# VIEWPOINTS

Discussion of topical issues
in urban morphology

## Urban morphology and computers 10 years on

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In the last decade there has been a growing interest in the use of GIS in the field of urban morphology. Ten years ago, I wrote in this journal that the potential of the computer is demonstrated, 'not only for the comparison of historical plans but also for visualization and analysis' (Koster, 1998, p. 7). Both in recent issues of *Urban Morphology* and in papers on urban morphology and computers at the Fourteenth International Seminar on Urban Form there have been examples of the use of information and communication technology in this field. Here I should like to refer to a few aspects relating to my current research on 'Paper and virtual cities'.

This is a joint project of the Virtual Knowledge Studio of the Dutch Royal Academy of Sciences and Groningen University. The central purpose of the project is to develop and integrate methodologies that (a) permit researchers to use historical documents more accurately in creating virtual reconstructions, and (b) help users to recognize technical manipulations and distortions of truth used in the process. In a sense the project focuses on the necessary initial processing of source materials that can subsequently be used in GIS research. It accords with the recent shift of focus in GIS from analysis to data sharing.

Computerized techniques, for example in the field of GIS, have created many opportunities to visualize the townscape. According to M. R. G. Conzen (1976), maps such as those prepared in the Historic Towns Atlas programme are a useful basis for further research on built form and socio-economic development. However, reliability is a key issue and is dependent on not only scale but also the measuring techniques used in surveying and the purpose for which the map was produced.

Research on Dutch cities illustrates this. The earliest maps of Dutch cities are from the early-seventeenth century and show the mathematical design of the fortification works as they were laid out by the engineers designing them. These maps represent the new fortification structures accurately, but are less reliable on the rest of the depicted structures (for example, roads and buildings in the city core). In some cases these structures are not even shown. Other maps, such as the cadastral maps, which in the Netherlands date from the 1830s, are accurate in depicting streets and buildings, but in the case of the fortified area only the main structures are shown. Still other maps show both plot structures as well as the bulwarks in great detail but, nevertheless, are very inaccurate.

In the Paper and Virtual Cities project we have created a specialized viewer that shows the Root Mean Square (RMS) error on a map based on the pairs of co-ordinates that are generated in the process of geo-referencing. Visualizing this error is useful in those cases where maps of a city are used at a later stage to produce a visualization of the townscape, for example using three-dimensional techniques. When creating a historical three-dimensional model we are dependent on the precise location of a built-up structure being mapped in order to make it fit with earlier or later periods. Using the RMS error viewer we can tell for each map, or even parts of a map, how accurate it is and how much a chosen point will deviate from its real co-ordinates. Knowing this the researcher can

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decide either to adapt the model or repeat the process of geo-rectification on a specific area on the map. This kind of information is already available in modern GIS but is rarely used owing to the difficulties of visualizing the error.

In the project we have created a toolbox that enables the researcher to annotate maps in a visual way. The user can load a digitized, preferably geo-referenced, map and use the toolbox to draw a separate layer on top of the map. The user can mark points that can be used for geo-rectification. Areas can also be indicated that have a specific characteristic (for example, a plan unit). These data are stored separately from the map and if the map is geo-referenced the data from one map can be compared to those of other geo-referenced maps of the same area. The output layers from this application can be stored on a server so that other researchers can benefit from the annotations. If any GIS connection is required, the application offers an export function to GIS using the Geography Mark-up Language (GML) export format.

In addition to the use of maps and GIS there is a growing interest in the use and application of three-dimensional city models. This type of application is a good way to reconstruct townscapes from the past. The main advantage of this kind of reconstruction is that the user can walk through the scene as if it were a real town, but is able to switch structures (for example, buildings) on and off. In our work on the Renaissance square in Pienza, designed by Bernardo Rossellino between 1459 and 1462, we reconstructed the relevant part of the town centre in order to examine the square from different viewpoints (Koster, 2006a). In the real world of today the view from one of these points is impossible since the town hall is blocking the view. In the digital reconstruction, this building can be ‘switched off’ and we can clearly see how Rossellino originally saw the connection between the façade of the cathedral and the square in front of it.

Since the sources used have varying degrees of accuracy, the end user needs to be able to assess the veracity of the final model. Different colours and hatchings can be used to indicate levels of accuracy. One of the earliest historical models in which this system is used is the NuME project showing a reconstruction of the medieval centre of the city of Bologna (Bocchi, 1999). Depending on the available sources, each object receives a colour and a texture. Buildings or objects that look brownish are those that do not have specific or reliable data available. Another type of presentation was introduced by Harrison Eiteljorg (2000): in some cases only the contour of the building can be seen and the walls are almost translucent.

