Conceptions of change in the built environment

Karl S. Kropf
Stratford-on-Avon District Council and Urban Morphology Research Group,
School of Geography and Environmental Sciences, University of Birmingham,
Birmingham B15 2TT, UK.
E-mail: ksk@compuserve.com

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Abstract. *This paper starts from the premise that urban morphology and process typology make use of a number of different, more or less explicit, quasi-evolutionary conceptions of change. The principal argument of the paper is that the evolutionary conceptions of change as used in these fields could be made more explicit, robust and broadly applicable if they were abstracted and broken free of specific historical periods and sequences. In particular the paper discusses the distinction between* ontogenetic *change and* phylogenetic *change. The further argument is made that, as a tautological (and heuristic) framework of ideas, a more abstract conception of change is analogous to ideas of evolution developed in other fields. The paper concludes by suggesting that urban morphology and process typology stand both to gain and suffer from the homologous relationship with evolutionary thinking in the life sciences.*

Key Words: change, built environment, evolution, Darwinism, organized complexity

The histories of urban from, architecture and the social and economic life of cities are descriptions of, amongst many other things, growth, successions, transformations, cycles, decay, catastrophes and shifting centres of activity and control. But, while the fact of change may be acknowledged, studied or engaged in professionally, details of the *process* of change are not necessarily considered to be relevant. On the one hand, to the practitioner, the way things have happened in the past is less important than what ought to happen in order to achieve a better environment now and in the future: the desire is often for less theory and more practical tools (McGlynn and Samuels, 2000). On the other hand, to a large number of academics, what tends to matter is the specific cultural origin and meaning of change, or the powers that control it, not a general, abstract model of change.

Yet, while there may not be universal interest in a close examination of the process of change in the built environment, professionals and academics often imply a process, if only vaguely, by the use of evolutionary metaphors and analogies. At a superficial level, biological evolution pervades current thought, particularly in association with human designs. References to evolution are common in advertising, marketing and journalism. In recent advertising campaigns, several car manufacturers make direct reference to

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evolutionary ideas. In one case, a brochure employs the 'monkey to man' graphic convention. Pictures of models from different years are arranged in chronological order to form a sequence just as natural historians did with animals such as the horse (see, for example, Gould, 1991) or as in the famous sequence of stooping monkey with long arms to upright, noble savage *homo sapiens* in order to demonstrate the progress of evolution.

Looking beyond the superficial, there is a rich and extensive history of biological and organicist metaphors in environmental design (for summaries see Steadman, 1979 and Malfroy, 1986). But, notwithstanding that richness of metaphors and the eminence of the figures who used them – most notably Camillo Sitte, Patrick Geddes, Lewis Mumford, Frank Lloyd Wright and Bruno Zevi – very few people have taken forward a thoroughgoing and rigorous theory of evolution in the study of the built environment. More commonly, the tendency in the use of biological and organicist metaphors has been, on the one hand, to conceptualize the development of architectural styles in terms of a life cycle: early, high and late styles equate to growth, maturity and decay. On the other hand, there has been a tendency to see buildings or cities as organisms. The city or building is a 'living' thing with physically distinct and functionally specialized parts.

Having said that, of the specialisms within the field of the built environment, urban morphology and process typology are, more clearly than most, built on an evolutionary conception of change, though not necessarily an explicitly biological one. The initiators of urban morphology and process typology such as Saverio Muratori, M.R.G. Conzen and Gianfranco Caniggia openly invoked notions of evolution as a means of gaining a better understanding of the built environment. Conzen makes explicit reference to an evolutionary approach (1960, in particular p. 7) as do Caniggia and Maffei (Caniggia, 1983, in particular section 2.2, 1984; see also Malfroy, 1986). In many ways, concepts of evolution seem to lie at the core of typological and morphological thinking.

Yet active, open application of ideas from biological evolution seems to excite as much scepticism as enthusiasm even within the field of typomorphology (Malfroy, 1986, 1998, Larkham, 1995, 1999). Conzen himself suggested that equating human history and natural history is an absurdity (Conzen, 1998). It is as if the more direct the analogy, the more suspect the author becomes. The closer to biological Darwinism, the more criticism is likely to be levelled.

Because of this significant degree of ambivalence and controversy, it is difficult to see what might be gained from drawing on modern conceptions of evolutionary change. It is difficult to see beyond the language and specifics of evolutionary biology, on the one hand, and typomorphology on the other, despite a common core of concepts and modes of expression deriving from a shared legacy from natural history.

