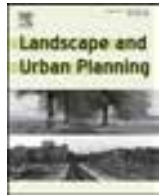




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Thinking organic, acting civic: The paradox of planning for *Cities in Evolution*

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HIGHLIGHTS

- Patrick Geddes introduced the theory of evolution to city planning over 100 years ago.
- His evolutionary theory departed from Darwin in linking collaboration to competition.
- He wrestled with the tension between bottom-up and top-down action.
- He never produced his *magnum opus* due to the inherent contradictions in his philosophy.
- His approach resonates with contemporary approaches to cities as complex systems.

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ABSTRACT

Patrick Geddes articulated the growth and design of cities in the early years of the town planning movement in Britain using biological principles of which Darwin's (1859) theory of evolution was central. His ideas about social evolution, the design of local communities, and his repeated calls for comprehensive understanding through regional survey and plan laid the groundwork for much practical planning in the mid 20th century, both with respect to an embryonic theory of cities and the practice of planning. But Geddes had a much wider agenda than town planning *per se*. He sought after a philosophy of life that went well beyond Darwinism verging almost on the spiritual at times. Yet his personal approach and the limits he imposed on his formal thinking meant that he was never able to establish his big picture in a way that later generations could easily grasp and build upon. He left us with enticing ideas, evocative phrases, and a practical philosophy of doing planning and building communities that has indeed survived as something more than a footnote in history. In this essay, we identify the key paradox of modern planning which seeks to intervene in systems that have enormous complexity, growing and evolving rather than being designed in any top-down fashion. We illustrate this paradox through Geddes' own career and life in which this tension between bottom up and top down was always to the forefront. We then sketch his influence on practicing planners and key intellectuals of the mid to late 20th century—Abercrombie and Mumford, Jacobs and Alexander. We bring this history of Geddes' influence up to contemporary times when the complexity sciences with all their focus on evolving systems, now permeate our thinking, suggesting various ways in which we might examine the history of the planning in the last 100 years in a new light through the lens of Geddes' arguments and principles

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1. Preamble

The idea that a town or city is not a fixed architectural product, but something organic, growing or 'evolving' in relation to its environment, is arguably the most fundamental contribution bestowed

by Patrick Geddes on planning. This idea generated the need for a different kind of theory – beyond architecture and engineering – both for our understanding and direct intervention in the planning of cities; and so helped crystallise the emergence of planning as a professional field in the modern era. But while biological analogy with its organic sensibility provides a satisfying grounding for urban theory, it raises a paradox when it comes to our explicit intervention in city design. If a city is a living thing, capable of growing or 'evolving' according to its own dynamic, what is the role for plan-

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ners? How do we create the city as an erstwhile living system whose biological analogue is not the product of design but of evolution? If a city is an example of self-organising complexity, what or who is the 'self' who is doing the organising? How should we 'think organic', but 'act civic'? This is the tension that we believe is intrinsic to the very idea of city planning, something that Geddes was one of the first to recognise, and which he struggled with during his entire life. This essay elaborates this thesis.

Historically, as long as a city could be merely viewed as an aggregate of inert architecture, then it could be legitimately designed, controlled, prescribed, like a building. But as Patrick Abercrombie came to realise, this was just an illusion or "pleasing dream" that was "shattered by Geddes" (quoted by Tyrwhitt, 1949, p. xii). In effect, by invoking the organic nature of urbanism, a complex web involving the growth of cities in relation to their environment, and human society within the built environment of the city, Geddes opened a Pandora's box. This implied that a city was a sort of wilful organism, sometimes having a spirit or mind of its own, with the planner never completely in control. Thus city design could not be treated simply as a soluble problem, hence Abercrombie's discomfiture. It gave rise to this paradox of planning which is probably irresolvable, hence endemic to the nature of city planning.

These questions are complicated by the fact that Geddes had his own theory of evolution – never conclusively articulated nor scientifically validated – which gave rise to different answers to the question of 'how to intervene', compared with Darwinian evolution. Geddes himself believed that cities – as with (other) living beings – evolved from their own impetus. But his inability to make his arguments sufficiently intelligible, or to convince readers of the literal biological veracity of his assertions, meant that his contribution to social sciences and town planning ideology was "littered with wrecks and confusion" (Meller, 1990, p. 320). As a result, he never managed to resolve the paradox, and we continue to live with the confusion to this day – the tension between top-down and bottom-up approaches to planning, which exists in the continued use of organic metaphors in planning rhetoric – even by designers intent on imposing their own will and artificial forms on buildings and urban layouts.

In this essay, we attempt to show how Geddes' thinking created and revealed the paradox of organic planning and we trace how those who followed have attempted – wittingly or otherwise – to grapple with the same problem. In doing so we first intend to crystallise what Geddes thought about evolutionary theory and cities. We need a clear statement so that we can trace how evolution as a central concept in the development and growth of cities and their planning has developed since Geddes and how this has converged on what we loosely call a complexity theory of cities (including their planning), one of the conventional wisdoms of planning in the early 21st century. In short what we will do here is trace evolutionary ideas in planning from the 1930s, through the work of Mumford, MacKaye, and Abercrombie to theories of self-organising city systems associated particularly with Jacobs and Alexander in the 1960s but also noting those who espoused the machine systems theory of cybernetics such as Chadwick and McLoughlin and the wider philosophy of systems articulated by West Churchman and Simon. We then pick up this thread again and tie it ever more closely to Geddes, noting the switch from top down to bottom up that lies at the heart of a much wider movement in the complexity sciences. What we will do is assess the extent to which Geddes has relevance to these more recent approaches to planning—albeit that they cover the 80 or so years since his death. We will conclude with some reflections on the extent to which we think Geddes' ideas will live on into an age where many of our cities are becoming widely automated with consequential implications for the way they function and the way we might plan them. In some respects, what is hap-

pening now is somewhat counter to what Geddes thought about the form and function of cities then but there are unusual and intriguing parallels back to this earlier age which we will exploit here.

2. Geddes and evolutionary theory

2.1. Patrick Geddes—a biographical sketch

Patrick Geddes who many refer to as the father of modern town planning (Mumford, 1966), wrote much but published much less than he wrote, spoke often but usually inaudibly in his many formal lectures, yet doggedly preached a message about social evolution that has echoed down the years and which resonates ever more strongly with respect to the way we approach planning one hundred years after the publication of his book **Cities in Evolution**. Unlike the founders of our field in the late 19th and early 20th century, Geddes was not trained in architecture or surveying but in biology, insofar as one could say he was formally trained at all. After a period of private tutelage during which he was exposed to various scientific fields as well as the works of Carlyle, Ruskin and others, Geddes eventually settled on studying botany at Edinburgh University in 1874. However, after only a week of dissecting lifeless plant specimens, he was won over instead by the vivid text of Thomas Huxley's (1870) wonderfully strident and forceful **Lay Sermons, Addresses and Reviews**, published in 1870, a collection of short essays that exhorted the world to accept and celebrate Darwin's theory (Darwin, 1859; Lightman, 2004, p. 764; Meller, 1990, p. 26). Geddes promptly left Edinburgh, and spent the next three years studying science through theory and experiment with Huxley in London. However, Geddes never took a formal degree, his training consisted largely of being exposed to Huxley's lectures at the Royal School of Mines (now Imperial College), and some peripatetic demonstration duties at University College (London) in Britain's first Physiology department, all from 1875 to 1879.

