TPR, 80 (6) 2009 doi:10.3828/tpr.2009.12

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Centenary paper

The evolution of cities: Geddes, Abercrombie and the new physicalism

One hundred years ago, the first coordinated reactions to the urban chaos of the industrial revolution were being established though a system of centralised planning, while the rudiments of a theory underpinning this collective action were also being fashioned, through the writings and rhetoric of Patrick Geddes. Drawing on Darwin's theory of natural selection, he laid the foundations for a response to urban growth that drew loosely on ideas of evolution, but which ultimately became established through the imposition of a top-down 'organic' order in city and regional plans associated with the work of Patrick Abercrombie, one of Geddes' best-known followers. This approach was rooted in 'physicalism', a perspective that assumed social problems might be solved by manipulating the physical built environment. This ideology began to fragment from the mid-twentieth century on as questions over its effectiveness in generating more liveable and equitable urban environments grew. Now, however, there are signs that with the contemporary problems of climate change, energy and sustainability, this viewpoint is being reasserted. We argue that the seeds of this perspective were first developed 100 years or more ago, primarily by Patrick Geddes, but that his unique style diverted the field from grasping the real message of an evolutionary physicalism, which is only now becoming apparent.

Ever since urbanists began to map and describe the city, the language of the human body has been widely used to describe urban form and to suggest ways in which cities might be planned. Such implications can, for instance, be seen in the drawings and writings of Leonardo da Vinci. In the late nineteenth century, both Arturo Soria y Mata (1892) and Ebenezer Howard (1898) likened settlements to organisms, and even Le Corbusier – while popularly associated with machine-age functionalism – was inspired by biology and considered towns to be biological phenomena (Le Corbusier, 1933; 1947). In a statement typical of this approach, the architect Jose Luis Sert, one of the key spokesmen for the Congrés Internationaux d'Architecture Moderne (CIAM) in 1942, said: 'Cities [are] living organisms; [they] are born and … develop, disintegrate and die … In its academic and traditional sense, city planning has become obsolete. In its place must be substituted urban biology' (quoted in *Time* magazine, 30/11/1942).

Despite their popularity, organic analogies have often remained implicit and unexploited in our theories of cities and city planning, and their consequences have not been fully worked through. In some cases, the organic analogy is sufficiently

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superficial that it is barely more than a figure of speech, without any direct practical application. While one may say that a city's parks are its 'lungs', the metaphor does not provide the planner with any specific 'lung-like' direction for the form or location of green space. The analogy implies little more than parks 'help a city to breathe' for one might just as well say that a city's trees are its lungs. On the other hand, if organic analogies are worked through too systematically, we end up with far-fetched metaphors and naturalistic fallacies.

Lewis Mumford (1938) tried to extend the idea of a city as organism to interpret 'amoeboid growth' and 'social chromosomes', arguing that since an organism has a definite boundary and maximum size, so should a city. The latter point is a logical *non sequitur*. Such problems with organic analogies contributed to their being discredited, regarded as being theoretically suspect, or practically unhelpful. Despite these issues, organic analogies remain popular, for other conceptualisations do not seem to capture the essence of growth that the analogy suggests (Kostof, 1991; Lynch, 1981).

Such problems stem from attempting to conceive of a city specifically as a living, growing organism. The analogy usually treats the city as a whole entity that develops over time, and whose optimal form (equivalent to a healthy, mature organism) is knowable in advance. This is in effect a developmental paradigm of cities, of the kind interpreted by Ebenezer Howard, among others. In practice, this went hand-in-hand with a top-down approach to planning: the planner knew the intended optimal form and applied this like any other act of design – little different from designing a machine or work of art, albeit with a biomorphic metaphor in mind.

In contrast to this developmental paradigm, however, we can identify an evolutionary paradigm, in which the city is not conceived of as a unified whole following a developmental programme, but is more usefully seen as a collection of interdependent, co-evolving parts. The evolutionary paradigm allows us to appreciate the organic qualities of cities, without implying there is a fixed relationship between the parts and the wholes, or an optimal mature form. Evolution is open-ended, and hence unpredictable in the long term, and thus it has important implications for how we conceive of, understand, and plan cities (Marshall, 2009).

We will argue that the great promise of organic analogies and their implications for theories of evolution thrown up more than 100 years ago have never reached the point where they have ever had any theoretical consequences for cities and city planning until now. The idea that the growth of industrial cities was out of control dominated the origins of modern town planning. Urban growth was frequently considered to be either monstrous or pathological (or both, as in the case of cancerous growth), thus implying that development deviated from some 'knowable' optimal form.

While later urban writers acknowledged that a city could have a will of its own (Kostof, 1992), early town planners thinking in organic terms were not content to leave the urban 'organism' to its own devices, but were intent on imposing their own ideas

of optimal form. Top-down plans were designed to stop city growth and canalise it elsewhere, rather than accommodate it. Plans for garden cities, decentralised development and bringing the garden into the town and vice versa were implicitly based on the idea that city growth was evil in some way, and that what was required was some radical exorcising of the forces that had given rise to such forms, rarely seen as being consistent with the way cities actually grew.

Such aversion to city growth did little to help the development of theories rooted in the notion that for cities to develop in a more ideal way, they should be built primarily on the basis of how human decision-making is actually driven, rather than on idealisations of how it should be driven. The assumptions which underpinned early town planning were based on a superficial, immediate, largely non-scientific view of human decision-making born of a science or rather ideology that did not yet acknowledge or even attempt to understand the mechanisms that might link spatial form to social process. It took half a century to abandon this view, and when it was abandoned in the 1960s, the world turned full circle and physicalism in planning took a back seat.

Today there is a new momentum to physicalism. On the one hand, this is to do with the revival of urban design and planning solutions based on physical models in the last 20 years – as seen, for example, in the rise of the New Urbanism (Katz, 1994; Hebbert, 2003), the UK's Urban Task Force (1999) with its design-led, physically specific urban spatial structure, and perhaps also those ecological approaches to urban design and planning which imply specific physical forms (Lang, 2009). On the other hand, there is a sense in which the foundations for a new kind of science that might enable us to truly understand how physical outcomes are generated by social processes is beginning. This is a science that links functions and flows to morphology through the biomorphic metaphor. What is so intriguing is that this was very much on the table 100 years ago and that there were then proponents who had a unique insight into what it might mean. This is the science of evolution, and one of the 'founding fathers' of town planning, Patrick Geddes, was present at its inception. Indeed he was the person who pushed hard for cities and their planning to be seen in evolutionary terms, and it is somewhat curious that he had so little impact on its subsequent science.