Perhaps it is the notion of metaphor that clouds the view? Just settling for the simple metaphor seems to do more harm than good, hiding important features, and perhaps uncomfortable difficulties, behind a comfortable and familiar screen. The quasi-evolutionary view is obfuscatory. Saying that things are similar but not too similar is to say nothing at all *unless the comparison is made specific*. How far do the similarities really extend? To what extent does typo-morphology take a truly evolutionary view of change? Do the metaphors go beyond reductive and received conceptions of evolution and take account of modern developments in evolutionary theory, particularly in the fields examining emergent behaviour, organized complexity, evolving systems and self-organization?

The following discussion seeks, in a small way, to answer some of these questions. By taking a more abstract view on both sides of the analogy it suggests that there are significant similarities between typo-morphology and evolutionary theory, the further exploration of which might be to the benefit of both. But, for as much as it stands

to gain, typomorphology also stands to suffer from the homologous relationship with evolutionary thinking in the life sciences.

Different kinds of change

Just as there is not a single, solid body of concepts that constitutes urban morphology and process typology, there is not a single, solid core of evolutionary ideas. Even the work of individual authors does not necessarily show a consistent, coherent conception of evolutionary change.

The various authors do identify similar objects, use similar modes of organizing and representing information and develop similar concepts and theoretical strategies. There is a similar interplay between the empirical and theoretical dimensions, between descriptive accounts of objects and specific changes, the identification of generic objects and general repeating patterns of change and attempts to place the descriptions and patterns within the context of ideas about broader, longer-term processes.

Thus, for example, Conzen identifies plan element complexes (street system, plot pattern and building pattern), the burgage cycle and the process of fringe-belt formation. He makes use of concepts and strategies relating to transformation borrowed from geomorphology and makes reference to periodization along more or less accepted lines of historical and art historical periods. The latter is combined with the concept of 'objectivation of the spirit'.

Muratori and Caniggia identify building types, tissue, urban organisms and territories and various kinds of transformation of these elements such as the 'tabernization' and 'insulization' of courtyard houses. These changes are set within the framework of the typological process which is in turn placed in the context of broader cycles of change at the level of the region (*territorio*) and, in the case of Muratori, repeating, cyclical change encompassing humans and their environment as a whole.

What this brief comparison is intended to show is that there are different kinds of change being described at different scales and levels of abstraction. Thus, the burgage 'cycle', tabernization and insulization are examples of the transformation of a single object (a plot or building) through a single, non-repeating sequence (generally a number of instances occurring at roughly the same time). Fringe-belt formation is an example of the transformation of a single, more complex object (a settlement) through a repeating sequence (various instances happening at various times). The typological process describes the transformation of types (a class or population of buildings or other elements) in which a generic process is repeated but the resulting sequence of specific transformations – a particular line of historical development – is not. The medium-term movement from one historical or morphological period to the next and the longer-term transformation, from one epoch to another, of a whole range of features defining a culture are examples of periodic change. In the latter case, repeating stages in the transition from one epoch to another form a repeating cycle or spiral of change – cyclical periodic change.

The common point shared by these different kinds of change is the notion of a *formative* or *transformative process*. Allied to that notion is the explanatory strategy that what we see now or at a given time is derived from what came before. To understand the end, or intermediate, result of a process – a building or town – one must examine and understand the process of formation.

By this account, the pervasive concept of *process* would appear to have displaced the argument that urban morphology and process typology have at their core an *evolutionary* conception of change. Which begs the question of what that evolutionary conception might be. An excavation of what has come to be called typomorphological discourse would probably find a fairly even dispersion of the terms 'formation', 'development', 'evolution' and 'transformation'. Certainly, little would be gained by attempting to determine in any unequivocal way the primacy, in importance or in time, of any

particular term. In many instances they seem to be interchangeable.

Yet juxtaposing the terms begins to suggest that there are, given present understanding, oppositions between them that subdivide the general notion of 'change' into different and more specific kinds of change. The aim of the following section is to tentatively draw a few lines between the different versions and explore some of the implications of making the distinctions.

Ontogenesis and phylogenesis

One of the fundamental differences between the four kinds of change as set out in the previous section is between the thing or entity that changes. In the cases of the burgage cycle and fringe-belt formation it is an individual object (a building, plot or town), in the case of the typological process it is a class or population of objects (a building type) and in the case of the movement from one morphological period to the next it is a fairly loosely defined set of features that, by inference, involves a fairly large number of 'populations' or classes (the types of activities and objects that make up a culture).

