture when looking at the city (p.98). More recent attempts using organic analogies range from Lidia Diappi's edited volume which takes a mechanistic approach to the *Evolving cities* (2004), to Stephen Marshall's individual contribution in the form of *Cities, design and evolution* (2008) more inspired by natural evolutionary theories.

Such a diverse range of views and uses of evolutionary metaphors in both organic and non-organic perspectives brings us back to the question, why do we need an

evolutionary perspective anyway? Before answering this, I first look at Hillier and Healey's introduction to their three-volume collection of key planning essays from the past century (Hillier and Healey, 2008). They identify three dialectical dimensions in the history of planning debates: first, substantive content oriented debates that focus on community development; second, the process dimension which predominantly stresses deliberation and engagement; and finally, a normative and practice-oriented dimension. Hillier and Healey appear to consider evolutionary perspectives emerging in the third dimension only as analytical responses to the normative approaches. This also exemplifies the current state of affairs vis a vis evolutionary approaches wherein, although deep empathies exist due to their close proximity with nature and life/living,[4] there are equally sets of misunderstandings on the part of planning academics and professionals who predominantly view evolution from its biological rather than its social, cultural and philosophical roots.

The brief review of some of the leading works in town planning, architecture and urban development above also reflects the disparate nature of the organic perspectives that have been adopted by planners largely independent of similar historical and contemporary works in other disciplines. I should clarify at this point that evolutionary metaphors are mostly not intended for normative prescription (unless they extensively adopt biological ideas). In fact, an evolutionary approach helps us to look at several perspectives which cannot be achieved from materialist viewpoints.

Healey (1997) argues that a non-materialist focus makes the planner aware about moral issues, cultural issues, other species, the carrying capacity of the natural world, daily life interactions and power relations, while at the same time raising questions about future priorities. Although Healey's observations, in this particular case, emerge from environmental dimensions, evolutionary approaches, in this respect can actually

go beyond this and help to clarify the multitude of misunderstandings that continue to exist within planning fora. An evolutionary perspective, therefore, may not necessarily look at cities as organisms, but rather regard the cities as evolving systems, paying particular attention to the role of active agency and behavioural aspects in achieving some extent of self-regulation. It accommodates elements of flexible adaptivity while, at the same time, looking at urban systems as integrated wholes. These perspectives can help to address such planning challenges as the differentiation between theory and practice, socio-economic integration, and identification of the visionary agency, as well as helping us understand why some planning practices prove to be successful in some communities and fail to take off in others.

This paper does not provide an exhaustive survey of evolutionary metaphors in urban architecture, design and planning, nor does it intend to prescribe any particular evolutionary approach as a panacea for urban planning theory and practice. It, however, aims to identify the main theoretical streams (i.e. vitalism, organicism, and Lamarck/Darwin –isms) in the history of ideas about urban planning, and relate them to the relevant, but widely scattered, works in urban planning and design that have been applied at different levels of abstraction.

What qualifies these theoretical streams for discussion in one place is the organic nature of their 'evolutionary' inference in urban planning. Although *vitalism* acknowledges the role of organics and inorganics, it asserts the importance of creativity and intelligence in vital impulse systems. These systems can exist in any individual or group and help to formulate goal oriented behaviour (Jenkinson, 1917). Thus a vitalist allegory can help explain evolutionary relationships between biological and non-material forces and society (Huxley, 2006; 2007). The approach of *organicist*

metaphors defines a dynamic relationship between the built and natural environment, society, history, and culture (Geddes, 1904 [1973]). Their integrative line of contact towards the relationship between living beings and the environment made organicist metaphors a favourite among urban architects and town planners in the nineteenth and twentieth century respectively (van Eck, 1994; Allen, 2005; Sohn, 2007). Finally, the natural evolutionary theories of Lamarck and Darwin have captured the imaginations of social scientists right from their first articulations (Sahlins and Service, 1960; Mayr, 1982; Ingold, 1986; Sanderson, 1997). Despite common evolutionary underpinnings, however, these streams have rarely had any direct communication with each other, especially within the urban planning domain. Following subsections further elaborate these statements.

2. The spirit of a city

The revival of *vitalism* is the philosophical and metaphysical notion for change that has particularly framed various conceptual issues in understanding urban social relations and interactions for the last twenty years. Vitalism calibrates the elements that animate organic beings, asserts the existence of a unique arrangement within organisms, and addresses the issues related to purposeful behaviour, cerebral stimuli, metabolism, and development (Jenkins, 1917). Traced back to Aristotle's *De Anima* and *De Generatione Animalium* (Müller, 1996), vitalism has attempted to provide philosophical, metaphysical and psychological explanations to the processes and forms that cannot be described through mechanistic reductionism of physical equations, chemical compositions and mathematical formulae (Driesch, 1914; Carlo, 1966). This means that such discussions historically have been concerned with the

role of active agency, in contrast to more mechanical and structural representations of human actions. As the mechanistic principles predominantly concern mathematical laws, efficient causality and atomism (Beiser, 2003), a general lack can be observed in terms of the ability of such paradigms in explaining mental events, complexities, organisation, causation, co-operation and social relations. These were the key issues in the debates between the vitalists and mechanists that went on until the first-half of the twentieth century (Singer, 1946). In the interwar period, there were some reconciliatory attempts to find common points between mechanists and vitalists through holism (Hasebroek, 1939). However, they remained short-lived.

In planning theory, the past two decades have particularly seen a wave of philosophical thought wherein the role of social networks, interaction and power relations is receiving wider attention (Hillier, 1993; 2008; Watson, 2002; Moulaert and Cabaret, 2006). Relational theories have also opened doors to invigorate the role that vitalism – as a philosophy for relationships between communities – could play in spatial planning. One such effort is reflected in Margo Huxley's approach to governmentality (2006, 2007) wherein she views vitalism as one among the three spatial 'operative rationalities' (other two are, dispositional and generative rationalities) for making governable spaces. These spaces form an environment that can translate the effects of social and biological evolution. Building on the Lamarckian idea of environmental impacts (Lamarck, 1809) and the Bergsonian notion of creative evolution (Bergson, 1907), Huxley asserts that:

> "A 'vitalist' rationality extends the logics of dispositional and generative causal properties of specific spaces and environments to a general bio-social and non-material environment, which can be shaped to foster the progressive development of humanity, race or nation. This environmental causality is 'vitalist' in the sense that it

> is seen to involve a life force outside the processes recognized in the physical sciences" (Huxley, 2006: 780).

In this respect, Huxley identifies policy and social expertise discourses in the USA from Roosevelt's inspiration for patriotism, will and leadership from nature, and the emergence of the Fabian Society in the UK. Vitalism, therefore, offers guidance for "dynamic, open-ended, bio-social, intellectual spiritual evolutionary processes" (Huxley, 2006: 782). Elsewhere, Huxley (2007) also considers vitalism as an idealistic rationality for urban social reform. By relating the role of the environment to social and biological evolution, Huxley here brings out the metaphysical nature of vitalist philosophy and attempts to address a major criticism of vitalism for being unable to address future-oriented issues of space, place and society.

Another approach to vitalist thinking in urban planning appears from John Pløger's search for urban vitalis (2006). Grounded in Georg Simmel's approach in explaining the social forms within an urban environment, Pløger uses observations and experiences from urban development projects in Denmark to identify vitalism as a philosophy that is already inherent in contemporary urban planning. Combining Simmel's ideology with that of Gilles Deleuze, Pløger introduces a sociology of active agency by implying that social life is both framed by routines and spatial patterns, as well as by 'generative processes' in the flows of everyday life that might be shaped by non-cognitive encounters and life forces (Pløger, 2006). A 'flow' in this case also becomes a vital force as it engenders social relations, exchange and substance. The author acknowledges the general reluctance among planners to accept vitalism as an essential factor of city life, primarily due to its unpredictable nature (p. 393). He, therefore, stresses the need for action at institutional, rather than individual,

levels to comprehend the contextual modalities of vitalist forces. However, given the evolutionary notion of all action being (partly) routinised or codified, the need for action could be argued more in favour of a collective, rather than institutional, level action.