Here we will recount this history, beginning with the theory of evolution and Geddes's unique contribution to its progress into planning. We will then sketch how planning developed in this manner through the work of practitioners such as Patrick Abercrombie and the way disillusionment with the physicalism that was implied by such centralised top-down planning led to a change in focus. In the late twentieth century, a new physicalism has emerged which is much wider than the old but now firmly based on the science of evolution. This new science is being forced by a new concern for physical problems that relate to the way cities function in terms of their energy (Batty, 2005). Our argument is that this is a new synthesis in the making and

that a new science of cities in which physicalism plays an important role is fast being fashioned. We argue that this, then, is the true legacy of Geddes and his successors such as Abercrombie.[1]

The Darwinian heritage: Geddes and evolution

Darwin, Geddes and natural selection

As Dobzhansky (1973, 125) classically asserted, '[n]othing makes sense in biology except in the light of evolution.' While it is possible to apply organic analogies such as the 'city as organism' without acknowledging the role of evolution, any examination of the morphologies that define actual organisms show deep and fundamental traits that are inextricably related to Darwin's theory. In fact these traits can only be generated by a process in which a given species evolves as the product of many small changes at the most elemental level. We now know that these changes are embodied in a genetic code that dictates the way the organism reproduces itself, but in the mid-nineteenth century, biologists had to be content with learning about the inherited characteristics of the organisms through painstaking observations, cataloguing different organisms and generating a detailed classification of species.

Throughout the nineteenth century until Darwin[2] published his magnum opus in 1859, informed scientific opinion accepted some form of evolutionary theory in which inherited characteristics were transmitted from generation to generation. Such theories of 'soft inheritance' associated primarily with Jean-Baptiste Lamarck were not based on any sense of the mechanism of natural selection or of fitness in the population and in no sense were complete, but they fitted the deeply ingrained sense

1 We must establish some historical context to this essay by telling the reader a little of the key actors who figure in our text.

First (Sir) Patrick Geddes (1854–1932) was born in Ballater and grew up in Perth, Scotland. He spent his formative intellectual years in London from 1874 to 1878 largely studying with Huxley at the Royal School of Mines (Imperial College) and then with Sanderson in University College. He is widely regarded as the 'father of British Town Planning' but made extensive contributions to geography, civics and sociology. He spent much of his life in Edinburgh and the University of Dundee, but was in India during the First World War and died in Montpellier, France in 1932, still striving to produce his grand evolutionary synthesis.

(Sir) Patrick Abercrombie (1879–1957) was born in Heaton Mersey, Lancashire. He was trained as an architect and became one of the single most important architect planners of the inter-war years through a series of city and regional plans and his writings in the *Town Planning Review*. He spent most of his academic life in Liverpool as a founder member of the School of Civic Design in the University, moving later to University College, London in 1935.

2 (Sir) Charles Darwin (1809–1882) was the first scientist to articulate the notion that biological life proceeds through natural selection, with the 'survival of the fittest' being the mechanism that guides development. Born in Shrewsbury, Shropshire, he spent much of his life in London which he returned to after his epic voyages on the HMS Beagle (19831–1836), where he gathered much of the material used to develop his theory of evolution that he published in his magnum opus *On the Origin of Species by Means of Natural Selection* in 1859.

of order of that era. Moreover, other theories of change such as those associated with the formation of the Earth were in the air and it might be said that when Darwin produced his great synthesis, the world was waiting for it (Larson, 2004).

The essence of Darwin's theory was natural selection, which lay at the basis of adaptation and speciation and which he regarded as 'this principle by which each slight variation, if useful, is preserved' (Darwin, 1859, 253). This led directly to the notion that those species that displayed the most traits that were most useful had the greatest capacity for survival through inheritance (with the consequent destruction or abandonment of those less fit traits). From this came the term 'survival of the fittest', coined in fact by Herbert Spencer, one of the most enthusiastic of Darwin's advocates and populariser of an extended theory which came to be known as Social Darwinism.

Some 15 years into the maelstrom following the publication of *On the Origin of Species* in 1859 came Patrick Geddes, who thrust himself into the midst of those dealing with new theories of biology, physiology and evolution. Endearing himself to Thomas Huxley, his early mentor, he spent five frenetic years in London, meeting Darwin at University College in Sanderson's laboratory in 1877 (Batty and Marshall, 2008), never acquiring a degree but restlessly pursuing his quest for explaining 'life', while at the same time broadening his view of evolution to the point where the biological, human and social worlds were one. Right from the beginning, Geddes was a maverick. He did not have a formal training in any discipline and this made him an unconventional scientist, ill-prepared for the rigour that was necessary to pursue detailed experimentation, despite some early successes in the laboratory. These characteristics did not augur well for making an academic career and his extremely wide interests probably diverted him very early from securing a permanent academic position. At the same time, his return to Edinburgh in the 1880s propelled him into the study of civics and town planning, through which he inevitably splattered with references to evolutionary theory, and which, in a sense, he regarded throughout his life as his professional expertise.

Geddes and the evolutionary mechanism

Geddes' approach to evolution was far wider than Darwinism. It not only embraced the writings of Spencer, but extended to the notion of life force (*élan vital*), something that was an anathema to true Darwinists, built around the writings of Bergson on creative evolution and passing rather quickly into the anarchism of Kropotkin and Élisée Reclus (Welter, 2002; Ando, 2005; Morrison, 2005). By the 1890s, Geddes had clearly moved away from any pretence at researching in biology, and although he produced a series of increasingly quirky text books on evolution (with Thomson, his faithful student and long-term collaborator), he never again entered the laboratory. In fact, his use of the term evolution in terms of civics, cities and planning was in

much the same way we currently use the term sustainability to apply to every aspect of planning. It was almost as though it was expected of a biologist turned sociologist and town planner, having been brought up in the shadow of Darwin, to pepper his conversations with references to evolution.