During his time in London, Geddes followed a reasonably classic laboratory training in plant biology and zoology, but he was also attracted early to those philosophers and activities who sought to add to Darwin's theory in terms of social evolutionism. In many senses, all his subsequent ideas developed from the notion that social development, particularly that associated with towns and cities – or more broadly what he termed 'civics' – depended upon the way individuals acted as part of a wider social organism that functioned in the contemporary language of complexity theory, from the 'bottom up'. His view of evolution went well beyond early Darwinism to embrace the writings of Herbert Spencer but what emerged ultimately was a faith in the power of the individual in engendering social change in cooperation with others, albeit with an aversion to state intervention. This was all tied up in somewhat unclear foundations that drew on rather basic evolutionism of a descriptive kind, more like the earlier theory due to Lamarck (Defries, 1927, p. 689; Anonymous (Nature), 1932).

Once back in Edinburgh in the 1880s and working as a demonstrator at the University, Geddes' ideas about society were phrased in these terms. This represented a fairly major departure from developments in evolution where in the late 19th century, genetics and statistics were the real driving forces giving credence to Darwin's theory in both experimental and analytical terms. As far as we can tell, Geddes did not follow closely these lines of thinking, as he was convinced the answer lay elsewhere. To an extent, his interest in the social in contrast to the physical moved him away from mainstream theory. It is possible his difficulties with experimental biology due to his poor eyesight for close range work (Choay, 1969), also compounded his already ideological disaffection with the more mechanical approaches to biology. There is little doubt

that he did not follow the emergent mainstream model of evolution emphasising natural selection yet he was clearly a very able biologist. But from his very earliest contributions, Geddes departed from the strict evolutionary theory that was developed after Darwin, eschewing anything so single-minded in favour of a more individualistic approach to social theory and action which quickly fell out of favour in mainstream social science and only ultimately came to be accepted in the more pragmatic and practical professions of town planning, social work and civics.

Geddes made many contributions to planning particularly in identifying critical themes and dimensions to its activity. He left us with the terms conurbation, megalopolis, the concepts of bio-nomics and man-days, the mantra of 'survey before plan', the nexus of 'local-global', and of course with 'regional planning'. In a life of perpetual travel, he met and influenced many people who were instrumental in articulating city and regional planning in the early to mid 20th century: Howard, Unwin, Abercrombie, Mumford, MacKaye amongst others. But ultimately, Geddes did not complete what he always argued would be his *magnum opus*, his ultimate contribution to a theory of society that embraced cities and city planning, built around his passionate belief in the life force, in evolution from the bottom up and in individual self-determination—what Geddes would call the organism's active participation in its own evolution. Indeed it is fair to say that he never really started this *opus* and as the years wore on and he continued to repeat himself, the prospect of any form of convergence on a clear and unequivocal theory and practice seemed ever more illusory, a retreating mirage on an ever expanding horizon.

In some respects, his final book **Life: Outlines of General Biology** (1931) with his co-author J. Arthur Thomson was really a rather elementary biology textbook but by then Geddes had left biology years before (Meller, 1990, p. 315). In fact, **Life** was more like a popular science book and was a far cry from what Geddes' professed aims were in writing a coherent sociology. It was published as two volumes with the second being dominated by Geddes' writings about the wider aspects of social life, which in the event, were repetitions of much that he had been writing about since his early years. We sense that to the end, Geddes still believed he would write his *magnum opus* but by then, the world had turned. In his later years, Geddes' views seemed increasingly like those of the late Victorians such as William Morris and John Ruskin who harked back to an earlier age where there was little automation and where cities were more ordered, gentle affairs than the monsters that had emerged in the later industrial revolution. By the time **Life** was published, evolution was in the midst of its modern synthesis based on strongly analytical and statistical mechanisms involving not simply natural selection and survival-of-the-fittest which were the watchwords of Darwin's era, but the genetics of mutation, drift, recombination and a host of related processes that now characterise the basic theory.

2.2. Geddesian evolution

Geddes in effect devised his own theory of organic evolution, which consciously departed from mainstream Darwinism (Batty & Marshall, 2009; Marshall & Batty, 2009). This theory was never concisely pinned down in print, nor conclusively established (or disproven) biologically, but may be found permeating Geddes' biological works and woven through his sociological and urban planning writings too. Thus we can sum up Geddesian evolution through three key aspects. First, and most fundamentally, Geddes saw all organic life having a sort of life-force which made the organism an active participant in its own evolution. Evolution was intrinsic and driven from within, rather than being primarily shaped by external, often accidental, influences such as natural

selection. Geddes did not deny that natural selection played a role, but saw it as a more peripheral influence, like the pruning of a plant that was already growing its own structure according to its own devices. This view of evolution saw living things in a continual self-propelled state of unfolding, and gave emphasis to the agency of the individual organism as an active participant in its own evolution as reflected in their statement "There is no warrant for thinking of organisms as passive pawns; they play the game. . ." (Thomson & Geddes, 1931, p. 1106).

Secondly, Geddes stressed the importance of cooperation, by which organisms together could mutually advance and benefit each other through a social evolution. He cited the evidence of the benefits of cooperation from the microscopic view of cellular cooperation up to whole societies, also seeing mammals' advancement over reptiles in their empathetic and social tendencies; and saw human civilisation – hence cities – at the pinnacle of this social evolution (Boardman, 1978, p. 130; Geddes & Thomson, 1889). This view emphasising cooperation was consciously set against the emphasis on competition associated with Darwinism. While not denying the competitive aspect of either nature or human society, Geddes felt that focusing on this "grim modern doctrine" (Geddes, 1884, p. 9) failed to capture the fuller, deeper, truer nature of life, and had malign social consequences—as it seemed to encourage, justify or at least tolerate, both militarism and laissez-faire policies that would leave the poor and the weak to starve.

Thirdly, Geddes' view of evolution recognised the importance of the relation between the organism and its environment – a view that is of itself obviously compatible with mainstream Darwinism – but again with a slightly different emphasis: this was less about an often hostile environment moulding the individual by forcibly culling the weakest specimens, but more to do with the active role that an organism could have in shaping its own environment; according to Mumford, Geddes saw man not just an adaptive organism, but increasingly a moulder of his own world (cited in Novak, 1995, p. 26). This put cities in pivotal roles, both as a triumphant product of life and social evolution, and as an enabling vessel for it.