More recently, Charissa Terranova (2008) has traced the roots of Marcel Poëte's (1935) urbanist philosophy to the vitalist ideas of *élan vital* by Henri Bergson (1907). Poëte's adoption of the Bergsonian notions of 'duration' and 'creative evolution' into *urbanisme* offered a challenge to the functionalist streams in early French architecture and town planning theory.

At present times when planners are increasingly expected to work with a diverse range of communities and cultures within an urban environment, Leonie Sandercock (2006) advocates a bottom-up approach to spirit-conscious planning for better public engagement. She asserts the importance of understanding the issues of faith, belief and spirituality within communities. Sandercock identifies two main behaviours (self-nourishment and connections-building) that can help planners incorporate spirituality into planning practice. A bottom-up understanding of the vitalist forces in urban contexts also goes hand in hand with Hoch's (2006) contention for consideration of the role of emotions, judgement and action in planning processes in the sense that it brings planners in close proximity to their communities.

The concepts of vitalism have often been criticised for their inability to forecast future events (Allen, 2005; Greco, 2005). But, most of all, the many vitalist arguments about inadequacies in mechanistic explanations have not been satisfactorily resolved (Bechtel and Richardson, 1998). Vitalists have also refused to take into account the notions of adaptation from Darwinian natural selection and genetics (Donzhansky, 1949). In planning theory and practice, the impact of external factors and the role of

the environment have largely been perceived through an urban focus. This actually limits the applicability of vitalist concepts as it overlooks the neighbourhoods and communities which exist beyond the perceived urban boundaries. This calls for a need to analyse the holistic multiscalar aspects of flexible adaptivity, as demonstrated by organicist approaches.

3. Holistic approaches to human-nature interaction

Discussions and applications of design principles and community dynamics during the nineteenth and early-twentieth centuries were preoccupied with views on the integrated interdependence of parts in a whole. These debates had actually emerged in urban planning as a romanticised response to the doctrine of mechanism in the late eighteenth century, and were collectively termed *organicism*.[5] Until that time, urban architecture, design and planning were primarily seen through rational geometric models (Friedmann, 1987). Organicism is defined as a holistic view of the interaction and relationship between humans, nature and the environment. In this manner, organicism can be regarded as the precursor of the modern field of urban ecology. The holist tenets of organicism have been traced back to Georg Hegel's organic worldview in its concepts of dialectic, the unity of opposites, and identity-in-difference (Beiser, 2003). Organicist viewpoints differ from those of vitalist spirituality in that organicism does not particularly take into account the existence of intangible forces. However, the aspect of adaptability of an organic form to the environment means that it contrasts more with atomistic philosophies.

Among more prominent theorists, Herbert Spencer analysed society as in between the two extremes of individualistic atomism and universal organicism – clearly

considering the first as the basis for the second (Gray, 1996), whereas Edmund Montgomery related the organismic unity to the development of social relations, ethics and morality (Keeton, 1947). Similarly, John Maynard Keynes abandoned his support for atomistic views in the 1920s to favour organicism in economics through the principle of organic unities in *Miscellanea Ethica* (Davis, 1989).

Organicism found widespread credence in the nineteenth century Western architectural theory which subsequently made way for urban planning. According to van Eck, the inspiration for the symbolic replication of the concepts of nature had actually emerged from "the artistic theory of antiquity and the Renaissance, that is, in rhetoric and poetics, combined with elements taken from Aristotelian metaphysics" (van Eck, 1994: 19). Leading theorists and architects of the period such as Schinkel, Viollet-le-Duc, Ruskin, Semper, Bötticher, Root and Sullivan acknowledged the metaphorical synthesis between architecture and nature by emulating the methods rather than the forms of nature (van Eck, 1994). However, by the end of the nineteenth century, the organicist school in architecture declined as the classical traditions fell out of fashion in architecture. Organicism re-emerged momentarily in interwar Germany with the works of Paul Wolf (1924) and Hugo Häring (1926), and also in post-war reconstruction efforts through the strategic urban plans proposed by such town planners and architects as Hans Scharoun, Hans Bernhard Reichow and Walter Schwagenscheidt (Sohn, 2007). Nevertheless, most of their ambitions to bring urban settlements into harmony with nature either did not materialise, or were scaled down to a few urban centres and housing estates. Sohn attributes this failure to the planners' perception of an organic system as an ideal that defined urban life through the principles of "optimum function, effectiveness, purposiveness, order, unity and

perfect economy—while excluding entropy, the immorality of dark red-light districts, and indolence" (Sohn, 2007: 519).

At the turn of the twentieth century, Patrick Geddes' holistic approach to town planning revived the tradition in the UK.[6] A disciple of Thomas Huxley, Geddes had initially proceeded with a conventional academic career in biology (Boardman, 1978). While working as a lecturer in zoology and a demonstrator in botany at the University of Edinburgh (Conway, 1970), he first attempted to apply the organicist approach to economic theory (Geddes, 1884).[7] Later, Geddes encountered various other theorists and their philosophies which ranged from the Catholic, Frédéric le Play, to the anarchist, Piotr Kropotkin (Hall, 2002), and from Auguste Comte's social science classifications to Spencer's social theory derived from physics and biology (Conway, 1970). Geddes' interaction with the French and German regionalists also became a major stimulus to his organicist thinking for regional planning in Britain (Geddes, 1915).

Geddes' multidisciplinary contributions extend from his works in human physiology to town-planning reports (Geddes and Thomson, 1890; Geddes, 1904[1973]). He particularly emphasised an organicist approach to urban and regional planning stressing the correlation between the environment, society and land-use not only inside the city, but also with its surroundings (Welter, 2003). His sociological, ecological and environmental views can also be regarded as a silent inspiration for the modern conceptions of city-region (Davoudi, 2008). Between the years 1890 to 1925, he had immense influence on the British town and country planning movement (Abercrombie, 1927; Mather, 1999) and the emerging urban planning fora in the United States, most particularly on the Chicago School (Berry and Horton, 1970).

The Chicago School's contributions (especially during the 1920s and 1930s) to early twentieth century research in physical planning, urban sociology and human ecology were through inter-disciplinary perspectives that were mostly influenced by organicist metaphors. Based on observation of the multiethnic, multi-centred, segregated and hierarchical social and economic arrangements of Chicago and other American cities, the School forged new research avenues in anthropology, urban design, and the spatial distribution of communities, industries and economies. Within its own conceptual tradition, the Chicago School accentuated the notion of population as the unit of selection (Mitman, 1988). Subsequently, the Darwinian concept of 'struggle for existence' was selectively employed to explain a biotic social order among competing organisms in a society (Park, 1936). Later on, the ideals of human ecology (that were actually adopted from plant ecology in the interwar period) were appropriated to form the concepts of functional distribution[8] and ongoing competition between communities and groups for survival and dominance within a metropolitan setting (Berry and Horton, 1970).

However, Geddes has remained a major influence for urban planners more particularly through his long-term relationship with Lewis Mumford (Novak, 1995). Being a proponent of G.H. Mead's symbolic interactionism (Blumer, 1969) which implies the role of symbolic communication in social interaction, Mumford saw the urban environment as "a theatre of social action, and an aesthetic symbol of collective unity" (Mumford, 1937 [2003]: 94). In the wake of the ongoing mechanist-organicist polarity of the time, Mumford preferred the historical views to validate biological concepts for the study and behaviour of urban society (Marx, 1990). In the post-war period, Mumford's works also made comparisons with V.G. Childe's (1951)

evolutionary views on urbanism in human societies, insisting that planning must remain close to the social realities (Mumford, 1956).