It is, however, key to Geddes' influence that he rarely invoked Darwin when applying evolutionary ideas to the social and urban contexts, as Geddes saw Darwinian natural selection as being too mechanistic and too reliant on competitive struggle. Rather, Geddes had his own interpretation of evolution which permeated his thinking and writings from the 1880s to his death in 1932. He interpreted evolution as being primarily driven from within the organism, rather than by external agency (as with natural selection), and he emphasised the importance of cooperation (from the scale of cells to societies), which ultimately triumphed over competition. According to this view, cities were the ultimate expression of social union and evolution (Geddes and Thomson, 1889, 312; 1911, 176).

His view of evolution led Geddes to employ two different kinds of organic analogy when it came to understanding cities and practising town planning. First, the city itself was conceived of as something 'organic', whether interpreted as a developing organism or 'evolving' in relation to its environment. In the context of his Ghent town planning exhibition, Geddes (1913, 80) claimed to detect

> a beginning, perhaps the first clear and definite beginning, of the comparative study of cities in their life; each shown as arising like a living being, in constant relation to its environment; ... Like the living being it is, a City also reacts upon its environment, and in ever-widening circles.

While the idea of a city as a living being may be very familiar to us now, it was hardly on the agenda then. It served to suggest that town planning was an integrating theoretical and practical activity, not simply a matter of laying down buildings and streets, like glorified architecture and engineering.

Geddes also introduced a second evolutionary theme, in which the city was itself an environment: a built environment, of course, whose design could positively influence the social organism it contained. In this second sense, the role of the planner was to influence social evolution beneficially through physical design. Overall, Geddes' evolutionary urbanism was therefore part 'developmental' (city-as-organism), part 'evolutionary' (in a non-Darwinian way) and part 'environmental' (city as environment, rather than organism). He thus mixed (and mixed up) a series of intricate themes, perhaps quite purposely, which in practice proved difficult for others to follow.

Geddes' classic book *Cities in Evolution* (1915) was a disappointment, somewhat of a rag-bag of ideas. According to Welter, 'the book assembles earlier published papers without managing to present in a coherent manner the larger meta-narrative that informed all of the individual essays' (2002, 251). Geddes interprets the growth of

towns in a way that appears to scramble developmental and evolutionary ideas, where on the one hand urban renewal could be seen as performing surgery on the body of the urban organism, while on the other hand, part of a more open-ended evolution. Sometimes he interpreted towns as following their own laws of growth (such as coalescing to form conurbations), while at other times he more explicitly discussed proactive interventions by the citizens (Geddes, 1915).

In fact, Geddes' major problem was that he was not a clear communicator. His book *Cities in Evolution* was ready by 1905, but difficulties over its intended audience delayed its publication until 1915. By the time it was reissued in 1949, much of the material that does pertain to evolution has been purged from the book as befits Geddes' heritage, which is much more focused on ideas of regionalism, ecology, civics and participation as well as the longstanding notion of survey before plan, but not on evolution per se. As it was, Geddes failed to spell out explicitly his application of evolution – that is, Geddesian rather than Darwinian evolution – and so the reader is left with the impression that his references to evolution are no more than figures of speech, that could have been invoked loosely by any urban commentator, as opposed to arising from the unique insights of one actually practised in biology and evolutionary theory.

As a result of Geddes' meanderings, a unique opportunity for a biologically authoritative interpretation linking Darwinian mechanisms to processes of urban change was passed up; with hindsight, this may have discouraged anyone else from doing so for decades. All that Geddes did was to suggest that the way towns had evolved in the past could be seen as a diversification of economic functions. His speculations about future evolution were rare, almost as though he was uncomfortable about proposing how towns might evolve in the future. It is even possible that here he sensed that the theory was not developed enough to even hint at what futures there might be. This tension is nowhere more poignant than in the responses to the first of his 1904 papers to the Sociological Society under the title of *Civics: As Applied Sociology*. There he lays out the essence of his notion that cities evolve through an idealised valley section which is both a geographic cross-section and temporal series; and how cities evolve through various stages of size and economic development, all quite descriptive but predicated on the basis that as cities grow, they superimpose themselves on past cities and historically they become larger.

Ebenezer Howard, perhaps misunderstanding Geddes' deeper message, took exception to this characterisation when he said in response

> The Professor reminds us how the vestiges of one civilisation lie super-imposed upon another, like geological strata, and asks: 'Understanding the present as the development of the past, are we not preparing to understand the future as the development of the present?' Following this line of thought, I venture to suggest that while the age in which we live is the age of close, compacted, overcrowded cities, there are already signs, for those who can read them, of a coming change so great and momentous that

> the twentieth century will be known as the great exodus, the return to the land … (Geddes, 1904, 23)

This has not come to pass. Although cities have spread out through sprawl, in general there has not been a 'return to the land', and Howard failed to see that economies of urban agglomeration would exert yet more powerful effects on the growth of large cities as the world became more urbanised. Geddes' deeper message, reflected in his largely unscripted ideology that cities were the vehicle for a great transition, driven from within, that would meld the social, the physical and the spiritual, was an equally misplaced ideology which would become wilder and more incoherent as he grew older, and one that he was never able to articulate in any considered fashion (Marshall and Batty, 2009).

Physicalism defined: Geddes and urban form

Morphology, the signature of evolution

Despite Geddes' failings, he can nevertheless be regarded as the first to imprint the analogy with evolution on our study of cities, and in his early years he developed many insights into the biology of cities which resonate strongly with current developments. In fact, in his concern for morphology summarised in his massive and learned entry to the ninth edition of the *Encyclopaedia Britannica* (Geddes, 1883), he articulated the view he held all his life that physical form held the major key to evolution. Tinkering with evolution thus held the key to successful town planning, notwithstanding his later sympathy with the eugenics movement pioneered by his friend Francis Galton. There is a particularly prescient section in *Cities in Evolution* (quoted in Hall, 1988, 147) where he argues that urban form should follow the example of plant forms which illustrate how they organise themselves to process energy most efficiently. Arguing analogously – and normatively – Geddes asserts '[t]owns must cease to spread like expanding inkspots and grease stains: once in true development, they will repeat the star-like opening of the flower, with green leaves set in alternation with its golden rays' (Geddes, 1915, 97).