Looking at the last idea of change first, the movement from one period of history to another owes more, directly or indirectly, to the legacy of Hegel's dialectic than metaphors from natural history or biology. Such notions as periodization, long-term cyclical change and the 'objectivation of the spirit' found variously in Muratori, Caniggia and Conzen, show that typomorphological thinking is bound up with Hegelian or at least historicist strategies in accounting for change (refracted, in the case of Muratori through the work of Giovanni Gentile and Benedetto Croce and in the case of Conzen through that of Ernst Cassirer). In particular, Muratori's identification of a repeating alternation between periods of crisis and 'renaissance', in which the latter resolves and encompasses the former, is fundamentally a dialectical version of change.

Whatever else Hegel introduced, he emphasized the notion of a formative process, a notion that, in itself, remains a robust part of both typomorphological and modern evolutionary thought. Many of the ideas with which Hegel packaged it, however, have been the subject of extensive criticism, not least by those who took up his ideas and developed them.

Given the force of the criticism, from Marx to Popper and, less directly, Foucault (to name only three of the most widely known 'critics'), it is difficult to support a strictly dialectical version of change, in particular the ideas of 'spirit' and the predictability, uniformity and regularity of cultural change. Clearly this is a gargantuan subject and not one to be dealt with here. But, whatever view one takes of cultural change it is likely to include, as a component within it, changes in the built environment. Put the other way around, the context of the formation and transformation of the built environment is in part made up of longer-term changes in a wide range of activities and ways of doing things that get labelled as 'culture'. The two, change in the built environment and 'cultural change', are not autonomous or completely distinct.

Examining the three remaining kinds of change, it is suggestive to recall the fact that morphology and typology as general strategies (as distinct from their specific application to human settlements and buildings) emerged in the context of natural history. Typology and morphology were fundamental to natural history (and remain fundamental to biology). The benefit of remembering that origin lies in a distinction made in natural history between *ontogenesis*, the origin or development of an individual, and *phylogenesis*, the history or evolution of a type. Analogous terms in modern biology are *development* and *evolution*. Correspondingly, there are two broad sub-fields, developmental biology and evolutionary biology. The two terms, development and evolution, have, in the context of biology, specialized meanings. Development is ontogenetic change and evolution is phylogenetic change.

Adopting such a distinction within the context of the built environment and typomorphology fairly quickly provides greater clarity and articulation in the discussion of change in the built environment. Indeed, in the context of the distinction between ontogenesis and phylogenesis, even the term *morphogenesis* remains a relatively general container for different kinds of change. On the one hand, transformations of a single entity as illustrated in the burgage cycle, tabernization, insulization or the process of fringe-belt formation in the growth of a town are examples of ontogenetic change. On the other hand, the typological process is a structure or model for the transformation of building *types*, and so represents an example of phylogenetic change. On this basis, a single entity – a building or a town – however long its history, does not evolve, it develops. An individual city undergoes ontogenetic change, that is, change to its physical form but does not, in itself, involve any phylogenetic change or evolution of a type.

According to this view, the 'life history' of a town, as referred to by Conzen (1960, p. 6), is a variety of ontogenetic change and, by the same token, it would be at best confusing to then say 'an *evolutionary* approach ... would seem to provide the rational method of analysis' (Conzen 1960, p. 7; my italics). On the basis of the distinction made in biology between development and evolution, it would be better to say that a *developmental* approach provides the rational method of analysis *when examining individual towns*. To draw an analogy between evolution, in its restricted sense as used in biology, and the change of an individual city would indeed be inappropriate and unproductive. Clearly, a great deal of urban morphological research is not about evolution, that is to say, not about phylogenesis.

The typological process as an example of phylogenesis

In contrast, the ideas of typological change put forward by, for example, Quatremere de Quincy, or Muratori, Caniggia and Maffei, involve the derivation of modern types from primitive precursors and so qualify as examples of phylogenetic change. The Muratorian typological process (Caniggia and Maffei, 1983, pp. 51-54 and 91-92) is one of the best-articulated descriptions of change in building types. For that reason it provides a good basis for examining the extent to which the view of change inherent in the description is 'evolutionary' and whether it might gain from comparisons with other examples of evolutionary change. Very briefly, alterations and changes to existing buildings form the basis for a new concept of the house or leading type which, in turn, forms the basis for the construction of new houses. Further alterations to those new, as well as previously built, houses form the basis for another change in the leading type and so on through cycles of building, physical alterations, changes in the idea of the house and new building according to that new idea.

Taking a more abstract view of the process and spelling out some of the underlying assumptions, it should be fairly uncontentious to assert a number of points at a basic level that apply not only to the typological process but other kinds of change in the built environment.