In these three aspects, we can readily see the potential for application of Geddesian evolution beyond biology to sociology and town planning. It gives a rationale for *active participation* by citizens in society; for collective action by cooperation in social and economic affairs; and the role for education, literature, art, architecture and *planning* in improving the cultural and physical *environment* to nurture society's further beneficial evolution. Moreover, the city itself was considered a "living being", reacting upon its environment (Geddes, 1949, p. 84).

To Geddes, this package of principles was not just a satisfying personal manifesto but was based on a biological reality hardwired into nature; he saw its power when he looked down his microscope as much as when he read treatises on economics and politics. This indeed provides at least a coherent normative framework, that gives structure to the second and third (sociological and ecological) aspects of his theory, that is, even if Geddes' core biological view of evolution is not accepted. However, Geddes struggled to convince others of the biological significance of his ideas; and as time went on, it became more difficult to associate Geddes' ideas with specific scientifically accepted truths. Hence today, the term 'evolution' is associated perhaps irreversibly with 'survival of the fittest' (Spencer, 1864) and the 'selfish gene' (Dawkins, 1976) – hence with connotations of individualism and laissez-faire economics – rather than social solidarity or the need for town planning. But for Geddes, this early evolutionary theory gave him a lifelong basis for action.

2.3. Conservative surgery: civics in situ

When Geddes returned to Edinburgh University in 1880 first as a demonstrator and then a lecturer in the Department of Zoology,

he rather quickly began to indulge his interests outside biology. To an extent, he was an outsider in that he had no degree and although politically he was well connected through Huxley – he had also met Darwin at University College (London) in 1878 – he found it hard to break into the university establishment and failed several times to acquire a permanent position (Mairet, 1957, p. 40). His forays into other academic areas – what we would now call political activism – did nothing to help his case and his growing preoccupation with the social conditions of those who lived in slum conditions in the city, diverted his attentions to a very different sphere. His academic work was marginal in biology during these years. At a time when he could have been making long lasting contributions to the subject, he was writing entries for the **Encyclopaedia Britannica** on solid but standard biological topics. He thus ended his experimental laboratory research almost before he began, probably due as much to his poor eyesight but also due to his diversions into civics. All this which was interspersed with presenting non-biological papers such as those on economics to the Royal Society of Edinburgh, was hardly what the establishment expected in a professor of biology.

As early as 1882, Geddes was campaigning for improving social conditions in Edinburgh's old town which was a mass of slums. This was entirely consistent with his views of social evolution, in that he believed that such improvements should be built step by step from the bottom up, taking account of very obvious problems which were as much social and behavioural as physical. His hands-on approach contrasted strongly with the emergence of more top-down movements and organisations that sought to improve the dreadful conditions in British housing during the late 19th century. Geddes' work in demonstrating what social evolution might mean in practice gathered pace during these years. He practiced what he preached in that he brought up his young family in the very housing he was focused on improving and by the 1890s, his extensive networks that were built around these activities, generated a variety of community activities and summer meetings. These led eventually to his quest to establish museums and exhibitions that would preoccupy his growing interest in the city and its region and would constitute his definition of sociology as civics in the early 20th century. These museums and exhibitions served both to help professionals understand the urban phenomenon that was the object of their intervention (Lightman, 2004, p. 766; Geddes, 1913), and to provide the public with a nourishing cultural environment to directly stimulate beneficial social evolution.

This approach to nurturing evolution may be contrasted with a more top-down kind of intervention – such as the “pompous imperial art” born of “compass and rule” (Geddes, 1949, p. 71) – that was abhorrent to Geddes' view about how life should be lived and how individuals, families and communities should organise themselves. But as Geddes began to work more formally on city design which really began with his being commissioned to design the parkland of Dunfermline in the early 1900s, this conflict and tension between development spontaneously evolving from the grassroots and being initiated as plans implemented from the top down became increasingly evident in his writings and responses as we will elaborate below.

2.4. Thinking machines

All acceptable theoretical expositions of social organisation and structure depend on a formal order that defines the direction in which that theory can be elaborated, applied and adapted to new conditions and new insights. Geddes himself sought such a logic in what he rather euphemistically referred to as his ‘thinking machines’ which were based on graphical frameworks relating the different dimensions that he defined as part of his perspective on social evolution. His ‘machines’ thus provided a framework for

classification as well as implying different relations between the various dimensions about which they were formed.

He defined these tools right at the beginning of his career before he returned to Edinburgh. In 1879 he visited Paris where he came across the work of Le Play whose writings on the organisation of society were based on the trilogy “Lieu, Travail, Famille” which Geddes' adopted as his famous triad of “Place, Work and Folk”. To Geddes, these were the key dimensions of a society reflected in Geography, Economics, and Sociology (and Anthropology), the basic components of contemporary social science. The second element was how he fashioned these dimensions into graphic form. In 1880, when he was in Mexico, the bright light left him temporarily blinded and in a darkened room, he began to trace out on the window panes a graticule of these which, he argued, represented the basic set of relations in any society. These he related to his triad in a 3×3 matrix where Place, Work and Folk represented the cells of the table on its main diagonal and the relations between Place-Work, Place-Folk, Work-Folk and the opposite of these the 6 cells that represented the off-diagonal components.

For the rest of his life, he elaborated this module, first by suggesting that one might repeat it as the core of a 2×2 template – a meta or supermatrix – which he called the Notation of Life whose dimensions he defined as Acts and Deeds versus Facts and Thoughts. Into each cell of the supermatrix, he nested variants of his 3×3 matrix, generating 36 cells in all, reinterpreting their meaning relative to these meta dimensions, elaborating this in various forms, for example by adding new classifications on top of the structure, and showing how one might search for relationships by folding the matrix in different ways. To Geddes himself – if not the reader, who could be forgiven for missing it – this interaction was in part alluding to the transition from inner resolve of the organism to action on the outward environment. But Geddes never articulated the structure into any concrete form or dynamics—in short evolutionary processes were largely lacking from the relationships captured in his machines and this immediately demonstrated the limits to such thinking.