More than 80 years later, when morphology came firmly back onto the agenda with cities being compared to fractals, it can be argued that Geddes might have been writing about how cities seek to fill their space in the most efficient manner following rules of self-similarity that show how they arrange their parts to conserve and utilise the transport of their energy in the most efficient way (Batty and Longley, 1994). Indeed, his article on morphology touched on the question of the geometric structure of organisms, plants mainly, in terms of the mathematics required to describe their functioning (Geddes, 1883). In the article, however, he was disparaging of all such efforts at mathematical representation, writing that

> Thus we find that even the best treatises on botany and zoology abandon the subject, satisfied with merely contrasting the simple geometrical ground forms of crystals with the highly curved and hopelessly complicated lines and surfaces of the organism. (Geddes, 1883, 843)

He said this, notwithstanding the fact that his training under Huxley had actually shown him that the path to biological explanation lay in such rigour. It is perhaps a rare glimpse of the fact that Geddes was emotionally unprepared and indeed ideologically opposed to the way biology was and would develop both in his own lifetime and beyond.

By the time Patrick Geddes entered the academy in the late 1880s as Professor of Botany at the University College in Dundee, his biological research had almost disappeared in terms of a day-to-day routine. As his appointment at Dundee was part-time, he was able to devote himself to applied sociology and civics in the regeneration of his beloved Edinburgh Old Town. Yet working alongside Geddes was the giant of morphology, D'Arcy Wentworth Thompson, whose book on *Growth and Form* published in 1917, two years after Geddes' own *Cities in Evolution*, still resonates down the years as the most complete statement of physicalism that we had until the rebirth of morphology through the recent science of fractals, chaos and complexity. Geddes must have known Thompson well since they appear on various photographs together (CASA, 2007), but there is little reference in either of their writings to each other, and by then Geddes' notion of evolution was as much social as physical or biological. This again is perhaps surprising given his early interest in morphology as evidenced in his *Encyclopaedia Britannica* article.

Classifying urban form and evolution

Geddes' approach to cities was largely based on his historical classification of urban form, urban life even, into two distinct periods, which he defined as paleotechnic (early industrialisation), and the neotechnic (the condition into which he supposed industrial society to be heading). This classification mirrored a kind of evolution or progression that was picked up aggressively by Lewis Mumford and exploited to its full extent in his books *Technics and Civilization* (1934) and *The Culture of Cities* (1938). In one sense, the implication of Geddes' approach was that the pathogenic social evolution of cities departed very radically from the notion of survival of the fittest.

In fact, Geddes had little time for the intricacies of Darwinian evolution, which he regarded as mechanistic. He thus failed to exploit one the of the key insights made by Darwin, based on the idea that small changes can lead to big effects, that a combination of many apparently disconnected changes can give rise to an aggregate order, to emergence as it is so powerfully conveyed today in the sciences of complexity. The corollary to this in city planning is the idea that very large interventions often give rise

to little actual change in the rest of the system, that big plans have little or no impact while small-scale changes can have an enormous impact. Geddes certainly appreciated this to an extent in that the 'conservative surgery' of urban renewal he initiated he saw as having the potential for a much wider self-regeneration of the urban condition (Pepler, 1955).

By the time the golden age of town and country planning began in the mid-twentieth century, there was little sense that a science of town planning had been forged, despite the fact that Geddes' message had certainly been driven home. As Abercrombie said: '[b]luntly, what Geddes taught was, that if you wish to shape the growth of a town, you must study it: it sounds simple, but the Civic Survey, by whose agency it can be done, is a sinister and complicated business' (Defries, 1927, 322). Evolutionary theory had, to an extent, been a digression, and it was almost incidental, in retrospect, that Geddes had begun his life's work with the greats, Huxley, Darwin, Wentworth Thompson among others. Geddes was never happy with the notion that evolution was about 'mechanism' and if one did not grasp this from the beginning, it was impossible to see the logic of Mendel, to appreciate the rise of genetics in the 1920s and 1930s, and to understand the modern evolutionary synthesis that has subsequently taken place.

Despite his failiures to appreciate and understand, Geddes produced some tantalising insights, and these must have been crucial for those following in his path such as Patrick Abercrombie, whose lot it was to develop town planning to the point where it became accepted or at least applicable in a universal sense in Britain. Geddes provided glimpses, always glimpses of the future, but his contribution with respect to evolution was as disappointing for the science of cities and the science of city planning as it was for the mainstream evolutionists of his time. As he moved away from practising biology, he lost touch with the latest developments in the field, and although he continued to write text-books on biological subjects until the end of his life, these were little more than restatements of his biological ideas already developed in the 1880s. He never produced his grand synthesis and it is hard not to think that that in the last years of his life in the late 1920s, when planning was gearing up for its golden age, he was simply ignored (Meller, 1990).

Abercrombie, the mid-twentieth-century consensus and the systems approach

The Liverpool School

To get a sense of what town planning was towards the end of Geddes' life, the *Town Planning Review* is by far the clearest statement of how professionals and academics thought of their world. The focus was almost single-mindedly on physical plans, layouts at different scales from the town to the neighbourhood, with a strong focus on

proposals with both national and international examples. The articles were written by a very small circle of academic-practitioners, led by Patrick Abercrombie who edited the journal and, by all accounts, wrote many of its articles. Insofar as theory entered this nexus of commentary and debate, it did so through discussions about plans, but it was a far cry from even the rudimentary theories that Geddes propounded in his writings in his early and middle years. An external observer with no knowledge of Geddes and his tradition could be forgiven for coming to the conclusion that planning was simply about tidying up the excesses of the industrial city, providing decent amounts of open space and a functioning transport system as well as more hygienic and liveable garden-city like environments.

Many of these seeds, of course, had been laid in the late nineteenth century in the Garden City movement. However, the focus of academic attention was provided by Charles Reilly's initiative and W. H. Lever's philanthropy in founding the Department of Civic Design in the University of Liverpool where Patrick Abercrombie established himself and the *Review* exactly 100 years ago. Geddes was also a significant force in these years in articulating the need for both an intellectual and social basis for planning through his city exhibitions, his work in the Outlook Tower in Edinburgh, and his contributions in helping to found the Town Planning Institute. But in 1914 – as he entered his seventh decade – he departed for India. Tragedy in his personal life left him floundering, and he never managed to really recreate the momentum of his middle years. In fact his spirit was still very much alive particularly in his dictum 'Survey Before Plan', which became a watchword for the practice of planning in the inter-war years. His relationship with Abercrombie is hard to figure; they knew each other quite well, but were of a different generation. Yet many years later in 1972, David Shillan in presenting the Sixteenth New Atlantic Foundation Lecture said: 'I remember vividly when I spoke of Geddes to the late Sir Patrick Abercrombie … his face lit up and he exclaimed "He was my master!"' (Shillan, 1972, 1).