Such a system can be complemented by a technique that offers a kind of labelling in which each element in the model receives a label that indicates the source. The advantage of such a labelling system is that it can also be used for other purposes. For example, labels can contain dates such as the date of construction or the date of demolition or structural alteration. The software can use these labels to show or hide objects for a certain period chosen by the user.

In the project a step-by-step model was run showing the transformative process of part of Alnwick. This was based on the surveys of Alnwick carried out by Conzen in the 1950s and 1960s and a modern survey by the author in 2004 (Koster, 2006b). Similar models have been used by Polidori and Bachilli (2007) using specialized software.

The labelling of objects within a three-dimensional model can be done using extensible mark-up language (XML). GML is an XML application with a close connection to GIS technology that offers the possibility of describing geographic objects. Using GML we can describe not only plan elements (streets, plots and building block plans), but also the building fabric and land use.

Based on Conzen’s surveys of Alnwick in 1953 and 1964 and my own in 2004, a specific XML application has been developed that enables the user to describe the town plan. Elements to describe the geometry of the objects are taken from the GML specification – for example, those elements that describe a plot by its real-world co-ordinates. However, the plot itself and the properties that are used to describe such a feature have to be defined in a separate language. We can describe the plot in a number of different ways. One description is based on its historical development and contains the succession of owners and their properties over time. It contains different types of information on the owner, such as name and occupation, the buildings and the use of the plot. The historical description will also contain the sources in which the information was found. Another description is concerned with the spatial component of the plot. This includes its area, the building coverage, and the perimeter of the plot and its buildings.

The combination of these data blocks may be imported into the GIS and can be presented in different ways. By presenting a simulation over a given period of time the changing townscape can be visualized. These changes may not be visible from the street. Some kinds of change may be evident only on maps and in building records. Visualization of elements that are only found in written records tends to be difficult, but again GIS can play a role. In a field like urban morphology, in which many different disciplines are involved, each discipline tends to treat the data differently. Whitehand (2006, p. 87) has pointed out that 'greater attention is needed to the building up of conceptual frameworks and the connecting of individual studies to those frameworks'. In order to establish such frameworks researchers from the different disciplines need to be able to use each other's data, but in order to do so these data need to be in a standardized format accessible to others. XML technology is likely to play a major role in this.

The future use of information technology in the field of urban morphology will be threefold. First, the role of GIS will continue to grow. Existing techniques, especially of rectifying historical maps, will improve. Provided that maps are well annotated, comparative studies will become easier with the increased digitization of data. Secondly, there will be increased use of three-dimensional virtual townscapes: improved automated techniques will allow these models to be created faster. Combinations of GIS and three-dimensional townscape models are still rare but a growing interest can be seen in several disciplines. Thirdly, there will be greater standardization of data.

The Paper and Virtual Cities project provides a number of tools to help these developments in urban morphology. It does so by creating a meta-data format that can be used to describe the variety of the townscape and by providing researchers with a number of tools that can be used to annotate the townscape as a whole. The same meta-data format can be employed in analysis and the visualization of data in both two and three dimensions by the use of GIS and virtual reconstructions. Urban morphologists should think about the data structure necessary to store the different datasets and to create the necessary framework. The internet and web technology will help in facilitating the exchange of data in order to undertake more comparative studies.

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# Fringe-belt theory and polarities-landmarks theory

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During the keynote address on fringe belts by M. P. Conzen (2008) at the ISUF conference in Artimino, I was suddenly struck by the great assonance that the fringe-belt theory developed by M. R. G. Conzen (1960) has with Muratorian polarities-landmarks theory (Muratori, 1959). The Conzenian and Muratorian schools have been interrogating each other for some time, and finding affinities (see, for example, Kropf, 2004; Marzot, 2005). But I had never noticed before that these two theories, both fundamental to the study of urban form, shared so many aspects as to be considered almost complementary.

The interpretative tools obviously differ, because of the different objectives of the disciplines involved – geography and architecture. Yet points of contact and exchange are numerous. This may relate to the considerable degree of independence that the Conzenian and Muratorian schools seem to have from their specific disciplinary backgrounds. What they share with one another are major common values and a common interest in 'reading' the development of urban form in a temporal-relational perspective.

Muratorian theory recognizes basically two kinds of polarities-landmarks: 'inner' ones, with civil characteristics, and 'external' ones, with specialist characteristics. In the inner ones there is recognition of the *civitas* in the *urbs*, that is to say the town as the embodiment of its citizens and made up of its public structures. To both of them we owe the co-ordination of urban fabrics. In the case of the external ones, however, the role of functional exchange between the town and its territory is also important. In such a category would be a monastic complex, but it would also include, for example, a hospital, lazaretto or another structure requiring a large inexpensive land parcel. Such features occupied and fixed the urban 'boundary' at a particular time as a fundamental place of contact between town and country. In general it is the polarities that set in order and hierarchize urban fabrics, while the landmarks define their 'architectonic presence' in the town. The latent basis of urban form evolution lies in the dialectic between inner and external (civil and specialist) polarities. And it is exactly on this subject that the comparison with fringe-belt theory has force.