1. From the previous description, it is fair to say that the typological process is an interaction between humans and their environment. If, as an aid to understanding, it makes very good sense to say that the built environment 'is' humans-interacting-with-their-surroundings seen as a whole, this is not to say that there are no distinct parts to the interaction. Holism is all very well, but holism is generally a matter of seeing parts together as a whole, not just saying that there are no parts.

2. It can be assumed that the typological process involves humans expending physical and mental energy (the input of human energy is a useful indicator for distinguishing the built from the 'natural' environment). Changes do not occur of their own accord. Building types do not just change, people

change them. Too often, though, the language used to describe change imputes the change to the types or forms, effectively removing human agency.

3. It is also fair to assume that, in the typological process, humans make use of their senses and in doing so tend to respond to, and think, in terms of *differences*. As a general rule, the human senses only respond to differences and are prone, for example, to acclimatize to a constant stimulus and in some instances to seek out difference. What triggers change in the typological process? Is it the perception of distinctions and differences, at the primitive level between, say, cold and warm, wet and dry and, at more developed levels, between the capacities and properties of materials, between the suitability of different forms to particular purposes, between differences of position within a structure or distinctions of status, image, or association?

4. It hardly bears mentioning that the term 'type' assumes the repetitive production of a particular form. To be able to classify, *a posteriori*, a number of individual buildings together as a type implies that the buildings were reproduced according to a common idea. Caniggia and Maffei discuss this at length (1983, pp. 39-54). In their view, a type is the result of a number of different people making objects according to a shared conception of the object. In some cases, the forms are repeated by tradition or as part of a *cultural habit*. The repetition might also be the result of a conscious, mechanistic reproduction, as in the case of prefabricated houses. Whatever the conscious state or immediate intentions of those involved, the repetition of forms is a kind of *replicative inertia*. It is easier (in time and resources) and more likely to be culturally acceptable to repeat what has been done before than actively to rethink every feature every time a building is constructed. Once a habit is established, to 'do nothing' equates to repeating the habitual behaviour. It is easier to keep going than to stop or to start from scratch.

5. The idea of a shared conception of an object assumes that the human response to the environment is mediated by some *version* of it. In general, that mediating version is conceived of as a mental *image* or *idea*. At this level, the extent to which the idea or image is *conscious* is not relevant. What is relevant is the part played by the idea in the process of formation and transformation. The interaction between humans and their environment is perhaps better described as at least a three-way interaction, between humans, their ideas, thoughts and concepts, and the environment. The image or idea may only be *partial* (not comprehensive in scope or detail) or *distributed* (different parts held by different people) in a particular act of building or transformation, and it may involve only a small part of the environment (a single house or part of a house). In this context, 'ideas, thoughts and concepts' are fundamentally and irreducibly *social*. That is, they only emerge through the continuing interactions of perception and communication, and are *shared cultural habits*.

6. If common conceptions and cultural habits lead to repetition of forms, experience of the actual variety of buildings suggests that there is a general tendency toward variation in the reproduction. It is rarely, if ever, the case that all individual buildings of a type are exactly alike. With a shared idea there is immediately scope for variation in the range of interpretations or versions of the idea held by different people. Variations might arise in the conception or execution of any given instance for a variety of more or less unpredictable reasons, for example differing experience of previous versions, different immediate intentions, variability in materials or workmanship, whim, experimental changes intended to test new ideas, or adjustments and deliberate changes made immediately before or during construction to take advantage of or ameliorate specific site characteristics.

7. The typological process describes a repeating sequence of new building, alteration, observation and back again to new building. The process is iterative and recursive and, like trial and error, learning or

the process of 'generate and test', is a form of feedback. Action at a given time is based on the perception of, and a response to, previous interactions. In forming and transforming buildings, if people respond to physical, biological or social constraints, to likes and dislikes, problems or opportunities, they do so principally by reference to interactions with and within buildings. The previous attempts at building are the starting point and context for subsequent attempts (Caniggia and Maffei, 1983, p. 62).

8. If the typological process is seen as one of trial and error or, better, generate and test, there are two stages of testing. First, there is the testing of the new form for internal coherence through the design and construction process. Will it stand up and do the parts fit together? Secondly, there is testing for external viability through active use under various, unpredictable, circumstances. Is the building good for its intended or any other purpose? Does it work within the current physical and social context?