Abercrombie was clearly steeled in the Geddesian tradition. Indeed, Dehaene (2005, 131) characterised him as a 'self-styled Geddesian'. He defined Town and Country Planning, as it came to be called in Britain, as seeking

> to proffer a guiding hand to the trend of natural evolution as a result of careful study of the place itself, and its external relationships. The result is to be more than a piece of skilful engineering, or satisfactory hygiene or successful economics: it should be a social organism, and a work of art. (Abercrombie, 1933, 27; quoted in Hall, 1995, and in Dix, 1978)

By the mid-1930s, the clearest expression of *Town and Country Planning* was provided by Abercrombie (1933) in his little book of the same name. One of the surprising features of planning as it then emerged was that there was so little emphasis on economic issues. Abercrombie's book was written at the height of a world depression, while the

rearmament of Germany and the threatened world war cast a long shadow. Moreover, when war began, physical planners could sense that there would be a massive reconstruction job waiting to be done once peace came. Many of the elements of how one might replan and reconstruct cities were established just before and during these war years, with the Garden City movement growing ever stronger in its influence on the prevailing ideology of planning. Abercrombie himself blazed the trail with his plan for Greater London, and the reconstruction that took place combined with the enormous backlog of industrial (slum) housing that needed to be cleared and which was begun in an earlier era, ushered in a golden age of city building in the name of the state (Hall, 1995).

A top-down order and the transition to the systems approach

Although Geddes' message shone through in various ways, particularly in Abercrombie's faithful application and elaboration of the 'Survey Before Plan' mantra in a succession of town plans prepared during the inter-war years (Wright, 1982), the practice of plan-making inevitably adopted a top-down stance. In this sense, planning departed radically from the method and logic of natural selection and the theory of evolution. In fact, Abercrombie (1937) himself was horrified by the wider implications of evolution for human affairs and would probably have been appalled at the sentiments we express here: that most city building is robust and resilient despite the fact that it portrays and reinforces a social condition that might be deemed quite undesirable. In his inaugural lecture to University College, London where he took up the post as Professor of Town Planning in 1935, he 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, 16)

In this sense, he argued, cities required a top-down order and it was planning's mission to enforce this. Professionals were thus pre-eminent and insofar as any theory was invoked, this was largely mechanical in its form and process. By the beginning of the 1950s, scientism, meaning the application of science to human affairs in the form of social engineering and policy analysis, began to have an ever-greater impact based around the notion that cities might be seen as systems to be engineered into more efficient forms. This approach was predicated on the development of new technologies, particularly the automobile and to a lesser extent air transport, but it was consistent with existing practice and easily absorbed into the mainstream. In fact, Abercrombie himself used various kinds of model, from the architect's icon to abstract representations of traffic flow in the late 1940s. The kind of systematic work that became *de*

rigueur by the 1960s is depicted in a picture of him illustrating the way he presented his plan for the reconstruction of Plymouth in 1945 (Batty, 2007).

As land use planning established itself as a comprehensive function of the welfare state in Britain, its role shifted to slightly more abstract concerns with the term 'spatial' being used rather than 'physical'. What happened as the world moved to explicit management and policy analysis was a quest to develop integrated theories of planning in which cities were seen to be systems, capable of being measured, manipulated and then optimised in the belief that certainly more efficient and possibly more equitable forms might be the result (McLoughlin, 1969). The systems approach which dominated planning at the end of the consensus was not, in our view, some new and radical development; rather, it represented a rather natural conclusion to a century of painstaking top-down activity in educating a reticent population and body politic into the need for rational planning (Massey, 1989). Rational planning, it was argued, was the only means to establish the good society.

We do not intend to elaborate this history further, but it is essential to note that the systems approach as it emerged in the 1960s was a natural culmination of at least 50 years of top-down planning built on a synthesis of paternalist social philanthropy in concert with engineering the environment. It was also a movement not really in tune with the idea of evolution and certainly not sympathetic to the notion that most of what is created in cities is rather well adapted to purpose. The systems approach was devised to impress radically new forms on the city in the belief that the functioning system was far from efficient, and that new forms of top-down control were needed to establish environments more fit for purpose. This was diametrically opposed to Darwin's message, which sought to explain evolution as the consequence of small changes, which are adopted if they improve the organism and which are subject to random but nevertheless ceaseless application, ultimately leading to the differentiation of the species and the 'survival of the fittest'. The systems approaches of the 1960s were much more akin to management and control than to the notion that well functioning systems must adapt themselves by learning what works and what does not, slowly but surely with the only way to achieve such improvements being through the relentless pursuit of small changes.

For much of the twentieth century, city planners and the plans they produced assumed that cities were in equilibrium and the focus was almost entirely on implementing some form of blueprint depicting a desired end state. The idea that cities and situations change continuously was mildly acknowledged, but master plans dominated the planning process (Taylor, 1998). The systems approach which emerged in the 1960s was entirely consistent with this notion of the city in equilibrium, notwithstanding the fact that contained within such theory lay rich ideas about feedback, exponential growth, emergence, chaos and of course evolution which now form the sciences of complexity (Chadwick, 1971). In this sense, these theories bolstered the notion of

master or blueprint planning by providing mechanisms describing and understanding how cities functioned in terms of their interacting parts, but there was little sense in which processes of evolution could be linked to such interactions.

Much of what was developed from the 1960s by way of theories and the models used to implement them was based on the notion that the process of adjustment to a new state was relatively unproblematic, with no sense whatsoever that the elements composing cities might adapt, mutate, survive or disappear from processes that we knew little or nothing about. Somewhat ironically, Geddes himself would not have been amused by what was taking place. For all that we have said about his non-Darwinian views of evolution, the mechanisms that were invented to articulate how cities functioned came more from engineering than from biology, and it would take another massive shift to bring Geddes' original ideas back onto the agenda.