Another post-war impact of Geddes' organicism emerged to strengthen the science of Ekistics that was developed by Constantinos Doxiadis. Geddes' disciple and town-planner Jaqueline Tyrwhitt collaborated with Doxiadis on a number of modern urban-design projects that incorporated organicist views (Shoshkes, 2006). Ekistics, as a science of human settlements, associated the biological with social experiences (Doxiadis, 1970) in its aim to build a global *entopia* that would comprise urban settlements incorporating an ecological approach to social, economic and technological developments (Bromley, 2003). Looking at the city as an organism, the approach anticipated urban growth from the individual to the global, while at the same time considering its relationships with local ecology and the environment (Dix, 1977). Nevertheless, with a design focus the view of urban growth and development was predominantly conceived in geometric axes, thus missing out on the real focus of organics. Over the period, attempts have been made to enhance the systems views in Ekistics in conjunction with other planning tools to explain strategic regional development (Burrows, 1980). However, with its partially static nature focusing on linear urban sprawl (Doxiadis, 1976), Ekistics has remained particularly inadequate to explain urban and regional diversity and dynamics in the longer term. This is exemplified by the institutional and developmental issues in the case of Islamabad[9] the capital city of Pakistan, purpose-built by Doxiadis during the 1960s (Maria and Imran, 2006).

Recently, the ecological concept of urban metabolism (Wolman, 1965; Newman, 1999) has been extended to urban planning. Swyngedouw and Cook (2009) have traced the issues of a metabolic-organic exchange in the works of natural scientists

such as Jacob Moleschott (1857) and Justus von Liebig (1855) who investigated the spatio-temporal issues that emerged from interaction between the process of urbanisation and the environment. Von Liebig particularly "argued that the 'metabolic rift' – the temporal/spatial separation of spaces of production and spaces of consumption through the emergence of long-distance trade on the one hand and the process of urbanisation on the other – influenced negatively the productivity of agricultural land, while exacerbating the problematic accumulation of excrement, sewage and garbage (and its disastrous social consequences) in the city." (Swyngedouw and Cook, 2009: 4). More in-tune with concerns about environment, sustainability and liveability (Newman, 1999), the urban metabolism approach looks at the complexity of urban ecosystems in relation to technological development, land-use, energy consumption and waste generation. This approach also helps to assess the future impact of planning and policy decisions in order to bring contemporary urban living in closer empathy with nature.

With their espousal of biological analogies, the holistic debates in organicism have not remained immune from criticism. The nineteenth century organicism in architecture was largely criticised for being too classical, in favour of ahistoricist modernity. In Britain, radical opposition against biological analogies was spearheaded between the 1880s and 1890s by periodicals such as *The Builder* and *The Building News* (van Eck, 1994). More contemporary criticisms, however, question the logical implications of organicism including its soft striving for balance, harmony and homogeneity parallel to its rejection of entropy and chaos (Sohn, 2007), and also whether the life-span of a city as an organism should be determined within an ecological perspective (K'Akumu, 2007). Within the field itself, despite its perspectives on urban architecture and design, the organicist focus of planning, after

Geddes, remained relatively less on theory building and more on practice-oriented implementation. As a result, while intending to shape place, some epistemological stances seem to aspire to a kind of 'social engineering'. The fact is that organisms have their own unique methods and codes of interaction with their environments. Any relationship with selection mechanisms and purposeful behaviour thus needs more elaborate conceptual tools to view the urban fabric through the role of local potential or new *agency* within the face of uncertainty.

From the above two sections, the major strength of vitalist and organcist thinking can be seen as their broader perspectives and multidisciplinary views that encompass natural, physical, and social phenomena and link them to the environmental dimension. However, these strengths became weaknesses when these traditions failed to fully incorporate the tenets that were offered by the evolutionary philosophies of Lamarck and Darwin. As a result, the evolutionary theories in planning became preoccupied with biological metaphors. And with the biological phenomena themselves being interpreted through mechanistic methods (e.g. genetics) in the first half of the twentieth century,[3] the theories became strangled by the similar mechanistic problems and issues that they were actually supposed to resolve (see van Eck, 1994; Bechtel and Richardson, 1998; Allen, 2005). In this respect, approaches to organic transformation and natural selection emerged as a major, but largely indirect, evolutionary influence on urban planning (Marshall, 2008).

4. Natural evolutionary theories

No discussion on evolutionary approaches can be considered complete unless it has looked at the works of Jean-Baptiste Lamarck and Charles Darwin in evolutionary

biology. Ironically, both Lamarck and Darwin avoided the term 'evolution', and it was Herbert Spencer who publicized it to explain complex organic change. It was not until 1866 that Darwin was persuaded by Alfred Wallace to use 'evolution' in subsequent editions of the *Origin of species*. So, before looking into their role in social sciences in general and urban planning in particular, it is worth summarising some of the basic concepts that Lamarck and Darwin offered.

Lamarck brought forward the first comprehensive theory of evolution in 1809 (Laurent and Nightingale, 2001), suggesting the inevitability of evolutionary progress and the importance of organisms striving towards their own improvement (Lamarck, 1830). At that time, the term 'evolution' carried the connotation of Charles Bonnet's theory of preformation.[10] According to Lamarck, the representatives of a species undergo constant 'transformation', both as they progress and as they encounter diverse physical conditions (Boesiger, 1974). The theory of transformation is comprised basically of two concepts: First, that it is 'purposeful behaviour' or a desire for change that causes transformation. Use/disuse of certain traits leads to their respective improvement or diminution in accordance with the available environment; second, the possibility of the 'inheritance of acquired characteristics' i.e. traits changed or acquired over an individual's lifetime could be passed on to any offspring.

Over the years, both these ideas of purposeful behaviour and the isomorphic inheritance of acquired characteristics have been largely rejected in biology, as no biological mechanism could be found to explain the process of acquired character being encoded into the genes and passed on to the offspring.[11] However, in a broader sense, Lamarck's explanations have received wider acceptance in the spheres of social and cultural transmission (Ingold, 1986) and socioeconomic evolutionary analysis (Hodgson, 1993; Martin and Sunley, 2007). The idea that acquired characteristics of

an individual or institution can be passed on to or imitated by others was taken on board by Richard Semon (1911 [1921]) to define cultural evolution through the concept of *Mneme*. It re-emerged in the 1970s with the study of 'memetics' (Dawkins, 1976; Blackmore, 1999).[12] Lamarck considered that progress towards complexity in organisms was subject to the demands of local environments (Lamarck, 1809 [1984]: 113). Since variations are supposed to occur largely through adaptations to the environment rather than through random mutations, for Lamarck, environment is the key agent of change (Hodgson, 2001).

Moving to Darwin's theory of evolution by natural selection, it is worth noting that the range of observations that inspired his thought process included, but were not limited to, Lamarck's theory of transformation, Charles Lyell's geological principles defining the evolution of Earth, and works in historical linguistics (Lyell, 1830; Darwin, 1859 [1998]: 319, Strauss, 2007). There are at least four main principles of Darwinian evolutionary theory that are of relevance for urban planning. First, the role of 'variety', which is randomly sustained among the population so that not all individuals are identical. Second, the processes of 'heredity' through which characteristics are inherited. This principle bridges a relationship with the Lamarckian inheritance of acquired characters. However, for Darwin, only the 'individual characteristics' are passed on. Third, the mechanism of 'natural selection' that allows the reproduction of better-adapted organisms. This process can either be 'directional' to favour beneficial mutation, or 'disruptive' to support the extremes of a phenotype in a population. And finally, the preservation of those variations that support the struggle to survive. This principle has also been termed as the 'struggle for existence' and interpreted by many biologists and some sociologists as competition or self-interest, whereas planners have related it to competitive co-operation (Park, 1936). A

serious attempt to demystify such misconceptions came from Petr Kropotkin who defined this principle in terms of individual initiatives and intellectual capacities through the elements of cooperation and 'mutual aid' (Kropotkin, 1902 [1976]).