If you define relationships in this fashion, then today one might speculate that matrices or even the theory of graphs (or its more modern application in network science) could be used to generate indirect relations and to extend them into forms that might show how elements in their cells can change under various operations. But in 1880, matrix algebra was largely unknown to most mathematicians but even had it been applicable, Geddes would probably have resisted associating these cells with any numeric information for his elaborations of these machines were strongly towards the qualitative and even spiritual dimensions of society as evidenced in his basic terminology. Geddes never quite explicitly spoke against the use of mathematics in evolutionary theory or in human affairs although he did betray some annoyance at the use of geometry in morphology in an early publication (Geddes, 1883). The tragedy however was not that Geddes developed these tools which at first sight are useful and interesting; but to realise them operationally, one would have to have engaged in much stronger analytical thinking than Geddes was ever prepared to do (or even had the background to pursue because he was never trained in mathematical analysis). As it was, Geddes became obsessed by them and in his last years, frantically attempted to elaborate them over and over again but to no avail. In fact, Mumford described the thinking machines as Geddes' ‘fatal addiction’ that became “...a kind of solitaire: a game that he could play by himself, if no one else would join him. Even without an audience he would go through one or another set of graphs, morning after morning, often hours before breakfast, as a pianist might go through his finger exercises, in preparation for a concert. Only the concert was never given; for he was unable to compose the new music.” (Novak, 1995, p. 366).

2.5. The grand theory

Geddes appeared to be aiming for a grand theory, a work of synthesis that would provide a general philosophy of life but he never managed to even sketch its essence. Instead he continued to elaborate his general concern for social evolution through his practical works in Edinburgh in his early life, his exhibitions devoted to civics in his middle years, and his practice of town planning in his later years. After his sojourns in India and Palestine, when he retired of sorts to his *College d'Écossais* in Montpellier in the 1920s, he continued to work on his theories and insofar as he produced a coherent body of thought, it is available in the succession of articles in the **Sociological Review** from 1904 onwards and in his idiosyncratic writings in his biology textbooks which became ever more general in pushing biology towards sociology.

The fact that he did not produce a single paper which laid out his theory in any depth or with any clarity, makes it very hard to reconstruct the essence of his philosophy and how it related to the progress of biology through theories of evolution. In fact, he wrote a lot but much of it was in the form of letters to others, what we would now call fugitive publications, meaning hard to get hold of pamphlets and suchlike, and yet he produced an incessant flow of rhetoric and commentary about the social condition. His was a very practical philosophy, as much developed *in situ*, in local communities and his reputation concerning this philosophy was spread as much by word of mouth as through what one might read in more learned publications (Boardman, 1944, p. viii). In Edinburgh in the 1890s, his Social Union, his Outlook Tower, his summer meetings, and thence the beginnings of his practice of town planning all provided pieces of the jigsaw that ultimately composed his approach to social evolution.

It is also hard to get any sense of the extent to which he read the works of others but certainly he was a voracious reader in his youth in the 1870s devouring the works of Herbert Spencer, Auguste Comte and those who followed Darwin. However his focus on the physical and spatial led him to the work of the anarchist geographers Élisée Reclus and Pyotr Kropotkin who he welcomed at his various summer meetings and whose writings inspired him to elaborate the essential quality of social life as collaboration rather than competition. In some respects, the strangest thing about Geddes was his non-political stance, not involving himself in party politics but in another sense through his thinking, he unwittingly involved himself in the most dangerous of politics. Much of his thinking about evolution and life was encapsulated in the influence that Henri Bergson had on him for Bergson argued that it was imagination and intuition that were the prime movers in evolution and in this sense, he invoked the concept of 'élan vital' or perhaps 'life' force which was picked up by Geddes as being entirely consistent with his philosophy. Why Geddes did not seize on this and spin his *magnum opus* around it we shall never know. It is entirely possible that by the time Bergson's book **Creative Evolution** (1907) was published in English in 1911, Geddes was on his way to pastures new, and we still do not know how voracious a reader he was at this stage in his middle years, although he did read good French and was well acquainted with Bergson's ideas already, meeting him for the first time in 1900.

It is still a puzzle why Geddes did not develop his grand theory. There are suggestions that temperamentally he was simply not cut out to develop such a monument to his own ideas. He perhaps hoped that others would provide evidence (e.g. corroborating his own version of evolution) to clinch the scientific validity of his ideas; he certainly hoped that others – such as Mumford and Victor Branford, as well as Thomson – would help him 'finish' his unwritten books. He was too impatient, too disorganised, continually plagued by debts, all of which left him little time for reflection which is so necessary to constructing a coherent work

that would outlast him and preserve his ideas for the future. When he might have made time for such reflection in his semi-retirement in Montpellier, the evolutionary landscape in terms of theory had long passed him by and the statisticians and geneticists were in the middle of inventing their modern synthesis in the very place where Geddes as a young man had met Darwin.

As we retrace Geddes' steps when we walk between our offices at University College, we still find it a mystery why Geddes showed so little interest in what was happening there throughout his lifetime. From 1880 to at least the 1950s, University College was one of the world's pre-eminent centres for genetics, statistics and evolutionary biology where many contributors from Galton to Pearson to Fisher fashioned the theories that now underpin the modern synthesis. Haldane did some of his remarkable work on evolution in the 1930s in the same place that where Geddes had worked and even Abercrombie and then Holford had offices a matter of yards away, from the 1930s to the 1950s (Batty & Marshall, 2008). In the 1920s, mathematics was also entering biology in another guise. Scientists such as Lotka blazed a trail that would lead to work by people like Rashevsky and von Bertalanffy who took from biology the foundations of general systems theory that became crystallised in the 1930s and dominated the social sciences after the second world war. In the 1920s, it is hard to know how aware of all this Geddes was for he had not moved in these intellectual circles for many years.

Arguably his book **Cities in Evolution** does contain the seeds of a grander theory but to pursue the theory, there is little doubt he would have needed to reflect much more deeply on the emergence of cities and how interventions of any kind would have interfered with their organic growth. Even today we do not have this kind of theory although we are edging towards it as we will imply a little later (Marshall, 2009; Batty, 2013). But it is tempting to pose the counterfactual as to what Geddes' grand theory might have been like had he developed it or perhaps what such a theory should be like knowing what we now know about evolution and cities.

2.6. The essential tensions

We will leave the latter point until later when we review progress towards this goal with respect to whether or not Geddes could have produced his *magnum opus*. To an extent its coherence would have been based on illustrating how his approach to urban change from the bottom up was consistent with the way cities developed or evolved. It would have been nice to think that he could have broached head on the notion of top-down intervention which indeed dominated planning throughout the 20th century and still does and resolved the tension with his conservative surgery, and the notion of the community encapsulating life from the ground up. Integration of his ideas would have been his greatest contribution, even by simply bringing them together in one place in a work of synthesis. This is something that might still be achieved by those who continue to evaluate and laud his contributions.