9. The step in the typological process from observations to new building, that is, the step from the 'test' of ongoing experience with buildings to the intention to build a new one, is fundamentally a matter of human choice. Which, in the range of current possibilities, should be chosen? Even in a time when building traditions are rigid and constrained, there is likely to be some variety from which to choose. What do people desire in a new building? Which alterations of previous buildings should be incorporated into the new conception of the house? Which are viable? Are there new activities that are not well accommodated in existing forms? And, while the incorporation of any modification or even the creation of a radically new form may be intentional, the intention is, in general, to serve a particular purpose within a particular place and time: not to take a step toward some ideal end point.

10. By definition, describing the typological process necessitates making the distinction between a type and a particular example of the type, between a class and a member of the class, between populations and individuals (a difference in what Whitehead and Russell (1925) called 'logical type'). At a basic level, without recourse to types – at least to *a posteriori*, analytical types – descriptions are reduced to anecdote and there can be no generalization. More specifically, the distinction between ontogenesis and phylogenesis has at its core a difference in logical type. Ontogenesis is about change in an individual and phylogenesis is about change in a type. Individuals develop: types evolve. The two kinds of change occur at different levels.

All circular chains of determination or feedback loops generate a difference in logical type. It is the difference between individual steps in the circuit and the circuit as a whole, between a life cycle and evolution. An individual 'life' cycle, of a building for instance, is not a circular but a linear sequence: construction, use, modification, demolition. There is no more to it. A life cycle is only *recurrent* over several generations – which is a move from individual to population and a move up in logical type.

In some respects, most – if not all – of these points are in danger of stating the obvious. Are they just random thoughts on the subject of buildings and building types, or can they be put together in a coherent way and add to the theoretical foundation already laid by the idea of the typological process? The points may or may not be contentious. Would it, for example, be contentious to say that the diversity of building types found today follows on the basis of cultural habits subject to variation and selection by human choice?

Darwin's idea of evolution

The last statement is a paraphrase of the words of Charles Darwin (1968, p. 342) and incorporates points 4, 6 and 9 as described above. In Darwin's own words, that idea is 'descent with modification by natural selection'. More neutrally, if less succinctly,

it is reproduction with variation and variable success in further reproduction within a particular environment. Within the mechanism are three fundamental components: first, reproduction – the replication or inheritance of form and features from one instance to the next; secondly, variation – there is not total fidelity but some variation in the reproduction; and thirdly, variable success in further reproduction – within a population, in a particular environment, some variations succeed in reproducing and others do not.

The idea is, in fact, quite difficult to express accurately and concisely. In English it comes out either too anthropocentric – implying an intentional selection – or as a circular argument. Worse still in this respect is 'survival of the fittest', a phrase not coined by Darwin but his somewhat disreputable champion, Sir Herbert Spencer. Though probably the most common 'nutshell' version of Darwin's ideas, it is overloaded with judgemental connotations – images of animals, mainly predators such as eagles or lions, themselves loaded with human cultural associations (nationalist or imperial connections hardly need mentioning). Such examples of success and fitness obscure the principles of the mechanism. Bacteria, by weight and number, are the most successful organisms on earth and, by that token, must be the 'fittest'.

A further source of confusion is the use of the term 'natural selection' as a shorthand for the entire mechanism described by Darwin. This leads such figures as Stephen Jay Gould to lapse into lazy and misleading statements suggesting, for example, that 'natural selection can act as a creative force' (quoted in Dennett, 1995, p. 267). Selection or, rather, variable mortality within a population, is not in itself creative. It can only work on and reinforce what has already been created by variation. Descent, variation and selection are all necessary parts of the process.

Through all the debates, there does seem to be general agreement that Darwin and his contemporary and co-discoverer Alfred Russell Wallace were on to something with the idea of descent with modification by natural selection. It remains the core idea of evolutionary thinking. Current arguments seem to arise out of the fact that no-one agrees on exactly what is inherited, how it is inherited, how (or in how many ways) it is modified and how (or in how many ways) it is selected.

It is evident even in Darwin's formulation that the idea is not tied directly to specific biological features but is fundamentally abstract, a point noted in 1891 by the American logician and philosopher C.S. Peirce.

> This Darwinian principle is plainly capable of great generalization. Wherever there are large numbers of objects, having a tendency to retain certain characters unaltered, this tendency, however, not being absolute but giving room for chance variations, then, if the amount of variation is absolutely limited in certain directions by the destruction of everything which reaches those limits, there will be a gradual tendency to change in directions of departure from them (Peirce, 1891, p. 149).

More than most expressions of the idea, Peirce's avoids the pitfalls of teleology, anthropocentrism and intentionalism.