It took at least another forty years for biology – with the development of modern genetics – to deny the existence of Lamarckian inheritance of acquired characteristics in organisms, and verify Darwinian concepts of natural selection, variation and adaptation, by means of neo-Darwnism (Conway, 1970; Richards, 1977). However, by that time the Darwinian principles had been generally applied in the social sciences. One of the reasons for this rapid acceptance was that these ideas were already perceived by social scientists as sociological concepts justified within the biological domain (Thompson, 1910). Over the century, this affiliation has strengthened as scholars find evolutionary principles too general and universal to be exclusively used in biology, a notion termed as 'generalized Darwinism' (Hodgson and Knudsen, 2008; Stoelhorst, 2008).

Interestingly, planning theory has largely avoided any direct use of Lamarck's and Darwin's key evolutionary concepts in urban planning with a few exceptions (such as Lambooy and Moulaert, 1996; Bertolini, 2007; Marshall, 2008) despite the fact that evolutionary strands have increasingly become stand-alone fields of inquiry, as apparent in the case of evolutionary anthropology, economics, sociology, and cultural evolution etc. The vitalist and organicist streams tend to avoid any express linkage with Lamarck's or Darwin's works, although a limited reference to their theories occasionally recurs, as discussed above.

A wider, more encompassing approach to evolutionary metaphors, as applicable to both biotic and inanimate entities, is found in Stephen Marshall's *Cities, design and evolution* (2008). Marshall regards evolution as not just a biological phenomenon but

more “as a concept that is general enough that it can be interpreted in both biological and non-biological contexts: but specific enough that it is clearly distinct from other kinds of change – growth, development, metamorphosis, adaptation and emergence – that may also be interpreted in both the natural and built environment” (p.17). Using Dennett’s (1995) definitions, Marshall attempts to justify that evolutionary metaphors are equally applicable to non-organic entities. He, therefore, proceeds to test the concepts of evolution, order and emergence in urban contexts and discusses the recent rise of neo-traditional urban forms in the West. However, when looking at the growth of cities, Marshall chooses to treat ‘development’ as a separate dimension from that of evolution, and as a result appears to restrict his views to the ontogenetic definition of development (i.e. growth of individual organisms) which does not fully accommodate social scientific perspectives (Flinn, 1997; Cordes, 2006; Bertolini, 2007). In my view, another key oversight occurs when Marshall compares aspects of the ‘game of evolution’ through its perceived strengths and weakness, amongst which he considers that evolution does not have or need a memory (Marshall, 2008: Table 9.2). I consider that this normative exercise actually disbalances Marhsall’s whole argument about the processes of evolution, as memory function happens to be a key element of evolutionary metaphors in various forms (e.g. Lamarckian inheritance of acquired characters, Darwinian natural selection, and neo-Darwinian genetic heredity).

The social science field, which has experimented with both Lamarckian and Darwinian natural evolutionary theories – especially in relation to adaptation to the changing environment – and which continues to apply its analyses in wider contemporary debates, is that of evolutionary and institutional economics (Dopfer, 2005; Hodgson, 2009a; 2009b). One of the key contemporary concepts in evolutionary economics is Nelson and Winter’s (1982) idea of ‘routines’ (based on

the concept of genes) that function as "repositories of knowledge and skills" or an institutional memory (Hodgson, 1988: 99). From the earlier discussions of organicism, we are already familiar with Keynes' organicist approach in economics (Davis, 1989), as well as Geddes' initial attempt at organicist thinking in economic theory (Geddes, 1884). Subsequent works in this respect have ventured to overcome mainstream economics' attitudes to rational justifications and equilibrium tendencies (disliked intensely by spatial planners!) to spell out the historical specificity of community relations, power dynamics, the role of stakeholders, network behaviour and social organisation within the perspective of socio-economic development, at micro, meso and macro levels (Moulaert and Cabaret, 2006; Mehmood, 2008).

A very interesting approach to urban planning in this respect is that of 'evolutionist cities'. Developed by Jan Lambooy and Frank Moulaert (1996) as an attempt to provide a comparative assessment of various typologies used by urban theorists, the distinguishing feature of this approach is its methodology, based on interdisciplinary debates in economic geography, institutionalism and evolutionary economics. The authors tackle issues of rational logics and order-inspired interpretations of urban development. They suggest the 'evolutionist' and 'regulationist' alternatives for the social, economic, and political regulation of urban form within the framework of institutionalist theories, based on the patterns of complex evolving systems, as provided by Veblen (1919) and Commons (1934). The 'evolutionist city' here is modelled as a 'social system of innovation' that is defined through local innovation, social learning, organisational structure, institutional creativity, and endogenous development potential. The authors assert that the range of analogies between social, economic and biological evolutionism varies according to the different schools of thought; from the preservation of main principles to the adoption of the full biological

metaphor (see Dosi and Marengo, 1994). This assertion substantiates the argument that the use of evolutionary analogy in social sciences should essentially be metaphorical. The authors consider the innovative behaviour of institutions as the strongest aspect of evolutionism whereby uncertainty can be overcome by a learning process that allows adaptation with the changing environment. This aspect is particularly strengthened by Nelson and Winter's concept of organisational routines (1982).

Within a metropolitan context, Lambooy and Moulaert also attest to Perrin's (1991) rationale that an evolutionary approach helps to improve the functional and network aspects of the urban institutions. However, the situation appears to suffer from a political economy bias when the authors reject the notion of the evolutionist city in favour of a 'regulationist' one. They justify their preference on the grounds of predominant parallelism of the evolutionist city metaphor to biologics as well as its insufficient explicability of the reproduction of labour in an urban environment.

The above discussion implies the need for a multidisciplinary approach when utilising the evolutionary metaphors, as there are debates existing, which planners can refer to, in social, cultural and economic evolutionary analyses that have already clarified such issues (see for example Sahlins, 1977; Ho and Fox, 1988; Hodgson, 1993). There has also been an increasing awareness recently in evolutionary economics to move beyond the mere mutual exchange of ideas to/from natural evolutionary theories (a trend termed by Hammerstein and Hagen (2005) as 'the second wave' of interactions between economics and biology), with a plea for wider synthesis, visible in the debates on generalized Darwinism (Hodgson and Knudsen, 2008; Stoelhorst, 2008) mentioned above. These developments also highlight a potential to revive the evolutionist city model.

I remind readers here that my purpose in this paper is only to illustrate the applicability of evolutionary metaphors and by no means to imply evolutionary and institutional economics as a standalone exemplar of evolutionary implications in urban planning. What is important from the above discussion is that, despite widespread misconceptions, the natural evolutionary theories can help us to understand the drawbacks of rational modelling, and to look at the character of local history, social dynamics, community participation, and path-dependent behaviour of communities and institutions. These debates have also been further broadened to compare evolutionism with the science of complex systems to support a more holistic-integrative approach, as I discuss below.

5. Towards a holistic-integrative dimension to urban planning

As in evolutionist city model above, economic geography appears to be one of the major contributors to evolutionary debates in urban planning. The emerging field of evolutionary economic geography has borrowed concepts from evolutionary economics to explain urban social and economic dynamics (see Boschma and Lambooy, 1999; Boschma and Frenken, 2006; Boschma and Martin, 2007). Discussions have also emerged on the field's potentials, similarities and differences with the complexity theories, a body of theories some of which synthesise evolutionary metaphors, as in the case of complex adaptive systems suggested by Innes and Booher (1999), Abel (1998), Martin and Sunley (2007) and others. A major impetus for the attraction of planners to complexity theories may come from the 'systems thinking' that has shaped a large corpus of planning theory ideas in its various forms (Burrows, 1980; Innes, 1999).