Before we relate his impact to the other greats who have dominated 20th century thinking in terms of evolutionary ideas about cities and their planning, we need to stand back a little and focus on the essential tensions that were clearly evident in Geddes' writings. These are reflected in ideas about local and global action, competition and collaboration in community development, and top-down versus bottom-up thinking in how cities evolve. One feature that we speculate with respect to the man is that he was not comfortable in writing about these tensions in any explicit way; thus he seldom argued for one side against the other. It now seems odd that he did not contrast his 'conservative surgery' in Edinburgh with his planning of Israeli cities (Tel-Aviv and Jerusalem), his small and larger scale actions in civic design in Indian cities with his rather grandiose plans for Dunfermline and Dublin, his city exhi-

bitions, and his observatories such as the Outlook Tower. Because he did not write about these issues, we tend to think that he was comfortable with this mix of philosophies but we ‘think’ he was supremely aware of these conflicts and despite his vociferous and single-minded quest for social action, he was unwilling to grapple with issues that he could simply not resolve. This could well account for the fact that he was never able to put together the material for his *magnum opus* for this required him to bring rather unlike things together and engage in a schizophrenia of synthesis that he was all too aware was enormously difficult.

Of course, when we now refer to bottom-up versus top-down actions, we tend to develop each as extremes although in practice, we are well aware that social development embodies complex mixes of both. Cities and societies do evolve from the countless bottom-up actions of individuals but they are influenced too by collective actions at all levels, one set of which we can identify with town planning. For Geddes to have developed his grand theory, almost certainly he would have had to synthesise these contradictory perspectives; and to develop even a descriptive synthesis, he would have required some stronger, albeit informal, analytical thinking. Cities do not blow themselves apart if there is nothing but bottom-up action for they are highly resilient structures but to improve them and steer them they require collaborative and coordinated action which is planning. This requires a synthesis which has never quite been produced and is, to some extent, an anathema today in the kind of unregulated world that has emerged over the last half century.

In terms of town planning, we suggest that no one expected such a synthesis from Geddes except Geddes himself and to some extent it is what followed him, how influential his ideas became, that is important. As it stands, arguably one of Geddes’ greatest legacies was simply the organic analogy with urbanism which enabled biological and hence sociological and ecological dimensions to enter planning theory – over and above anything architectural – at least in Anglophone spheres of influence. It was however left to others to wrestle with the consequences and to these we now turn.

3. From Cities in Evolution to the evolution and design of cities

3.1. After Geddes: MacKaye to Abercrombie and Holford

In 1923, Geddes made his third and last trip to America, a trip organised by Mumford who introduced him to Benton MacKaye whose own philosophy dovetailed closely with Geddes’ views and the need to relate growth to nature and to survey before plan. At a two-day meeting at the Hudson Guild Farm in New Jersey, MacKaye who like Geddes drew much of his inspiration for comprehensive thinking from Huxley, explored regional planning with the master. Indeed MacKaye and other colleagues from the fledgling Regional Planning Association of America relished this contact with Geddes who was then known as the champion of regional planning. MacKaye’s own views on the integrated nature of landscape, cities and their regions was also the basis for his remarkable book **The New Exploration** published in 1928 whose subtitle *A Philosophy of Regional Planning*, was in some respects a testament to Geddes, so Mumford, Geddes’ most ardent advocate in America, reports (MacKaye, 1928). In many senses, this book was the first clear statement of how cities functioned with respect to their landscape as systems of ‘metropolitan flow’. If you consider this book with Geddes’s own **Cities in Evolution** together, they provide the clearest origins we have to many of the ways in which we are now thinking about cities as functions of interaction which underpin the physical forms that provide our comprehension of urban order and complexity (Batty, 2013).

Yet although Geddes’ spirit and teachings lived on after his immediate death through his much younger intellectual and professional disciples such as Mumford and Abercrombie, the tensions between top-down plan-making and bottom-up organic development which were already deeply embedded in the differences between an evolutionary view of society and one that might be controlled and managed, were quietly buried. Indeed it is implicit in MacKaye’s writings that he also wrestled with this tension that pit the natural world against the artificial, the organic against the planned, for he worked in his later life for those triumphs of top-down intervention through the New Deal in the United States such as the Tennessee Valley Authority and the National Forest Service.

Geddes himself had lived with this tension throughout his life but more acutely one suspects in his later years, continually talking about organic development and evolution but engaging in practice that appears to us as characteristically top down, advising governments and authorities and actually developing schemes in the spirit of master planning. It is hard to guess what his disciples really thought. Mumford certainly ascribed to organic and evolutionary sensibilities albeit selectively so, and was sufficiently a convert to the need for positive intervention to control emergent problems such as urban sprawl to acquiesce in this debate. Abercrombie drew from Geddes more a concern for regional planning than a concern for social evolution. Indeed in his inaugural lecture to University College in 1935, he was strident in his reactions to the notion that cities would self-organise themselves. As we will see, contemporary approaches rely strongly on evolution as competition from the bottom-up in the spirit of Adam Smith, but in this context, Abercrombie (1937) said: “I would like to remark that we are (it is assumed) agreed upon certain fundamentals such as: the necessity of planning as compared with a reliance upon the evolutionary chaos, with Adam Smith’s invisible guiding hand behind the clouds—an ancient fallacy this, which still has its votaries” (Abercrombie, 1937, p. 16). In so saying, Abercrombie is echoing Geddes’ own distaste for the competitive side of Darwinism as well as Smith’s economics; and yet in doing so Abercrombie is publicly dissociating evolution from the need for planning. For all that he hailed Geddes as his ‘master’ and praised his formative influence on planning, here Abercrombie is perhaps unwittingly helping to bury Geddes’ legacy.

In fact, Geddes’ contributions were mainly with respect to the practice of regional planning in the middle years of the century. Regional planning became significant from the depression on into the years of reconstruction after the second world war and this meshed well with similar efforts in north America associated with the New Deal that linked him to MacKaye. In these years, sociology moved dramatically away from anything that Geddes had assumed, economics became explicitly mathematical, and the kinds of theory that came to dominate planning in its most generic sense, emerged from political economy and positivism associated with social philosophers of science such as Hayek and Popper amongst others. In 1954, the Town Planning Institute celebrated the centenary of Geddes’ birth and this was confirmation of his impact on professional planning. At this time, planning had not really embarked on its drive towards the social sciences and it was still a largely parochial top-down architectural response to physical development. The then President of the Town Planning Institute, William Holford, Professor of Town Planning at University College after Abercrombie, eulogised Geddes’ when he said: “I cannot escape his influence. The Greek epigram on Plato is applicable to him: ‘Wherever I go in my mind, I meet Geddes coming back’ “ (quoted in Boardman, 1978, p. 448). At this point, Geddes was the only personage who had brought a modicum of theory to our thinking about cities, their future, and their planning but all this was about to change.

