a framework the key components that combine to form the complexity of urban phenomena. They shared the same desire for 'global' comprehension that makes their schools of thought compatible. This could provide the basis for convergence towards a shared system: a basis for a unified theory of urban morphology. Conzen revealed his awareness of this in the introductory part of his book, where he notes that 'our geographical comprehension of townscapes is hampered by the lack of a theoretical basis yielding concepts of general application' (Conzen, 1960, p. 3).

From this perspective, a role of primary importance is played by the 'processual' viewpoint, which is unquestionably the soundest, most consistent common denominator between the two schools (Conzen, 1960, pp. 4, 9; Muratori, 1967). However, awareness of the time-spans associated with urban processes raises the issue of the interrelationship of past, present and future. On the one hand, this involves the 'historical' question of the urban forms of the past as a basis for understanding those of the present, and, on the other hand, the 'architectural' question that is posed for those who have to 'plan', that is 'project' (literally 'throw forward'), the present forms into the future. A fundamental issue for architects is that it embodies the dialectical interrelationship of 'reading' and planning (Whitehand, 2012, p. 61). Planning has an ambivalent role: it can be understood and used both as a 'means' (that is as a tool *for* the 'reading') and as an 'end' (that is as an intentional product resulting *from* the reading). Those who do not practice as architects can legitimately find it hard to recognize the role of planning and its importance in the transformation process of the man-made environment (Caniggia, 1976).

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Vegetation as a component of urban form

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In Conzen's formulation the urban landscape (or townscape) comprises three form complexes – land use, building fabric and town plan – and their interrelationship over time. The town plan, in turn, comprises the street pattern, plot pattern and building block plans (Conzen, 1960).

The question arises of how does or should vegetation fit into this established theoretical and methodological framework? This question can be illustrated by an ongoing debate in the British planning system. Does backland development in urban gardens constitute a desirable contribution to the policy goal of encouraging development on previously developed land as part of an overarching strategy of urban concentration? While the debate is in part about maintaining an appropriate level of green space in urban areas and the need to consider the biodiversity benefits and other ecosystem services provided by brownfield sites, it also raises a wider question of whether a garden is seen as an integral part of the urban fabric or as something that has a different, non-urban character. If it is the former, as many would argue, then there should be some identifiable way of incorporating gardens, and

vegetation more generally, into Conzenian urban morphology.

Conzen's studies of Alnwick (Conzen, 1960) and Ludlow (Conzen, 1988), for example, do not address vegetation directly. Open spaces are identified as a distinct land use and residential premises as another, although in the latter case buildings themselves often occupy only a small proportion of the whole plot. In the town-plan analysis of Alnwick the fringe belts of the town are considered but the focus is on the plot pattern, land use and building coverage characteristics of these areas rather than their vegetation.

Conzen's theoretical construction of the three form complexes helps in considering the place of vegetation. Conzen (1988) defines two types of relationships between the form complexes: static and dynamic. In the case of the static links, the hierarchical relationship is essentially spatial such that 'the town plan 'contains' or harbours, and through its plot pattern forms the physical frame of, the land utilisation pattern, and the land use units, each within its own plot, in turn contain the building fabric' (p. 260). In the static links a distinction can be drawn between that vegetation which, like the built fabric, 'fills' plots, for example in parks or residential gardens, and that which was created to, or continues to, fulfil a linear demarcation role, for example as street trees or roadside verges. In the former case vegetation occupies the same position in the hierarchy as the built fabric; in the latter vegetation forms part of the architecture of the framing town plan.

The dynamic links are based on the different rates of change of the form complexes in response to functional demands and are thus temporal or historical. In this case, 'town plan and, to a lesser extent, urban building fabric show considerable persistence of forms, usually over many centuries, compared with land utilisation; thus reflecting patterns of past landownership and fixed capital investment' (p. 255). Here vegetation would seem generally to occupy the same hierarchical position as land use, although where vegetation patterns correlate with plot boundaries and other components of the town plan, a greater permanence in the landscape is likely to reflect that functional role.