Hillier and Healey (2008) characterise systems thinking as a major intellectual wave in planning theory during the 1960s. In terms of the holistic-integrative dimensions, wider attention was paid to integrated urban and regional planning in this era (Berry, 1964; 1970). C.W. Churchman (1968: 13-14), for instance, identified four different strands to systems thinking: first the efficiency approach, which concentrates on reducing waste (of time, resources, materials, etc.); second, the scientific approach with its objective and behaviour oriented models; third, the humanistic approach, which gives consideration to values, interaction and understanding; and finally, the anti-planning approach that generally opposes any rational attempt towards planning. Churchman's views, however, remained predominantly that of a management scientist, so for him the planner mostly appears as a unit separate from the planning process.

The systems approach has been recently taken to another level in urban planning through the works of Judith Innes and David Booher who view the city as a complex adaptive system, and examine the role of individual agency in collaborative planning efforts (Innes and Booher, 1999a; 1999b). The authors have also reflected as to how the network relationships between agents can help develop learning and adaptation within such a system (Booher and Innes, 2002; Innes et al, 2007). Similarly, Christopher Alexander (1977; 2002) has considered complexity thinking beyond time-space dynamics, through complex and interactive geometric patterns in nature. He defines regions of space at a global level as vital elements of a whole, with the environment as a field of wholes (Mehaffy 2004). More recently, Porter and Córdoba (2009) have identified three general interpretations of systems thinking from a sustainability perspective: functionalist (linear, structural and mechanistic), interpretive (communicative and subjective) and complex (agency-network

interaction). It is the applications such as these which have brought complexity thinking to become the flavour of the decade in the early twenty-first century.

Complex adaptive systems are characterised by self-regulation, innovation and adaptability using tacit knowledge. Such systems can also perform at different spatial scales in different environmental situations (Abel, 1998). A case in point is the study of the system of urban transportation networks provided by Bertolini (2007), who examines the lessons learned from the development of Amsterdam's transportation infrastructure from the post-war period to the turn of the century. Bertolini employs metaphors from complex adaptive systems and evolutionary economics to substantiate the need for adaptability and flexibility in urban transportation policy and planning. This approach allows him to integrate the variation among social actors, together with the importance of local history and specificities, and to discard those assumptions which regards equilibrium as a natural state of the system. Bertolini uses the metaphor of organisational routines (from Nelson and Winter, 1982) to describe urban transportation planning and land-use policy as path-dependent systems. The routines, in this case, emerge from the internal organisational patterns as well as the selection environment. As a result, instead of deliberating on all possible options in a situation, only the tested alternatives are considered. The dynamic features of routines also allow adjustments to the changing environment while concurrently testing newer alternatives. This approach helps to highlight the complex evolutionary nature of policy and planning, and demonstrates the limitations of a 'purely rational approach' in accomplishing adaptability to change. In essence, Bertolini advises planners not to disregard historical, evolutionary and complex patterns of change before spending their energies in the face of 'persisting uncertainty'.

As a serious attempt to understand the transportation systems through an evolutionary paradigm, Bertolini offers new insights for the study of urban and regional transportation networks as complex systems. However, it is not clearly illustrated what role the organisational routines play in the day-to-day business of urban transportation systems in general, and the case study in particular. Since these routines play a role similar to genes in biology, it becomes obvious that modern evolutionary theory has much more to offer to planners than has been previously perceived. And in the present day dynamics, the ongoing interest in evolutionary theories may well be the defining element of the next decade with many more interesting planning theories and case studies making use of the evolutionary metaphors.

6. The place of evolutionary metaphors in planning – An inquisitive synthesis

From the discussions above, various points of commonality and differentiation have become visible among the three major streams of vital forces and energy flows (vitalism), holistic-organic perspectives (organicism), and natural evolutionary theories (Lamarckism and Darwinism) in urban planning. This proves, at least, that these three streams are not contradictory, although some differences persist. However, elements of commonality does not mean that the streams can be used interchangeably as metaphors. Whereas vitalist forces offer a guide to goal directed behaviour, organicism accommodates the flexible adaptivity and self-regulatory nature of organisms. Similarly, natural evolutionary theories have the suppleness to offer adequate consideration of non-organic entities. The complex systems approach, as discussed above, can help to extend the holistic-integrative perspectives to urban and

regional planning and development in a wider sense. Meanwhile, it is important to understand that, in order to avoid terminological confusions and preconceived notions of the concepts, evolutionary theories in social sciences should clearly be used in a metaphorical manner as metaphors contain a conceptual, if not a theoretising capacity. In the past century, as planning ideology has moved on from a 'town and country' to more integrative 'spatial' approach, so have the theories and concepts of evolutionary metaphors. Without prioritising any of the particular theoretical streams discussed in this paper, there are visible signs of a renewed interest in evolutionary ideas within current planning literature and practice.

It should be added that the concepts and literature on the three evolutionary streams still remain quite disparate. But as indicated above, there was little attempt in the past to take advantage of the similar stances inherent in these streams (e.g. resistance to mechanistic doctrine). In fact, most of the work focussed on the differences between the streams, with only an occasional exchange of ideas. This paper should be read as an attempt to bring them together on one platform. A holistic-integrative approach to evolutionary metaphors would not only provide more comprehensive metaphors, but it would also reinforce the ideas to which these strands have single-handedly contributed. Such an approach can help planners to develop measures to cope with future social, cultural, economic and environmental crises and resource constraints. Would a future paper be able to define the next decade through an evidence-informed revival of human-nature interaction? The omens are encouraging!

Notes

1. One of the major recent attempts to bring together natural and social science debates by means of systems thinking is made by Khalil and Boulding (1996).

However, their focus remains more on 'biological' rather than 'evolutionary' processes. Subsequently, Bertolini (2007) has attempted a systems approach using metaphors from evolutionary economics to explain the evolution of transportation systems in Amsterdam.

2. See for example the much debated concept of 'sociobiology' as coined by Edward Wilson (1980). Unfortunately, the criticisms of such biological metaphors also led to a general disapproval of theories making use of evolutionary metaphors (Sahlins, 1977).

3. The philosophy of 'mechanism', as an opposing strand to organic approaches, views organisms as non-holistic material entities with various processes occurring simultaneously to serve one common purpose. This doctrine finally became the motive for the foundation of 'life sciences' on similar grounds as 'physical science' in the early part of the twentieth century (Allen, 2005).

4. There has been a fascination of nineteenth and twentieth century scholars with the growth and development of cities and metropolitan areas as 'natural' organisms. Lynch (1984: 98) relates this enthralment to an "affection for nature, and desire to be close to natural, living things" by urban dwellers.

5. Various, and often conflicting, meanings and perceptions exist on organicism. For example Gilbert and Sarkar (2000) assume organicism as part of 'materialistic holism'; Carmona and Tiesdell (2007: 35) consider it as inspired by the "biological metaphors and philosophical concepts of vitalism"; whereas the Oxford Dictionary of Philosophy regards it as an 'opposing' doctrine to vitalism and Darwinism (Blackburn, 2008).

6. Some authors have related Geddes' evolutionary philosophy to town planning with the vitalist strands (see for example, Novak, 1995; Huxley, 2006: 782; Crampton and

Elden, 2007: 198). A major reason for this widespread confusion can be attributed to some of Geddes' works such as *Cities in evolution* wherein he uses various metaphors that have been more commonly used in vitalist approaches. However, the focus here is on his organicist thinking, as is evident in much of his work, which I detail later.

7. In this article, Geddes criticises the lack of linkages between economic theory and practice and offers multidisciplinary insights to improve qualitative and quantitative analyses through biological, ecological, psychological and ethical principles. Fourteen years later, Geddes' close friend, Thorstein Veblen, published the seminal work asking 'Why economics is not an evolutionary science?' (Veblen, 1898).