3.2. Cities as self-organising systems: the legacy of Jacobs and Alexander

Jacobs (1961) led a sea-change in thinking about cities and planning in the latter half of the twentieth century. In **The Death and Life of Great American Cities**, she lambasted orthodox planning as a force that while capable of destroying poor urban environments was typically incapable of recreating liveable urbanism in its place. She sparked a revolution in planning thinking that has eventually become the new orthodoxy. While much of her book focuses on practical concerns, in her last chapter she made a significant theoretical contribution following Weaver (1948) in identifying the city as a problem of organised complexity. This aligned cities with biological systems, rather than being simple aggregates of architecture. In a work otherwise not intended to be anything about biology, Jacobs was merely arguing that correctly understanding the problem would allow the planner to make more successful interventions. Accordingly, she promoted a bottom-up rather than a top-down approach (incremental rather than comprehensive redevelopment) through advocacy for an urban package of mixed uses, short blocks, 'eyes on the street', and a host of other local scale principles that few could argue with but which many eschewed.

On the face of it, Jacobs has little say about Patrick Geddes; indeed, what she does say explicitly is hardly sympathetic. In **Death and Life**, she associates him largely with garden cities and regional planning, sandwiching him between Ebenezer Howard and Lewis Mumford, in a wider critique of the wrong-headedness of planning, in creating sterile places that were antithetical to real cities (1961, p. 26). Part of her problem was that she saw much of twentieth century town planning as too abstract and Utopian—more concerned with what societies should be like than how cities actually work. She specifically rails against inappropriate organic analogies, arguing that a city is not put together like a mammal, honeycomb or coral. Her preferred intervention should start with observing cities as they really are, especially from street-level experience. To an extent, this mixes a message that at one level is evolutionary and bottom up but like Geddes before, is sceptical of formal mechanism.

Of course, observing the life of cities is quintessentially Geddesian. Geddes exhorted all sorts of surveys, including biological, social and regional surveys, to ascertain the urban condition prior to any intervention. His own appreciation of the 'drama' of life experienced not least in the Edinburgh's old town wynds and courtyards should lead us to expect that he would equally appreciate Jacobs' 'ballet' on Hudson Street, New York, and allow us to speculate with confidence that Geddes would side with Jacobs over those who would demolish her part of Manhattan to make way for a freeway. Arguably, Jacobs' solutions of 'unslumming' and provision of short blocks and mixed uses would fit well with Geddes' ideas for 'conservative surgery'. And, although it generally goes unremarked, even the idiosyncratic title of Jacobs' first and most influential book is couched in vitalistic terms. We can readily imagine that Jacobs and Geddes would have much more in common in life than the written record indicates. Had they been contemporaries, they may well have been kindred spirits and a powerful duo in making the case for slow, incremental and local change when it comes to the planning of cities.

Nevertheless, the fact remains that it was all too easy for Jacobs or anyone else to overlook Geddes' credentials as a keen observer of *Homo sapiens*, or a 'student of cities' (Hirt & Zahm, 2012) without seeing past Geddes' enthusiasm for garden cities and regional scale manipulation that would pigeon-hole Geddes with what had become planning orthodoxy. This suggests that many of the subtleties of Geddes' messages – and some rather big ideas too – even despite his frequent use of slogans, were probably lost on many who followed him. For Geddes, there was no equivalent of the simple and graphic logic of Howard's (1904) cluster of **Garden Cities of**

To-morrow or **Le Corbusier's Ville Radieuse** (1933, 1964). Geddes' set of solutions had little traction: it was (and is) difficult to reconcile, on the one hand, his enthusiasm for 'small straightenings' of alleys from Edinburgh to India, with his master planned grid for Tel Aviv on the other.

In fact, there is one other point at which Jane Jacobs' thinking ultimately resonates with Geddes, albeit in a backhanded way. In **The Economy of Cities**, she restates her conviction that a city is not an animal, but allows herself to invoke an organic analogy of her own; she calls this her 'epigenesis theory of cities', by which "a city grows by a process of gradual diversification and differentiation of its economy" (Jacobs, 1970, p. 129). There is no space here to deconstruct this analogy in any detail but suffice it to say that Jacobs' arguments could also be couched in evolutionary terms. Her descriptions of inventions and business practices derived from predecessors, and new work arising on existing or 'parent' work (Jacobs, 1970, p.55), sounds rather like evolution over multiple generations of reproduction, specialisation, speciation and adaptive radiation. While we can now interpret Jacobs' urban theory as echoing Darwinian evolution, this is hardly endorsement of Geddesian evolution. Nevertheless, by the time Jacobs wrote **The Nature of Economies**, she was explicitly drawing attention to the comparability of economies and ecosystems (Jacobs, 1999, p. 8) and learning about economics from nature (cf. Vermeij, 2004)—a worldview completely at one with Geddes'. Ultimately however, we are still left with the paradox – or perhaps rather the limitation of any organic analogy – of what to do about intervention: how can top down meet the bottom up and *vice versa*?

The 1960s also saw the emergence of another of the giants of urban thinking whose work continues to resonate with us ever more vividly: Christopher Alexander. In **A City is not a Tree** (1966), Alexander (1966) argued against the simplistic structures of top-down planned cities, and in doing so posed profound questions about how cities could be designed, which unleashed a decades-long quest for how to reconcile the top-down instincts of the planner versus bottom-up inclinations of individual inhabitants, a challenge which to a significant extent remains unresolved. It is 50 years since this article was produced and the fact that it is still as relevant today as then is testament to its power (Mehaffy, 2016). Alexander has since produced a string of books all in some way or another addressing this challenge, including **A Pattern Language** (Alexander et al., 1977), **The Timeless Way of Building** (Alexander, 1979), **A New Theory of Urban Design** (Alexander, Neis, Anninou, & King, 1987), **The Nature of Order** (Alexander, 2002–2005) and most recently, **The Battle for the Life and Beauty of the Earth** (Alexander, Neis, & Alexander, 2013). Indeed his first book – his Ph.D. thesis **Notes on the Synthesis of Form** (1964) – is perhaps his clearest expression of the idea that good design of buildings (and cities) is vernacular, tried and tested, slow but sure built on incremental improvements from the ground up.

As with Jane Jacobs, there is little or no explicit overlap with Geddes in terms of citation or influence. Yet Alexander's work has resonance with Geddes in a number of ways. First and most obviously, across his set of publications Alexander presents several ways of creating buildings and laying out settlements in an ostensibly bottom-up manner, including incremental design, 'making' buildings without designing them on plan. Alexander is sensitive to grasping the spirit of a locality before intervening. Perhaps most suggestively in **The Nature of Order**, Alexander presents an interpretation of how Piazza San Marco in Venice was created through unfolding increments, in a way that is reminiscent of Geddes' conviction that towns and cities have a life of their own that they express by evolving over time, that the planner should study and use as a guide for sympathetic intervention. Secondly, Alexander is not afraid to invent his own theories where he finds conventional theories unsatisfactory. In **The Nature of Order**, he even goes as

far as dismissing current neo-Darwinian orthodoxy as not entirely convincing, and attempts to present his own version of structure-forming processes which he believes applies to many natural processes (which of itself could be considered a bold enterprise, were it not presented within the context of an even more radical, somewhat bizarre theory of the universe in general). Thirdly, Alexander sets his own theories against the prevailing orthodoxy, and sees things in terms of a long running battle (in Alexander's terms, between a 'System A' and 'System B'). This echoes the way Geddes saw himself in a great struggle to persuade the world to move away from a competitive, mechanistic 'world system' to a more sympathetic, organic one (Boardman, 1978; Geddes, 1929a, 1929b).