Gregory Bateson (1980) has suggested a further refinement that helps both to overcome some of the shortcomings of Darwin's own formulation (mainly its tendency to mislead) and the criticisms of its wider applicability (see, for example, Gould, 2000). Looking at the matter in terms of abstract principles, Bateson emphasizes the importance of the initial process of formation of an organism – known variously as embryological development or epigenesis. In Bateson's view, the necessity of ensuring that the internal parts and processes function together acts as another form of 'selection' or, better, an initial test of the viability of the new organism. A revised and more abstract version of Darwin's descent with modification by natural selection might then be *reproduction with variation and testing for internal and external viability*. Thus the

components are, first, reproduction; secondly, variation; thirdly, testing for internal coherence (do the parts work together as a whole?) and, fourthly, testing for external viability (is the whole able to persist in the environment with which it interacts and reach the stage of reproduction?).

Drawing a parallel between the typological process and Darwin's idea of evolution is not to suggest that the typological process *is Darwinian*. Rather it is to say that the typological process and the Darwinian view of evolution share features – reproduction, variation and testing for internal and external viability – and that those features can, within their separate contexts, be seen to occupy similar relative positions in constituting a process. The structure of the process is tautological and heuristic. It is a way of seeing that aids understanding.

Evolution and organized complexity

The tendency toward greater abstraction in the development of the idea of evolution has been in evidence over most of the 150 years or so since the publication of *The origin of species*. Evolutionary theory has become not only more detailed, particularly with the addition of genetics to form the 'modern synthesis', but it has also become part of a broader exploration of a wide variety of phenomena referred to variously as organized complexity, complex adaptive systems, self-organization and emergent behaviour (general works dealing with these subjects include Prigogine and Stengers, 1984; Poundstone, 1985; Coveney and Highfield, 1990; and Cohen and Stewart, 1994. Hacking, 1990, also provides an illuminating discussion of the history and importance of chance).

Darwin's book (and the earlier joint paper with Alfred Russell Wallace to the Linnean Society) cleared the way – or created the need – for such investigations by taking as a principal target a dearly-held belief: the idea that all living organisms were independently created and remain immutable. Their success in hitting the target, by showing that creation and immutability do not fit the facts, left two looming questions. How did the complexity and diversity of life come into being in the first place? Where does the pattern and structure of life come from?

If they did not identify the ultimate source, Darwin and Wallace did provide a simple and elegant mechanism for the modification of forms and the generation of diversity. The development of evolutionary theory – and its abstraction into ideas of self-organization – has built on a basic combination of principles: replication, variation and variable success in further replication. In doing so, developments such as Bateson's have drawn on a number of disciplines. Aside from the obvious contribution of genetics, organic chemistry and molecular biology, significant steps on the way from Wallace and Darwin must include developments in logic, statistics, probability, thermodynamics, information theory, semiotics and mathematics. More recently, the exploration and application of non-linear equations, made feasible by the use of computers, has led to significant developments in the theory of organized complexity and self-organizing systems.

With respect to the built environment, it is worth noting that the arch-empiricist Jane Jacobs posed a relevant question at the end of *The death and life of great American cities* (1961). She asked what kind of problem a city is, and responded that 'cities happen to be problems in organized complexity, like the life sciences' (1961, p. 433). But, 'because the life sciences and cities happen to pose the same kinds of problems does not mean they are the *same* problems' (1961, p. 439). In the qualification, Jacobs recognized the danger of scientism and, at the same time, the value of abstraction as a means of countering it. The similarity is generic and structural, not specific and material. And, if Jacobs did not refer to evolution directly, she did, in a prescient way, point to an updated, more generalized conception of evolution with the phrase 'organized complexity'.

What are the features of organized complexity or evolving systems? Bateson (1980, p. 102) offers six criteria as a lower threshold for an evolving system.

1. It is an aggregate of interacting parts.
2. The interaction between parts is triggered by difference.
3. The process requires collateral energy.
4. The process requires circular (or more complex) chains of determination.
5. Within the process, the effects of difference are to be considered as transforms (i.e. coded versions) of events which precede them.
6. The description and classification of these processes of transformation disclose a hierarchy of logical types immanent in the phenomena.

All of these criteria are included in the features highlighted in the foregoing examination of the typological process as an example of phylogenesis.

Again, to draw a parallel between the typological process and evolving systems is to say that, within their separate contexts, different examples of evolving systems can be seen to have similar features occupying similar relative positions in constituting a process. And, while the processes might have similar structure, they are more than likely to be flexible and to vary. To gain anything from a comparison, one would want to ask whether examples show similar features and similar tendencies. Do they show similar kinds of flexibility and variation?