8. Such as Burgess' concentric zones model (see Park et al, 1967).

9. The original plan of Islamabad was based on Doxiadis' concept of *Dynapolis* – a dynamic metropolis – which incorporated three entities: the new city of Islamabad in the foot of Margalla Hills, the nearby twin-city of Rawalpindi, and the neighbouring national park (Doxiadis, 1965). However, the linear grid-iron structure plan of the city did not consider the institutional dynamics (Maria and Imran, 2006). Hence, the twin-cities and the national park continued to be governed under separate institutional arrangements which followed their own distinct planning and development trajectories.

10. The hypothesis of 'preformation', promoted by Charles Bonnet and others in 1762, states that development of an organism occurs by the unfolding and growth of characters already existing in the embryo at the beginning of development. The theory also considers a coordinating relationship and order between the organic parts (Cheung, 2006)

11. It is, however, important to note that some of the current debates in biological sciences are actually calling for an Extended Evolutionary Synthesis (EES) to

reconsider the ideological constructs of evolutionary theory. Some of these discussions relate complexity issues in biology with endogenous processes in organisms; a concept close to Lamarckism (Pigliucci, 2009).

12. The memetic theory of cultural evolution defines memes as existing in the form of fashions, beliefs, traditions, skills, vocabulary and ideas. These memes may be transmitted across communities and societies at various spatial scales. In this sense, they follow the Lamarckian principle of the inheritance of acquired characteristics. Memes are self-replicators, are subject to evolution, and can be inherited. They reproduce in a suitable environment, and can be manipulated (memetic engineering) through advertisements, brainwashing, and education (Blackmore, 1999). However, unlike genes, they are only replicated from one individual to the other in a meme-pool by way of imitation (Aunger, 2002).

Acknowledgements

Thanks to the three anonymous referees for helpful comments. On draft versions, discussions with Zan Gunn, Frank Moulaert, Simin Davoudi, Patsy Healey and Jean Hillier were invaluable.

References

Abel, T. (1998) Complex adaptive systems, evolutionism, and ecology within anthropology: Interdisciplinary research for understanding cultural and ecological dynamics, *Georgia Journal of Ecological Anthropology*, 2, 6-29.

Abercrombie, L. P. (1927) Geddes as Town-Planner, in A. Defries (Ed), *The interpreter Geddes: The man and his Gospel*, pp. 322-325, London: Routledge.

Alexander, C. (2002) *The Nature of Order: The phenomenon of life*, New York: Taylor & Francis.

Alexander, C., Ishikawa, S. and Silverstein, M. (1977) *A pattern language: Towns, buildings, construction*, New York: Oxford University Press.

Allen, G. E. (2005) 'Mechanism, vitalism and organicism in late nineteenth and twentieth-century biology: The importance of historical context', *Studies in History and Philosophy of Science Part C,* 36, (2 Special Issue), pp. 261-283.

Aunger, R. (2002) *The electric meme: A new theory of how we think*, New York, Free Press.

Bamforth, D.B. (2002) Evidence and metaphor in evolutionary archaeology, *American Antiquity*, 67(3), 435-452.

Bechtel, W. and Richardson, R. C. (1998) Vitalism, in E. Craig (Ed), *Routledge encyclopedia of philosophy*, pp. 10, London: Routledge.

Beiser, F. C. (2005) *Hegel.* London: Routledge.

Bellan, R.C. (1971) *The evolving city,* Vancouver: Copp Clark Pub. Co.Berry, B. J. L. and Horton, F. E. (Eds) (1970) *Geographic perspectives on urban systems with integrated readings,* Englewood Cliffs, NJ: Prentice-Hall.

Berry, B.J.L. (1964) Cities as systems within systems of cities, *Papers and Proceedings of the Regional Science Association* 12, 147-163.

Berry, B.J.L. and Horton, F.E. (Eds) (1970) *Geographic perspectives on urban systems with integrated readings,* Englewood Cliffs, NJ: Prentice-Hall.

Bertolini, L. (2007) Evolutionary urban transportation planning: An exploration, *Environment and Planning A* 39(8), 1998-2019.

Blackburn, S. (2008) *The Oxford dictionary of philosophy.* Oxford: Oxford University Press.

Blackmore, S.J. (1999) *The meme machine,* Oxford: Oxford University Press.

Blumer, H. (1969) *Symbolic interactionism: Perspective and method,* Englewood Cliffs, NJ: Prentice-Hall.

Boardman, P. (1978) *The worlds of Patrick Geddes: Biologist, town planner, re-educator, peace-warrior,* London: Routledge.

Boesiger, E. (1974) Evolutionary theories after Lamarck and Darwin, in F.J. Ayala and T.G. Dobzhansky (Eds) *Studies in the philosophy of biology: Reduction and related problems*, London: Macmillan**.**

Booher, D.E. and Innes, J.E. (2002) Network power in collaborative planning, *Journal of Planning Education and Research*, 21(3), 221-236.

Boschma, R.A. and Frenken, K. (2006) Why is economic geography not an evolutionary science? Towards an evolutionary economic geography, *Journal of Economic Geography* 6(3), 273-302.

Boschma, R.A. and Lambooy, J.G. (1999) Evolutionary economics and economic geography, *Journal of Evolutionary Economics*, 9(4), 411-429.

Boschma, R.A. and Martin, R. (2007) Constructing an evolutionary economic geography, *Journal of Economic Geography*, 7(5), 537-548.

Boyd, R and Richerson, P.J. (Eds) (2004) *The origin and evolution of cultures*, New York: Oxford University Press.

Bromley, R. (2003) Towards Global Human Settlements: Constantinos Doxiadis as Entrepreneur, Coalition-Builder and Visionary, in J. Nasr and M. Volait (Eds) *Urbanism: Imported or exported? native aspirations and foreign plans,* pp 316-340, London: Academy Editions.

Burrows, B.C. (1980) Urban and regional planning – a systems view, *Long Range Planning*, 13(2), 67-81.

Carlo, W.E. (1966) 'Reductionism and Emergence: Mechanism and Vitalism Revisited', *Proceedings and Addresses of the American Philosophical Association,* 40, pp. 94-103.
Carmona, M. and Tiesdell, S. (2007) *Urban design reader.* Amsterdam: Architectural Press.
Childe, V.G. (1951) *Social evolution,* London: H. Schuman.
Cheung, T. (2006) The hidden order of preformation: Plans, functions, and hierarchies in the organic systems of Louis Bourguet, Charles Bonnet and Georges Cuvier, *Early science and medicine*, 11(1), 11-49.
Churchman, C.W. (1968) *The systems approach*, New York: Delacorte Press.
Commons, J.R. (1934) *Institutional economics: Its place in political economy.* Madison: Macmillan (1961 edition, published by The University of Wisconsin Press).
Conway, J. (1970) Stereotypes of Femininity in a theory of sexual evolution, *Victorian Studies* 14, 47-62.
Cordes, C. (2006) Darwinism in economics: From analogy to continuity, *Journal of Evolutionary Economics*, 16(5), 529-541.
Darwin, C. (1859 [1998]) *The Origin of Species,* Hertfordshire: Wordsworth Editions. (Reprint of the first edition)
Davis, J.B. (1989) Keynes on atomism and organicism, *The Economic Journal* 99(398), 1159-1172.
Davoudi, S. (2008) Conceptions of the city-region: A critical review, *Journal of Urban Design and Planning* 161(DP2), 51-60.
Dawkins, R. (1976) *The selfish gene*, Oxford: Oxford University Press.
de Roo, G. and Miller, D. (1999) *Integrating city planning and environmental improvement: Practicable strategies for sustainable urban development,* Aldershot: Ashgate.
Dennett, D.C. (1995) *Darwin's dangerous idea: Evolution and the meanings of life*, New York: Simon & Schuster.
Dix, G. (ed.) (1977) *Ecology and ekistics,* London: Elek.
Dopfer, K. (2005) *The evolutionary foundations of economics,* Cambridge, MA: Cambridge University Press.
Doreian, P. and Stokman, F. N. (Eds) (1997) *Evolution of social networks,* Amsterdam: Gordon and Breach Publishers.
Dosi, G. and Marengo, L. (1994) Some elements of an evolutionary theory of organizational competences, in R. England (Ed), *Evolutionary concepts in contemporary economics,* 157-178, Ann Arbor: The University of Michigan Press.
Doxiadis, C.A. (1965) Islamabad, the creation of a new capital, *The Town Planning Review*, 36(1), 1-28.
Doxiadis, C.A. (1970) Ekistics, the science of human settlements, *Science* 170(3956), 393-404.
Doxiadis, C.A. (1976) *Action for human settlements,* Athens, Athens Publishing Centre.
Driesch, H. (1914) *The history and theory of vitalism,* London: Macmillan and Company.
Faludi, A. (1973) The "systems view" and planning theory, *Socio-Economic Planning Sciences*, 7(1): 67-77.
Faludi, A. (2004) The impact of a planning philosophy, *Planning Theory*, 3(3), 225-236.