Finally, there is also similarity with Alexander being able to inspire a dedicated body of followers, who have made some headway in applying his ideas, even if those ideas do not find as widespread application in practice as his theoretical brilliance might otherwise deserve. This circumstance is perhaps not incidental, but has a specific resonance, in the sense that part of the problem of trying to apply Alexander's ideas is the extent they are bound up with his own very specific unorthodox view of how nature (and the universe) works. This is a particular problem for what some regard as his *magnum opus* **The Nature of Order**, a work that across four volumes runs to thousands of pages (without an index), whereby it is rather difficult to pin down precise definitions of concepts or trace their relation to mainstream science. Alexander runs into the same paradox as Geddes, in that his interpretation of urban history implies that cities have or had some sort of timeless way of unfolding – as seen in the case of Piazza San Marco – and yet we seem now to need explicit exhortation, of a specific kind of way of intervening, to achieve what seems to have come naturally in the past. In short, we can no longer indulge in un-self-conscious design, for all that we do is now self-conscious.

3.3. Before Darwin, Newton: the machine age and the rise of the complexity sciences

Positivism and modernism were such strong currents in the western world from the early 20th century that by the 1960s, the notion that top-down intervention could be managed rationally was generally accepted. This rationality was consistent with a world of clockwork, a world of machines that flew directly in the face of what Geddes, Jacobs and Alexander had ever imagined. The machine analogy where the city was regarded as a system of interacting parts, well behaved and consistent with a thermodynamic equilibrium reinforced by negative feedbacks, became the dominant model. This so-called systems approach assumes a world where planning is regarded as a controller. Indeed the dominant statements of such an approach are reflected in the British texts by McLoughlin (1969, 1973) and Chadwick (1971), where the system is a cybernetic machine capable of being steered towards some optimal state. The notion of the system evolving was simply not present in this machine analogy where the world was conceived using the mechanics of Newton rather than the chemistry and biology of Darwin. In many respects, this systems approach was directly opposed to the notion of evolution but in fact it was short lived as a movement and quickly evolved to a system of thought, now called the complexity sciences, that have turned these ideas upside down. There were of course advocates of a less rigid approach to systems at the time where the whole was always greater than the sum of the parts. Simon's (1962) 'The Architecture of Complexity' had an enormous influence on Alexander (1964) and his contemporaries and on the subsequent development of complexity theory in the social sciences and economics. West Churchman (1971) provided something of a philosophical backdrop to the field, influencing his colleagues at Berkeley in particular Horst Rittel and Mel Webber to see the

systems approach as being totally inadequate in dealing with what he and they termed 'wicked problems' which were resistant to all forms of systems-based policy analysis (West Churchman, 1967; Rittel & Webber, 1973).

Anyone who has read and absorbed Jacobs' (1961) thesis knows that we need to articulate cities and intervention within them as systems that are ordered and evolving from the bottom up. The systems approach to an extent was the last great wave of the machine age which over the last 50 years has evolved to one which is much more akin to conceiving cities as biologies and ecologies, entirely consistent of course with evolution in all its traits. We will not use this essay to provide a detailed account of the complexity sciences for we have catalogued this and its relationships to Geddes at length elsewhere (Batty & Marshall, 2009, 2012) but we need to note the salient issues.

There are many concepts in complex systems that resonate with Geddes and many that do not. The notion of evolution and surprise is central to complexity meaning that the notion that we might predict in any deterministic way is long gone from such theory. Geddes as far as we are aware did not say very much about prediction for in his day, it was almost an act of faith that the world was entirely predictable in one sense in that it was assumed that man had control over his own destiny. This meshed with religious orthodoxy but it was fast being demolished by Darwinism and evolutionary theory and then in the 1920s and onwards by the march of information technology and the loosening of social norms as to acceptable behaviour. Now the vocabulary of contemporary systems is writ large with notions about path dependence, the importance of history, the idea of emergence, surprise, creation, innovation, nonlinear dynamics, chaos, far-from-equilibrium and such like which are replete in our description of cities. To an extent, we believe Geddes could have had a field day with such ideas but the critical problem of intervention from the top down is still a mystery and the notion in which contemporary life is determined by a mixture of bottom-up with top-down styles of behaviours and intervention is the challenge of our age. Yet Geddes would also have been dismayed by the dreadful experiences that the world has suffered at the hands of top-down planning and by the lack of conservative surgery in contemporary practice. His tension would never have been dissolved by the paradox that a good understanding of cities and society in evolution were difficult to reconcile with appropriate ways of intervening in the evolutionary process. He would perhaps have been intrigued by the fact that even planning theorists who in the last 50 years have sought to study and invent new organisational forms for planning have also been influenced by the move to complexity and implicit evolutionism with works such as Innes and Booher's (2010) **Planning with Complexity** and Healey's (2006) **Urban Complexity and Spatial Strategies** reflecting the general notion that the world is ever more complex and needs to be studied using these new perspectives on complexity of which there are many variants.

Our last foray into how Geddes relates to the contemporary city involves a force that was barely articulated during his day and now embraces information and computation. The world of Patrick Geddes was mainly composed of material things amongst social ideas but now so much of what we work with is information that complements and substitutes for many of the functions that gave rise to the late 19th century city. We are guessing but we do not think that Geddes was very comfortable with new technologies but the wider meaning of information is something that he may well have grasped and run with. Although we have implied here that Geddes was not well disposed to abstruse mathematical abstraction – which incidentally is now so central to the entire panoply of modern science – he was not averse to abstraction *per se* and in many senses, the information society and the smart city which is fast emerging in its wake is one where information is processed in ways that do not

depend on analysis but on social relations. We simply leave these as open questions. Indeed, we have largely left the last 30 years somewhat open-ended for there is much still to be said about how Geddes' legacy relates to our recent world and our new-found interest in living in cities: we leave his influence on diverse aspects of planning in more recent times to others, some of whom are writing here.