Using this theoretical framework it is possible to consider how vegetation is incorporated into the urban landscape. Development, at whatever scale, may entail attempts to create completely new 'plantscapes' or involve use of existing vegetation, for example mature trees along boundaries or as particular features. Conzen (1981) considers how the development of residential accretions by small building firms tended to preserve irregular field boundaries as development progressed 'field by field' (p. 115). It would be interesting to study whether this 'cellular or mosaic pattern' is still observable in terms of the trees and shrubs that can be found in the current landscape as well as in cartographical evidence. If so, then cues from the pattern of vegetation in the landscape would tend to reinforce morphological units.

Thinking instead about ongoing modification, particularly at a small scale, an interesting comparison can be made between the ways buildings and vegetation change. Brand (1995) considers what happens when users take over a building. Its construction is over and it is nominally complete but a new set of processes of adaptation begins. In this insight two different sets of process and agents of change are identified, both involving human actors. By comparison, vegetation will change both through natural processes and as a result of human intervention. Biological processes will result in the death of individual plants and their replacement by others. This may result in a change in the species composition in a particular stand of vegetation as a result of competition or succession, a change in the age profile of particular species or no discernible change, as would be the case with yearly processes of germination, growth, reproduction and death in annual plants. Vegetation may, therefore, exhibit more change than even the Conzenian conception of land use and there is the potential for vegetation patterns to generate more variety, and therefore heterogeneity, in the townscape than is exhibited in the buildings and uses that occupy the same plots.

It appears, therefore, that vegetation can be incorporated into a Conzenian approach to urban morphology. There are established aspects of morphological study which could be focused on the vegetative components of the urban landscape: for example, consideration of the impact on vegetation of extensions and backland developments; the role of vegetation in creating a sense of place and how this can inform practice in conservation and design; and the role of house builders as agents of change exhibited in the types of 'plantscapes' they create. There are also subjects that have not hitherto formed part of morphological study that could be incorporated, such as changing garden practices. However, this is not necessarily a straightforward matter: it raises questions of scale, the definition of change, what conventions are adopted by map-makers regarding the recording of trees and other vegetation and how those conventions vary over

time and between places. It may be partly for these reasons that urban morphologists have so far seldom explicitly considered vegetation as a component of urban form.

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Urban form and energy

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In a recent 'viewpoint' in this journal it was argued that three fundamental issues should be on the urban morphological research agenda for the present decade (Oliveira, 2011). One of these was the development of key cross-disciplinary links between urban morphology and the various fields of knowledge studying the city in order to promote effective integrated research on urban areas.

Energy plays a fundamental role in today's world. The way urban areas are built has a great influence on the present and future demand for energy. The influence on transport demand is mainly expressed in trip generation and on built structures in terms of end uses such as heating, cooling and lighting. Despite the undeniable linkage, scientific research on urban morphology has remained poorly linked with that on energy. On the one hand, urban morphology focuses on the physical stocks of cities and on the processes and actors shaping them, somehow ignoring the issue of urban flows. On the other hand, research on energy has been adopting sectoral visions of the problem and has not been able to deal effectively with the spatial dimension of cities embracing all the different scales. The absence of a comprehensive view has been disabling further advances in shared knowledge and action on energy efficiency and urban sustainability.

Most literature on energy has been addressing one of two scales of analysis. At the city scale, scientific research has been exploring the dichotomy between compact and diffuse patterns of urban development, the variations of density (of built forms and of inhabitants), and the land-use patterns, connecting these aspects with transport (including systems management and the construction of infrastructures). At the building scale, recent research tends to cluster around three main lines of investigation: the establishment of different frameworks for classifying built forms (from an urban energy perspective); the design of innovative methods for estimating the energy consumption of buildings; and finally, the analysis of the potential of buildings for improvement. Despite the remarkable advances achieved at both scales of analysis, the two communities of researchers seem to exist in largely separate worlds. As Batty reminded us, although it might seem strange, there is hardly any work on connecting what we know about the size and shape of buildings to what we know about their location (Batty, 2008).

However, in the last few years, a number of studies have started to address intermediate scales of analysis – between the city, taken as a whole, and the building, seen as a self-defined entity – that have been previously ignored, possibly due to the complexity of environmental processes and the lack of data. Osmond (2010), Bonhomme *et al*. (2011) and Sarralde *et al*. (2011) propose a set of tools that, despite some limitations, do enable researchers and practitioners to start dealing with the issue of energy consumption at intermediate scales. The first of these papers proposes the urban structural