There are a number of things that comparison would *not* offer, particularly if one is clear about what evolutionary theory might seek to explain. It is not seeking to explain the way a settlement 'works' – the complex dynamics of social, economic and political inter-relationships operating at a particular time, even if there is an implicit 'ecological view' to evolutionary thinking. So, just as evolutionary biology is not ecology (but might make use of and contribute to ecology), evolutionary thinking applied to the built environment would not be human ecology.

By the same token, current evolutionary ideas applied to the built environment would not be a rehash of quantitative systems analysis as pursued in the 1970s (see, for example, Chadwick, 1978). Despite the fact that evolutionary theory might make use of mathematical ideas and some forms of quantitative analysis, those are not its principal methods. As Ernst Mayr (2000) has noted, one of Darwin's important contributions to modern thought is a rigorous theory and method based on concepts as opposed to laws, in particular, as opposed to quantitative laws. For Mayr (2000, p. 69), 'observation, comparison and classification, as well as the testing of competing historical narratives [have become] the methods of evolutionary biology, outweighing experimentation'.

As an aside, mathematical modelling, including the more recent non-linear mathematics of dynamical systems, *has* played an important part in the development of ecology. Indeed, systems analysis, in some form, has not entirely disappeared from the study of human settlements. Non-linear mathematics has been applied in ecological approaches to examining the socio-economic dynamics and interrelations of cities (see, for example, Dendrinos, 1992). But, again, evolutionary thinking applied to the built environment would not be human ecology.

On another front, the application of current evolutionary thinking to the built environment would not provide socio-biological explanations for built form as adaptations for human survival (much less as adaptations for the survival of human DNA). That would be a matter for sociobiology. Such an approach is already implicit in Richard Dawkins's notion of the extended phenotype – the idea that all the constructions of an organism, for example a bird's nest or beaver's dam, are a part of the expression of the organism's genetic 'code' (Dawkins, 1982). No doubt, in time, someone will explore the idea of cities as the extended phenotype of humans, in the way that so many other forms of human behaviour are being approached on that basis. This is not to label Dawkins a sociobiologist (though some might). The extremes of sociobiology and a more recent variant known as evolutionary psychology have rightly been

criticized for seeking to explain too much with too simple a version of evolutionary theory. In a critique of the approach, Gould suggests that for its adherents, 'evolutionary theory 'means' a search for adaptive origins. The task of evolutionary psychology then turns into a speculative search for reasons why a behaviour that may harm us now must once have originated for adaptive purposes' (Gould, 2000, p. 100).

If these areas of evolutionary thinking might prove less than productive, one might gain from looking into the broad, if not entirely objective, overview of Dennett (1995) on various debates within the field; or the more specific debates on evolution and cultural transmission, for example Richard Dawkins's idea of the meme (Dawkins, 1976, 1986; Blackmore, 2000) or the less radical views of Cavalli-Sforza (1981, 2000).

Aggregates and emergent patterns

It has been said that a good theory does not provide unequivocal answers but helps one to ask more intelligent questions. Attempting to establish a more clearly defined view of change in the study of the built environment might provide that aid. In the same way that Foucault issues an imperative within the field of discourse, well-articulated evolutionary thinking in the built environment should insist that 'we must define precisely what these changes consist of: that is, substitute for an undifferentiated reference to change – which is both a general container for all events and the abstract principle of their succession – the analysis of transformation' (Foucault, 1989, p. 172).

So, in addition to making a distinction between ontogenetic and phylogenetic transformations, evolutionary thinking also makes a distinction between the ontogenetic change of an *individual entity* and of an entity made up of an *aggregate of those individuals* in a particular place. This refers to a distinction made in the analysis in the first part of the paper. There are, on the one hand, transformations of a single object (a plot or building) through a single, non-repeating sequence such as the burgage 'cycle', tabernization and insulization. On the other hand, there is the transformation of a single, more complex, aggregate object (a settlement) through a repeating sequence such as fringe-belt formation.