Fothergill, P.G. (1962) *Historical aspects of organic evolution,* London: Hollis and Carter.
Friedmann, J. (1987) *Planning in the public domain: From knowledge to action,* Princeton, NJ: Princeton University Press.
Geddes, P. (1884) An analysis of the principles of economics, *Proceedings of the Royal Society of Edinburgh* 12, 943-980.
Geddes, P. (1904 [1973]) *City development: A report to the Carnegie Dunfermline Trust,* Shannon: Irish University Press.
Geddes, P.S. and Thomson, J. A. (1890) *The evolution of sex,* New York: W. Scott.
Geddes, P.S. (1915) *Cities in evolution,* London: Williams & Norgate.
Gilbert, S.F. and Sarkar, S. (2000) 'Embracing complexity: Organicism for the 21st century', *Developmental Dynamics,* 219, (1), pp. 1-9.
Gray, T. (1996) *The political philosophy of Herbert Spencer: Individualism and organicism,* Aldershot: Avebury.
Greco, M. (2005) 'On the vitality of vitalism', *Theory, Culture and Society,* 22, (1).
Hammerstein, P. and Hagen, E.H. (2005) The second wave of evolutionary economics in biology, *Trends in Ecology and Evolution* 20(11), 604-609.
Häring, H. (1926) 'Zwei Stadt', *Die Form 1*, pp. 172-75.
Hasebroek, K. (1939) Das Vererbungsproblem in seinen Beziehungen zum Mechanismus und Vitalismus, *Acta Biotheoretica* 4(3), 165-180.
Hilberseimer, L. (1944) *The new city: Principles of planning.* Chicago: Paul Theobald.
Healey, P. (1997) *Collaborative planning: Shaping places in fragmented societies,* London: Macmillan Press Limited.
Healey, P. (2007) *Urban complexity and spatial strategies: Towards a relational planning for our times,* London: Routledge.
Hillier, J. (1993) To boldly go where no planners have ever, *Environment and Planning D: Society and Space* 11(1), 89–113.
Hillier, J. (2008) Plan(E) speaking: A multiplanar theory of spatial planning, *Planning Theory* 7(1), 24-50.
Hillier, J. and Healey, P. (2008) *Critical essays in planning theory,* Aldershot: Ashgate.
Ho, M.-W. and Fox, S.W. (Eds) (1988) *Evolutionary processes and metaphors,* Chichester: Wiley.
Hoch, C. (2006) Emotions and planning, *Planning Theory and Practice*, 7(4), 367-382.
Hodgson, G.M. (1988) *Economics and institutions: A manifesto for a modern institutional economics,* Cambridge: Polity Press.
Hodgson, G.M. (1993) *Economics and evolution: Bringing life back into economics,* Cambridge: Polity Press.
Hodgson, G.M. (1994) Precursors of modern evolutionary economics: Marx, Marshall, Veblen, and Schumpeter, in R. England (Ed), *Evolutionary concepts in contemporary economics,* 9-35, Ann Arbor: University of Michigan Press.
Hodgson, G.M. (2001) Is social evolution Lamarckian or Darwinian? In J. Laurent and J. Nightingale (Eds) *Darwinism and Evolutionary Economics,* pp 87-118, Cheltenham: Edward Elgar.
Hodgson, G.M. (2004) *The evolution of institutional economics: Agency, structure, and Darwinism in American institutionalism,* London: Routledge.
Hodgson, G.M. (2009a) On the institutional foundations of law: The insufficiency of custom and private ordering, *Journal of Economic Issues* (1), 143-166.

Hodgson, G.M. (2009b) Darwinian coevolution of organizations and the environment, *Ecological Economics*, **in press**.

Hodgson, G.M. and Knudsen, T. (2008) In search of general evolutionary principles: Why Darwinism is too important to be left to the biologists, *Journal of Bioeconomics* 10(1), 51-69.

Huxley, M. (2006) 'Spatial rationalities: Order, environment, evolution and government', *Social & Cultural Geography,* 7, (5), pp. 771 - 787.

Huxley, M. (2007) 'Geographies of Governmentality', in Crampton, J. W. and Elden, S.(eds) *Space, knowledge and power: Foucault and geography.*Aldershot: Ashgate, pp. 185-204.

Ingold, T. (1986) *Evolution and social life,* New York: Cambridge University Press.

Innes, J.E. and Booher, D.E. (1999a) Consensus building and complex adaptive systems a framework for evaluating collaborative planning, *Journal of the American Planning Association*, 65(4), 412-423.

Innes, J.E. and Booher, D.E. (1999b), Consensus building as role playing and bricolage toward a theory of collaborative planning, *Journal of the American Planning Association*, 65(1), 9-26.

Innes, J.E., Connick, S. and Booher, D.E. (2007) Informality as a planning strategy: Collaborative water management in the CALFED Bay-Delta Program, *Journal of the American Planning Association*, 73(2), 195-210.

Jacobs, J. (1961) *The death and life of great American cities,* New York: Vintage Books.

Jacobs, J. (1969) *The economy of cities,* New York, Random House.

Jenkinson, J.W. (1917) Vitalism, in C.J. Singer (Ed) *Studies in the history and method of science,* pp 59-78, Oxford: Clarendon Press.

Khalil, E.L. and Boulding, K.E. (Eds) (1996) *Evolution, order and complexity,* London: Routledge.

K'Akumu, O.A. (2007) Sustain no city: An ecological conceptualization of urban development, *City* 11(2), 221-228.

Keeton, M.T. (1947) Edmund Montgomery: Pioneer of organicism, *Journal of the History of Ideas* 8(3), 309-341.

Kropotkin, P.A. (1902 [1976]) *Mutual aid, a factor of evolution,* Boston: Porter Sargent Publishers (Reprint 1976).

Lamarck, J.B. (1809 [1984]) *Zoological philosophy: An exposition with regard to the natural history of animals,* Chicago: University of Chicago Press (translation from 1st French edition of 1809).

Lamarck, J.B. (1830) *Philosophie zoologique,* Paris : G. Bailliere.

Lambooy, J.G. and Moulaert, F. (1996) The economic organization of cities: An institutional perspective, *International Journal of Urban and Regional Research* 20(2), 217-237.

Laurent, J. and Nightingale, J. (Eds) (2001) *Darwinism and evolutionary economics,* Cheltenham: Edward Elgar.

Liebig, J.V. (1855) *Principles of Agricultural Chemistry,* London, Walton & Maberly.