4. The evolution of cities

Only now do we have the rudiments of a theory for the evolution of cities. Such a theory or theories, for there are several alternative paradigms, are in their infancy and it has taken 100 years or more since Geddes published his book to give any credence whatsoever to these ideas. If we examine the elements of such a theory, then it clear that it is very different from the descriptive polemics that characterized Geddes' work. To develop such theory, we require agreement about how we should represent cities and we require mechanisms that generate how urban activities develop in space and time. Such a theory involves an ability to manipulate mechanisms so that alternative city forms and functions can be understood, and these are a prerequisite to effective planning. Had Geddes remained with experimental biology, he may well have begun to fashion the elements of such a theory. The kind of painstaking dissection and focus on mechanism that he worked with in Huxley's Lab in the mid 1870s, is much closer to the methods of a workable theory of cities than anything that he subsequently did with respect to social evolution. Today, our science of cities, although only barely formed, is the product of a long history in urban economics, location theory, transportation science, and social demography, structured in the manner of social physics (Batty, 2013). It is intent on relating how these processes generate the physical form and function of cities (Marshall, 2009). But it is still grappling with the conundrums that Geddes lived with involving the tension between forces that drive evolution and change from the bottom-up and those that direct or interfere with it from the top down. It will continue to embrace these issues for this science of human affairs will always be very different from its physical counterparts and analogies.

The rudiments that are now established draw from many sources and it would have been impossible for Geddes to have even begun to establish such a theory for such a superstructure of ideas is the product of many minds over many years. So the search for a counter-factual, the kind of theory that Geddes might have established had he taken a different path, is a chimera. It would be nice to think that Geddes as well as Abercrombie, MacKaye and Mumford between them might have produced workable theory in practice that could have enabled us to avoid the worst excesses of the mid 20th century when institutionalized town planning began to intervene in urban development, but this would be a vain hope. What Geddes did do is establish the notion over and over again that cities develop from the bottom up, that cities like life are organically structured, and although he did not quite say it, that we intervene in them at our peril. The examples of his 'conservative surgery' are now widely agreed as the way we should go about changing peoples' lives in cities for the better, and this is entirely consistent with an evolutionary approach.

What is to be regretted is that Geddes never wrote anything equivalent to *Spencer's (1873) The Study of Sociology* or even *Bergson's (1907) Creative Evolution*. *Cities in Evolution* does not come near for it was assembled quite quickly and as many commentators have said, it was more a selection of essays than a reasoned treatise about how cities evolved organically. From what we have said here, we believe that Geddes' was simply not equipped or temperamentally suited to writing a *magnum opus*. To do this to order

at the end of one's life is well-nigh impossible for any of us. We consider that great works cannot be preordained or predefined in this way. Like evolution itself, they emerge and only long after the event do we recognize them to be so. Mumford might have been able to do this with Geddes but by the time he met him in person, he was far too involved in his own philosophies of cities to ever take on such a task. It is clear that for many years, Geddes' prevailed on Thomson to lead his continued text book writing in biology long after he, Geddes, had worked on anything in that field but Thomson was too much a biologist to embrace the wider and deeper *opus* that Geddes aspired to. So he turned to Mumford who agonized over this, but in the end realized that working with Geddes at the end of his life would have been impossible. What Geddes' contribution to a theory of cities now needs is a work that painstakingly unpicks all that he said about evolution from his papers, letters and the vast amount of commentary about the man. But such a deconstruction would only be effective if it could be used to reconstruct cities in evolution in the light of neo-Darwinian theory, contemporary biology, but also mathematical biology, urban economics, social and statistical physics, indeed in the light of the entire edifice involving a science of cities that has been assembled since Geddes published his famous book.

In taking account of modern evolutionary models of change (Ziman, 2000) and in needing to take account of neo-Darwinian evolution, we need to be as alert to Jane Jacobs' interpretations of the diverse and dynamic economies of cities (and the nature of economies too) as to Geddes' simplistic exhortations for cooperation over competition. We also need to keep abreast of the advances in genetics over the entire period since Geddes formulated his theories, including the idea of the city as an 'extended phenotype' (Dawkins, 1999); and also alternative physiological perspectives, such as the 'extended organism' (Turner, 2002). Learning from nature and evolution could imply a plurality of approaches from **Recombinant Urbanism** (Shane, 2005) to considering humanity's relations with nature via **Zoöpolis** (Wolch, 2003) or **Biophilic Design** (Kellert, Heerwagen, & Mador, 2008) and any number of other approaches which follow the spirit of Geddes without necessarily knowing it.

Ultimately, when it comes to resolving the paradox of organic planning, the existing but different planning approaches we have looked at seem to either propose something bottom-up (Geddes' conservative surgery, Jacobs' 'unslumming', Alexander's un-self-conscious design, and so on) or else propose something top down (as some of Geddes' master planning seemed to be, and as any number of quasi-organic writers such as Mumford and Abercrombie thought about organisms but act as if they are produced by divine design). The latter is little to do with biology but we might conclude that we could have some combination of top down and bottom up. Here, we may note two possibilities: interpreting urban coding as roughly analogous to genetic engineering; and/or interpreting regulation such as development control as roughly analogous to artificial selection (Marshall, 2011, 2012). These allow for different kinds of actors: not simply as a single omnipotent designer, nor an uncoordinated rabble of individuals. For the 'genetic coding' case, it is implied there is a collective public actor who sets the code (genotype) that is to be common to all participants, and then individuals use that code to design their own products (phenotypes). For the 'artificial selection' case, it is implied that there is a collective public actor who gives selective permission to private individuals' proposals. In each case there is one actor acting in the collective interest and a set of individual interests. The combination of the two gives something that in one sense has a top-down element that provides the planner with some sense of control, and in another, the bottom-up emergent element that makes it seem as if the city has its own mind after all.

In our conclusion, we are still somewhat surprised that Geddes' legacy has not only lived on but has become ever more significant as our understanding of cities has matured. There is little doubt that the sense of mystery that his work still evokes together with his intriguing personal life and the great proliferation of his writings that no one so far has made complete sense of, let alone published, still provides an enormous archive of material that needs continual reinterpretation. This could link some of Geddes' theories – which have yet to be fully evaluated or taken to their logical conclusion – with modern interpretations of order in biology, evolutionary transitions and organism–environment relations echoing in the works of the likes of John Maynard Smith, Stuart Kauffman, Michael Lynch or Scott Turner. We believe that what is now needed is a detailed evaluation of Geddes' contribution through the development of ideas in sociology, evolution, and practical town planning over the last 150 years, a task that is enormous and erudite but requires disciplinary perspectives that have not been used to evaluate his contribution so far. This then is the challenge that we pose here. It is a challenge that might be broached with respect to the continuing, indeed growing interest in the ideas of a man who with a slightly different personality and style might have been long ago forgotten and simply ascribed to a footnote in history. The fact that this has not happened provides us with many lessons for our contemporary disciplines and professions.

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