The social city, the corporate state, and the rebirth of morphology

The quest for corporatism and efficiency

Despite the developing notion that cities could best be thought of as machines rather than organisms and planned by developing analogies with command and control systems, there were some signs that cities were being likened to living systems. Ideas about how cities scaled with size, building on allometry and scaling first introduced by Wentworth Thompson (1917), extended by Huxley (1924), and popularised by Haldane (1926) were being pursued by theoretical geographers (Bunge, 1962). Architects and designers were beginning to think of buildings as ordered geometries and design as an equally ordered process of manipulating such geometries to human ends (March and Steadman, 1971). Yet the mechanical analogy was dominant, and in hindsight, it was no surprise that the momentum to plan cities in this way faltered. In fact, the quest for efficiency simply ignored the diversity and heterogeneity of the city, i.e. its complexity, which represented its social condition. Thus planning took a different turn, away from spatial form to social process and to the quest for a just rather than good society. The post-war consensus broke, and in the 1970s there began a profound and lasting restructuring of the public sector and the role of the state. This saw planning move from its prime position to a process of engendering economic development consistent with the entrepreneurialism and corporatism that has come to dominate all policy-making and management in the late twentieth and early twenty-first centuries.

To illustrate how planning has changed, examining the volumes of the *Town Planning Review* provides a useful picture. From 1909 to 1959, it was dominated entirely by physical plans, and the practical process of generating and to an extent implementing such plans. Regard for explicit theoretical debate was minimal: there was

no need for there was a consensus as to what planning was all about. During the next 20 years or so until the mid-1980s, the scientism of planning made itself felt in articles on how to plan using various techniques. There was still an emphasis on physicalism, on geometry and layout and zoning, but the tone had begun to change towards development processes, implementation, and related planning instruments. Into the 1990s, the journal was dominated by planning theory as it broadened its scope to deal with the just society and then by economic development and corporate organisation. Sustainability too in its most generic sense became significant in the 1990s, but it would be easy to think this had little or nothing to do with physical planning from the commentaries within.

In a sense, this is a picture of fragmentation. The last 10 years have echoed a strange mix of public administration and the corporatism, procedures, instruments and management, with occasional forays into countryside and urban design, reminiscent of a previous age, but with little focus whatsoever on the idea of a physical plan. In fact, the idea of the plan has retreated, and many contributions now are studies of small-scale development rather than its planning. Readers might thus be hard pressed to find any enthusiasm for a new physicalism from what the academy is now writing about. The message of this article, however, is that it is waiting in the wings, biding its time as planning begins to focus once again on how cities might be ordered in terms of their space and space economy in the wider quest to achieve their social goals.

Lone voices: Jacobs and Alexander

Despite the heritage of Geddes, which did not lead to any widespread thinking of cities as evolving, living systems, there were still lone voices preaching the message that our understanding of cities and their planning should be from the bottom up. To an extent, the public participation movement embraced this message but it was Jane Jacobs (1961) who, through her seminal text *The Death and Life of Great American Cities*, laid the groundwork.[3] She argued that it was the diversity of cities that marked their quality and that this diversity was formed from countless individual decisions, generated from the bottom up. Her corollary was that top-down urban planning destroyed such qualities that made cities what they are. Jacobs drew her inspiration, of course, from observations of life in large cities, but she bolstered her ideas by reference to the way the biological sciences were developing. Drawing on Warren Weaver's (1948) address to the Rockefeller Foundation in which he argued that the greatest challenge

3 Jane Jacobs (1916–2006) was a journalist and urban activist who led the movement against the corporate planning machine in many North American cities. However, her real contribution to our essay is her argument that cities are complex systems. Her magnum opus *The Death and Life of Great American Cities* published in 1961 drew on ideas in the biological sciences to explain why cities need to be diverse, heterogeneous, messy, 'disorganised', as befits a complex system.

was to deal with systems of organised complexity, systems that had the complexity of human organisms, not the dry sterility of statistical physical systems, she fashioned her argument around ideas that were entirely consistent with evolution.

However, she saw Geddes quite differently: not as the promulgator of 'conservative surgery', user participation or an ecologically sensitive approach, but as a supporter of planned towns, of Ebenezer Howard and the Garden City movement but on a grander, regional scale. The fact that Jacobs did not grasp his fundamental message is once more evidence that Geddes failed to communicate, and this must have been reinforced when his greatest disciple Lewis Mumford (1962) launched an intemperate attack on her for deriding the Garden City. Nevertheless, her message that 'cities happen to be problems in organised complexity, like the life sciences. They present situations in which half a dozen or several dozen quantities are all varying simultaneously and in subtly interconnected ways … The variables are many but they are not helter skelter; they are interrelated into an organic whole' (Jacobs, 1961, 433) resonates down the ages and is a mantra for our times.

In parallel fashion, the same sentiments were being advocated in architecture. Christopher Alexander (1964), in his PhD thesis *Notes on the Synthesis of Form*, argued much the same: good architecture, he said, was well adapted to context, the product of many decisions about form which were tried and tested as those who lived and used buildings sought to adapt them to their purpose.[4] Modern architecture, such as the machine architecture of Le Corbusier and others, could never be well adapted in the same way, hence his proposal that design be based on an intimate study of vernacular problems with construction being fashioned from the bottom up, a message he continues to preach (Alexander, 2002). To an extent, this message was also lost in the wilderness, for both Jacobs and Alexander were calling for an approach to architecture and planning that diverged massively from the top-down corporatism of the state that increased dramatically as the twentieth century wore on.

In fact, the rebirth of an interest in physical form and more importantly in understanding how it can be linked to processes of development and decision has not come from within planning itself, but from a more generic interest in complexity that has recently swept through the sciences and now social sciences. We will not describe the origins of this movement here, but suffice it to say that in many fields, particularly those that are associated with human affairs, there has been slow realisation that problems are considerably more complex than was hitherto assumed. To an

4 Christopher Alexander (1936–) is widely regarded as the greatest architectural theorist of our time. His argument is that design should be developed from the bottom up, and that the process of achieving good design is a process of building to ensure slow but sure changes that provides fitness for purpose. To achieve this, he has defined a series of generic patterns which are controversial. His four-volume work *The Nature of Order* (Alexander, 2002) is a long, intricate and somewhat arcane summary of his ideas, but his 1964 book *Notes on the Synthesis of Form* is by far the best exposition of bottom-up evolutionary design.

extent, as cities have got larger and wealthier, more opportunities enable individuals and institutions to react over a wider range of choices, and this is clearly making physical structure more complicated to unravel. Small changes leading to unexpected consequences of dramatic import stand alongside large changes that seem to have no impact whatsoever while the time horizons over which change makes itself felt are in themselves unstable.