Lyell, C. (1830) *Principles of geology; being an attempt to explain the former changes of the earth's surface, by reference to causes now in operation,* London: J. Murray.

Lynch, K. (1984) *Good city form,* Cambridge, MA: MIT Press.

Maria, S. I. and Imran, M. (2006) Planning of Islamabad and Rawalpindi: What went wrong? *42nd ISoCaRP Congress*. Istanbul.

Marshall, S. (2008) *Cities, design and evolution,* London: Routledge.

Martin, R. and Sunley, P. (2007) Complexity thinking and evolutionary economic geography. *Journal of Economic Geography*, 7(5), 573-601.
Marx, L. (1990) Lewis Mumford: Prophet of organicism, in T.P. Hughes & A.C. Hughes (Eds) *Lewis Mumford: Public intellectual,* 164-180, Oxford: Oxford University Press.
Mather, A.S. (1999) Geddes, geography and ecology: The golden age of vegetation mapping in Scotland, *Scottish Geographical Journal* 115(1), 35-52.
Mayr, E.W. (1982) *The growth of biological thought: Diversity, evolution and inheritance*, Cambridge MA: Belknap Press
Mehaffy, M. (2004) Towards a new science of architecture, and a new architecture of science, *Katarxis*, 3, http://www.katarxis3.com/Review_Nature_Order.htm, accessed 10 June 2009.
Mehmood, A. (2008) *Analysing socioeconomic development on small islands from an evolutionary perspective,* unpublished PhD thesis, Newcastle University.
Mitman, G. (1988) From the population to society: The cooperative metaphors of W.C. Allee and A.E. Emerson, *Journal of the History of Biology* 21(2), 173-194.
Moleschott, J. (1857) *Der Kreislauf des Lebens: Physiologische Antworten auf Liebig's Chemische Briefe,* Mainz: V. von Zabern.
Moulaert, F. and Cabaret, K. (2006) Planning, networks and power relations: Is democratic planning under capitalism possible?, *Planning Theory* 5(1), 51-70.
Moulaert, F. and Mehmood, A. (2009) Analysing regional development and policy: A structural-realist approach, *Regional Studies* (forthcoming)
Müller, W.A. (1996) From the Aristotelian soul to genetic and epigenetic information: The evolution of the modern concepts in developmental biology at the turn of the century, *International Journal of Developmental Biology* 40(1), 21-26.
Mumford, L. (1937 [2003]) What is a city?, in R.T. LeGates & F. Stout (Eds) *The city reader,* 92-96, London: Routledge.
Murdock, G.P. (1959) Evolution in social organization, in B.J. Meggers (Ed) *Evolution and anthropology: A centennial appraisal*, pp 126-143, Washington DC: The Anthropological Society of Washington**.**
Nelson, R.R. and Winter, S.G. (1982) *An evolutionary theory of economic change.* Cambridge, MA: Belknap Press of Harvard University Press.
Newman, P.W.G. (1999) Sustainability and cities: Extending the metabolism model, *Landscape and Urban Planning* 44(4), 219-226.
Novak, F.G. (Ed) (1995) *Lewis Mumford and Patrick Geddes - The correspondence,* London: Routledge.
Park, R.E. (1936) Human ecology, *The American Journal of Sociology* 42(1), 1-15.
Park, R.E., Burgess, E. W. and McKenzie, R. D. (1967) *The city,* Chicago: University of Chicago Press.
Perrin, J.C. (1991) Réseaux d'innovation - milieux innovateurs - développement territorial, *Revue d'Économie Régionale et Urbaine* 3/4, 343-374.
Pigliucci, M. (2009) Down with natural selection? *Perspectives in biology and medicine*, 52(1), 134-140.
Pløger, J. (2006) In search of urban vitalis, *Space and Culture* 9(4), 382-399.
Poëte, M. (1935) Les idées bergsoniennes et l'urbanisme, *Mélanges Paul Negulesco*, Bucharest: Imprimeria Nationala, 11.
Porter, T. and Córdoba, J. (2009) Three views of systems theories and their implications for sustainability education, *Journal of Management Education*, 33(3), 323-347.

Richards, R.J. (1977) Lloyd Morgan's theory of instinct: From Darwinism to neo-Darwinism, *Journal of the history of the behavioral sciences*, 13(1): 12-32.
Sahlins, M.D. (1977) *The use and abuse of biology: An anthropological critique of socio-biology,* London: Tavistock Publications.
Sahlins, M.D. (1987) *Islands of history,* London: Tavistock.
Sahlins, M.D. and Service, E.R. (Eds) (1960) *Evolution and culture,* Ann Arbor: The University of Michigan Press.
Sandercock, L. (2006) Spirituality and the urban professions: The paradox at the heart of planning, *Planning Theory and Practice*, 7(1), 65-97.
Sanderson, S.K. (1997) Evolutionism and its critics, *Journal of World-Systems Research*, 3(1), 94-114
Sanderson, S.K. and Alderson, A.S. (2005) *World societies: The evolution of human social life,* Boston: Pearson.
Semon, R. W. (1911 [1921]) *Die mneme als erhaltendes prinzip im wechsel des organischen geschehens,* Leipzig: W. Engelmann [Semon, R. W. (1921) The mneme, trans. Simon, Louis, London: Macmillan].
Shoshkes, E. (2006) Jaqueline Tyrwhitt: A founding mother of modern urban design, *Planning Perspectives* 21(2), 179-197.
Singer, E.A., Jr. (1946) Mechanism, vitalism, naturalism. A logico-historical study, *Philosophy of Science*, 13(2), 81-99.
Sohn, E. (2007) Organicist concepts of city landscape in German planning after the second world war, *Landscape Research* 32(4), 499-523.
Steward, J.C. and Murphy. R.F. (Eds) (1977) *Evolution and ecology: Essays on social transformation,* London: University of Illinois Press.
Stoelhorst, J.W. (2008) The explanatory logic and ontological commitments of generalized Darwinism, *Journal of Economic Methodology*, 15(4), 343-363.
Strauss, D.F.M. (2007) Did Darwin initially develop a theory of evolution in the biological sense of the word? *South African Journal of Philosophy*, 26(2), 190-203.
Swyngedouw, E. and Cook, I. (2009) Cities, social cohesion and environment, Sociapolis Survey Paper, *Socialpolis Conference*, 11-12 May, Vienna
Terranova, C.N. (2008) 'Marcel Poete's Bergsonian Urbanism: Vitalism, Time, and the City', *Journal of Urban History,* 34, (6), pp. 919.
Thompson, J.A. (1910) *Darwinism and human life,* New York: H. Holt & Co.
van Eck, C. (1994) *Organicism in nineteenth-century architecture: An inquiry into its theoretical and philosophical background,* Amsterdam: Architectura & Natura Press.
Veblen, T. (1898) Why is economics not an evolutionary science?, *Quarterly Journal of Economics* 12, 373-397.
Veblen, T. (1919) *The place of science in modern civilisation and other essays,* New York: B.W. Huebsch (Reprinted 1990, New Brunswick, Transaction Publishers).
Watson, V. (2002) The usefulness of normative planning theories in the context of Sub-Saharan Africa, *Planning Theory* 1(1), 27-52.
Welter, V.M. (2003) *Biopolis: Patrick Geddes and the city of life,* Cambridge, MA: MIT Press
Whitehead, A.N. (1926) *Science and the Modern World*, Cambridge: Cambridge University Press
Wilson, E.O. (1980) *Sociobiology,* Cambridge, MA: Belknap Press of Harvard University Press

Wolf, P. (1924) 'Dresden als städtebaulicher Organismus', in *Dresden: Das Buch der Stadt.*hrsg. von Rat der Stadt Dresden: Dresdesn Industrie und Verkehrs-Verlag

Wolman, A. (1965) The metabolism of cities, *Scientific American* 213(3), 179-190.