The distinction between individual and aggregate entity recognizes that a city is composed of, amongst other things, plots, and involves a different form of control than that operating at the level of the individual building or plot. A settlement involves an aggregate of relatively autonomous agents acting at the level of the plot in addition to numerous forms of limiting controls operating at various other levels, including the settlement as a whole. Recognizing the difference between individual and aggregate highlights that, even if human intentions are involved, it remains that in many cases the choices made are stochastic. From the point of view of the larger scale, the choices are random and are not made with any idea of the larger pattern to which they may contribute. One might then begin to pose such questions as what patterns, if any, at higher levels of scale are *emergent* from the mass of choices made at lower levels – *and so outside direct, conscious human control*? Do interactions at one level of scale (individual) lead to recognizable but not consciously planned patterns at higher levels (aggregate)? Are there instances in which an emergent pattern comes to be perceived and *becomes the basis for conscious designs* (a process suggested by Caniggia and Maffei (1983, pp. 165 ff.) in the case of planned gridded settlements)? What are the conditions and context, the range of possible choices, that allow the patterns – which are, in effect, objects – to emerge? Are there changes in the range of patterns (number and kind) that emerge under different conditions?

The speculator's paradox and other quandries

Reference to circular chains of determination and the other features of evolving systems can provide insights into the interactions in

the built environment that lead to transformations and emergent patterns. It often seems to be the case that the interactions or patterns appear paradoxical. For example, comments about speculative building often focus on the lack of choice. This leads to what might be called the speculator's paradox. Why is there so little choice? In the 'hard' version, *people can only buy what speculators build and speculators only build what people buy*. A 'soft' version inserts the *idea* of the building (Bateson's fifth criterion). *People only* ***want*** *what speculators offer and speculators only offer what they think people* ***want***. Clearly, not *everyone* wants what the speculators offer, and those not catered for are most likely to see the situation as a chicken-and-egg trap. Which comes first, the buyer's idea of the house or the speculator's? The first step towards dispelling the paradox is to recognize that, as a semantic paradox, it omits *time* and the circular chain of determination that occurs in time. The situation is similar to the notion of a market – you can only find the highest price that will clear the market by setting a quote (a judgement or hypothesis) and adjusting the price if necessary over time on the basis of buyers' reactions to the previous quote. As a speculator, you can only get an idea of what people want by looking at what people have bought in the past. You can only find out if you are right by building something and offering it for sale.

The apparent trap is not entirely a matter of semantic paradox. Interactions involving circular chains of determination *do* give rise to the possibility of self-reinforcing circuits. Within a particular environment, a dynamic interaction can settle around what is called an attractor. In terms more appropriate to the context of speculative building, people can get stuck in mutually-reinforcing *habits*. As long as *most* buyers are happy buying what the speculators build, the speculators see no need to offer anything different. Change *is* possible over time, however, because there *is* variation and *choice* within a range because, within a group of people, not everyone has the same ideas and desires. Also, people's ideas and desires change. Within this context one should not underestimate the effects of fashion – or the interactions giving rise to fashions.

The operation of circular chains of determination can also lead to *mutually modifying habits*, particularly in cases of ontogenetic change. One of the more memorable expressions of this is Winston Churchill's observation regarding the British Houses of Parliament in London. 'We shape our buildings, and afterwards our buildings shape us' (quoted in Brand, 1994). In fact, this expression allows for two interpretations depending on whether there is scope for variation and choice. If there is no variation there can be no choice and the circle is mutually reinforcing. Once shaped, the building will shape all those who use it to want the building to be built the way it is. If there is variation, if people see and use the building in different ways, there is choice and changes might be made. If enough changes are made, the building will become something different and people will begin to see and use it differently. If we change our environment enough, we often have to change the way we see and use it.

This leads to the very large and open question of the relationship between environment and behaviour and the so-called form/function debate. If anything can be said briefly about what an evolutionary view could bring to bear on these subjects it is that they are unlikely to be amenable to any kind of linear, determinist explanation. An evolutionary view would show that the relationship between humans and their environment is prone to a variety of both healthy and pathological interactions.

Conclusion

Recognizing the plurality of results is to recognize that we are beyond the point of blindly accepting evolution as unity, as a process that only allows for continuity and equates evolution with progress. Making the distinction between ontogenesis and

phylogenesis, between individual and aggregate and identifying the features of evolving systems such as circular chains of determination and differences in logical type, helps us to begin filling in the details and allows us to see a much more intricate and fascinating picture.

But, just as those tools bring benefits, they also have a potential cost. However much one works to abstract the ideas and put them firmly in the terms and context of the built environment, there are always people who will, as W.V. Quine put it, 'read with a broad brush' (quoted in Dennett, 1995, p. 265). There is always the danger that the fact of borrowing will be seen as more important than the result, that the reductive polarizations and exaggerations from the source of the borrowing (or one of the sources) will be imported along with the core ideas.

None of these seems a worthy reason not to take the risk.

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