Our understanding of cities as for many other complex systems appears to be getting less, but there is also a slow realisation that changing the physical form of cities to meet social goals is a somewhat more effective way than broaching social change directly: that controls and instruments to engender physical change are somewhat less intrusive than the more direct forms of action. There is also a growing belief that in complex adaptive systems, identifying pressure points and engendering small but local change can be as effective, if not more so, than the kinds of grandiose plans that have dominated past practice: once again echoes of Geddes' 'conservative surgery'. Hamdi (2004) describes the essential logic of this style of planning.

The complexity sciences and the contemporary logic of physicalism

Complexity and physicalism

The complexity sciences have developed from a synthesis of many scientific disciplines and domains, from mathematical modelling of various kinds, from evolution and biology, from statistical physics, and from economics. The essential criterion for a complex system is a collection of elements that act independently of one another but nevertheless manage to act in concert, often through constraints on their actions and through competition and co-evolution. The physical trace of such complexity, which is seen in aggregate patterns that appear ordered, is the hallmark of self-organisation.

This ordered appearance does not imply that systems that are self-organising are optimal in some way (and we are referring here to all physical and social systems that are fashioned within human decision-making), but rather it asserts that such systems are resilient within limits. They may reveal gross inequities and inefficiencies and these may be revealed in their physical form, but they are nevertheless self-sustaining. Moreover, the notion of equilibrium, which dominated science and social science from the nineteenth century onwards, has largely been abandoned in this new thinking as highly organised systems no longer tend to some steady state but are always far-from-equilibrium, disequilibrium having little meaning in such a context. Cities are the exemplar *par excellence* and this has profound implications for how we intervene in their organisation through different forms of planning (Batty, 2005).

Physicalism has come back onto the agenda because the resultant patterns that

emerge from such order no longer appear simplistic. As we have learnt about how density, energy use, accessibility and mobility combine in intricate ways to produce different city forms, the quest to link physical to spatial to non-spatial has become an ever-greater challenge. Indeed, the development of sustainable communities which combine these elements in different ways has given rise to a 'New Urbanism' that seeks to use insights from morphology, transportation planning, and ecological balance to design new communities that are sustainable and renewable from within (Talen, 2005).

Yet despite half a century of effort in thinking about city shapes and forms from many different perspectives, we still know very little about the way cities use energy, convert this into movement patterns, translate these into densities of development, thus producing different forms ranging across a spectrum from sprawl to compactness, centralised to decentralised, centric to polycentric. We still do not know if cities that have higher densities, all other things being equal, use more or less energy and time in movement than cities that have lower densities. This lack of insight is not because we are dealing with a changing economy, one that is becoming more complex as it surely is, but largely because we have not established a research programme to figure it all out. This will take more than planners, geographers, architects, sociologists and economists, for it is a truly interdisciplinary quest (Batty, 2008).

Two contemporary concerns – energy use and climate change, which cut across one another in diverse ways – will only ever be informed if we move to a theory of cities that links their morphology to the processes of their functioning. To predict how changes in the demand and supply of different fuels which enable individuals and the movements which power the economy to function in different spaces, we need a theory of how cities link such movements to locational, transport behaviours and to trade. This requires a theory of urban dynamics that is far beyond anything we have at present.

The seeds of this kind of thinking are being sown in developments in systems biology, allometry and related areas – which in one sense go back to Geddes – in the new economic geography, in growth theory, in a new appreciation of scaling and size in cities, and in new ways of thinking about mobility and access to resources. These concerns blend economics with physics in a manifestly evolutionary, neo-Darwinian framework which takes as its essence, the notion that cities are forever out-of-equilibrium and that a multitude of bottom-up decisions, while realising coordinated and ordered patterns, produce shocks and abrupt changes in ways that are intrinsically unpredictable. The effects of climate change, for example, force us into this kind of thinking, and as part of this quest we are beginning to generate new ways of thinking about the future and the role of prediction and predictability in such systems.

A theory of cities built on morphological energetics

A particularly surprising feature of contemporary urban theory is the complete lack of any focus on questions of energy. In transportation modelling, energy has been subsumed as cost and time and thence embedded in micro-economic theory that articulates the way individuals and groups decide their location based on utilities and budgets. Energy enters via the back door, so-to-speak, with its relation to morphology implicit at best. Moreover, the use of energy and the way it is distributed which in most biological systems has an intimate relation to morphology is easy to ascertain by examining metabolism and mass throughout the plant and animal kingdoms. There has been a mild flirtation with ideas of biological energetics during the last 50 years in urban planning, but the debate has never been elevated to dealing with spatial systems until quite recently. New directions in morphology linked to geometry and complexity are now fast developing, and it is very likely that these will provide the foundations of a new physicalism that will consider social and city systems in analogy to the biological, perhaps even as an extension of this science (West et al., 1997).

Essentially thinking of cities as complex systems takes us back to Jane Jacobs and the notion that cities are vehicles of enormous heterogeneity, which maximise rather than minimise economic and social opportunities. Although Geddes blazed the trail of local renewal with a philosophy of life that was tolerant of personal and individual differences, he and his successors in the town planning movement were almost forced by the times in which they lived to adhere to a model of uniformity that considered good planning to be the imposition of an homogeneous order, quite counter to the notion that cities were incubators of innovation, opportunity and creativity. To an extent, this was a reaction to the horrors of the industrial city, to the slum, and to the extremely unhygienic conditions that dominated their functioning.

Fifty years ago, before the world turned away from a concern for the spatial and physical, there were tentative steps to link location to health through the many intermediate processes that determined health outcomes. Coupled with a concern for climate change, alternative energy resources, and issues of pollution, all of which are highly localised and location-specific, there is now a real chance to explore how all these factors interrelate. The mobile world that has emerged complicates the picture, and there is an even more urgent need for a theory of cities and their functioning across the spectrum which links their physical form to the myriad processes that govern the ways they process energy, the way people agglomerate to gain value from their activities, and the way face-to-face contacts are being both strengthened and mediated by electronic transactions and interactions.

A theory of cities must start from the premise that the city is a well-ordered working system, resilient to a degree and adaptive in the sense that external and internal pressures lead to readjustment that continues to keep the system functioning. Most of what goes on in cities can be considered to be optimal from the point of

view of the individual or the decision-taker, despite the fact that collectively problems emerge that we would all agree need to be resolved through some form of planning, intervention or explicit management. For many years, there has been a debate about the disconnection between cities and their planning to the point that in the 1970s it became legitimised through the idea of theories *of* planning contrasted with theories *in* planning. In that the professional and scientific mind sets that led to each were often dramatically different, theories of planning took a different form and logic from theories in planning; and because of this separation, planning was often regarded as part of the problem rather than part of the solution (Rittel and Webber, 1973).

A theory of cities in which it is assumed that multiple decisions generate feasible solutions provides a starting point for a theory of planning where the focus is on ways of steering these decisions into ways in which collective outcomes are optimised. This is a very different focus from the notion of forcing top-down plans onto the existing nexus of decision-making with the often-disastrous consequences which have coloured planning during the last century. If we are able to understand how collective outcomes are formed through the repeated actions of bottom-up decisions that adapt, mutate and innovate with respect to an individual's action space, then making small changes at this level is likely to have far greater consequences for the collective outcomes that we observe in physical changes that planning uses routinely to manage the city (Hamdi, 2004). To make sense of all this, a new theory of cities is required, one that builds on evolutionary thinking, linking to the complexity sciences in the ways we have indicated here.

If we were to pursue this venture, then we would be able to assemble many more pieces of the jigsaw than we have been able to plug together so far. Ideas about the optimum city, the compact city, urban sprawl, mobility and transport interactions, the location of work and home, would all begin to fall into place through an integrated theoretical perspective in which many different viewpoints relating to different theories in planning might be related, if not reconciled, despite the intrinsic unpredictability that evolutionary theory implies for future development. Planning would emerge naturally from this kind of theory.

A concluding synthesis

The challenge, then, is to build a new theory of cities and their planning which is all of one piece, where the divide between theories in planning and of planning disappears, where planning is seen as a set of collective actions that weave in and out of ordinary decision-making, thus steering the system in ways that mesh with the way the system functions routinely. In a sense, the realisation of this integrated approach to planning theory and practice could arise from a synthesis of the 'new physicalism' in the sense of the theory just outlined, and the kind of contemporary 'physicalist'

planning exemplified by New Urbanism. New Urbanism is not the only contemporary approach that aims to meet a diversity of social, economic and environmental objectives through the physical design of the urban fabric, but it is a well known and well documented reference point that serves our present argument. New Urbanism in a sense represents the reassertion by architects, urban designers and physical planners of the importance of the design and physical configuration of the built environment, as being central to what used to be called 'town planning' – in the face of otherwise more diffuse concepts such as 'spatial planning'.

Accordingly, New Urbanism is emblematic of a shift already happening, of reoccupying the void left by the move away from 'physicalist' planning since the 1960s and 1970s. As such, New Urbanism has come under some of the criticism associated with old-style physicalist planning – a supposed preoccupation with physical form and environmental determinism, a belief in universal values, utopianism, and the attempt to impose order from the top down. Moreover, New Urbanists – and other planners promoting physically specific kinds of urban vision – are open to the criticism that their ideas of how cities should be are not fully grounded in a theory of how cities actually are, or came to be. These critiques mean that while New Urbanists – as with many planners in general – may applaud and embrace Jacobs' and Alexander's critiques of Modernism when it comes to analysing the problem, they may yet be accused of coming up with the kinds of top-down solution that run counter to what Jacobs and Alexander intended (Marshall, 2009). While the reality is more complex than this, the basic point here is that there is, at the very least, an opportunity for uniting the best of what physicalist approaches to planning can offer – that is, pragmatically oriented, physically explicit visions of how cities could or should be – and what can be offered by scientific theories of urbanism, about how cities actually work.

Taking New Urbanism as an exemplar of how physicalism is beginning to reassert itself in planning, although important, it is as yet largely a superficial reaction to the wider quest of thinking of cities as physical structures where manipulating their form represents the most obvious and least intrusive way of generating more efficient and equitable systems. New Urbanism needs to be underpinned by much deeper foundations, building on energetics which encompasses how flows and functions can evolve and grow in situ with the most modest of designs and the smallest of interventions. The call for planning theory to be informed by our widest understanding of the way the world works – combining the biological and ecological with the social and economic, in an evolutionary perspective – is not of itself novel. As Geddes said of his Ghent exhibition: 'we are not simply exhibiting town plans, but aiming towards the indication, in parts even the elaboration, of a Science of Cities' (Geddes, 1913, 85). Geddes (1904) understood more than 100 years ago that 'a city is more than a space in place, it is a drama in time.' His legacy and that of his successors, particularly Abercrombie, was beautifully captured by Holford speaking at a symposium on the

occasion of the centenary of Geddes' birth 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, 448).

Evolutionary theory is ever more powerful in its explanation of the way we develop and behave. Despite the influence of fashion (and it is no accident that the current interest in Darwin and evolution has recently been spurred by his own bi-centenary), what is encouraging to our quest is that the study of cities and their planning is beginning to broaden in ways that were largely unanticipated by those closest to its science and professionalism. It is beginning to embrace many disciplines whose methods have been honed on different kinds of problem, the logic of which suggests that to develop robust and meaningful theories about the city and its planning requires a far wider range of disciplines than has been envisaged hitherto. We have sketched out elsewhere some possible approaches to planning commensurate with emergence and evolution (Batty, 2005; Marshall, 2009). The crucial step – still to be made convincingly – is to apply the scientifically inspired understanding of urban morphology and evolution to actual workable design tools and planning approaches on the ground. For the new physicalism to be realised, as we enter *The Town Planning Review*'s second century, we need the coming generation of urban theorists and town planners to combine the scientific inspiration of Geddes with Abercrombie's political and professional pragmatism.

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