The specialist (external) polarities-landmarks are generally situated inside a fringe belt. The monasteries of the inner fringe belt of Koblenz are an example, as are the Mendicant Orders located at the edge of thirteenth-century towns and contributing to the urban fabric of these towns in a vital way (see, for example, Guidoni, 1985). The principal churches were located in the inner fringe belt as major external, specialist landmarks. As the towns grew and reorganized they became inner civil landmarks and a new 'boundary' and a new fringe belt were created farther out. Most striking are the traces of the fourteenth-century San Giacomo Hospital and the sixteenth-century College of St Atanasio dei Greci left behind in the expansion of the Trident of Campo Marzio in Rome (Maretto, 2008, pp. 146-53). Another example is the town of Chioggia. Here the first urban limit is marked by the presence of a series of convents at the edges (inner fringe belt?) of the two main islands. The second one consists of two external 'specialist islands' – L'Isola dei Cantieri (Shipyard Island) and the Isola dei Magazzini (Salt Warehouse Island) (see, for example, Maretto, 2005).

Generally speaking, if we confine our analysis to pre-twentieth-century cities, the limit marked by the external polarities-landmarks represents a kind of 'architectural translation' of the Conzenian fringe belt. These are preliminary thoughts, but there are attractive possibilities for extending them further.

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# Urban morphology, historic urban landscapes and the management of historic cities

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A recent editorial in this journal focused on the gap between research and practice in urban morphology (Whitehand, 2007). In the case of historico-morphological aspects, it drew attention to the desirability of links with supranational organizations concerned with urban conservation. For the past decade I have been engaged extensively as an international consultant by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and partner organizations on assignments related to the management of historic cities. As such, I should like to take up the invitation at the end of that editorial to comment on developments in UNESCO that are pertinent to practical applications of urban morphology.

Urban morphology is little recognized, understood or applied in relation to the management of historic cities in my country, the United Kingdom. By comparison, in France and Italy urban morphology (whether expressed as such or not) has been a cornerstone of strategic urban planning and conservation policies and practice since at least the 1960s. In these countries safeguarding the panorama of cities as well as their urban grain and functional diversity has been the norm rather than the exception. One has simply to compare the urban landscape of Paris with that of central London, or the conflicting scales and limited range of activities in the historic core of York with the smaller scale multi-functionality of a parallel cathedral city such as Chartres, to note the differences (Rodwell, 2007b).

The concept of *historic urban landscape*, as adopted and promoted in recent years through UNESCO and supported by the International Council on Monuments and Sites (ICOMOS), is an attempt to articulate an overarching tool that comprehends the holistic management of historic cities: from the protection of their visual image; through the conservation of their historic built environment and its enhancement by way of appropriate contemporary interventions; to continuity of the socio-cultural human activities that constitute an indispensible component of its sense (or spirit) of place (Van Oers, 2006).

At the global scale, the practice of urban conservation – as opposed to the preservation of individual monuments and ensembles treated in isolation – is a relatively young discipline that has few internationally agreed principles, let alone tools. In the United Kingdom, the two principal ingredients are *architectural and historic interest* and *streetscape* (or *townscape* – arguably a misnomer) and the protective system is fragmented: limited to individually identified listed buildings and conservation areas. There are no policies or guidance – and no perception of the need for them – that deal with historic cities as a whole (Rodwell, 2007b, 2008b).

Initially across much of Europe and North America, then by globalizing extension across the continents, planning theories based on the separation of functions (land-use zoning) and the concentration of high land values in the centres of cities have tended to focus commercial pressures for development into their most sensitive historic areas. Add to this the current fashion for iconic modern architecture that ignores its context and one has a heady cocktail for conflict.

The conflict, however, is not just physical – a question of tall and out-of-scale buildings or inconsiderate design, materials and colour. The notion behind the holistic management of historic cities is to secure their evolutionary development, taking into account issues of ecological sustainability as well as geo-cultural distinctiveness and identity. It is as much people-driven as it is artefact-driven: focused on the inhabitants and others who conduct their daily lives within historic cities, without which they serve a limited range of activities and lack the essential ingredients of spirit of place. A historic city that is overtaken by tourism, for example, 'may preserve the container, but what about the contents' (Rodwell, 2008c)? An anthropological approach – one that is directed towards identity, sense of belonging, creative continuity, and the dynamics of socio-economic processes and evolving human aspirations – is increasingly recognized as the way out of the received notion amongst conservators and their peers that 'the city is a monument; unfortunately it is inhabited' (Rodwell, 2007a, 2008a).

The sequence of international conventions over recent decades has disclosed a considerable progression and enlargement of perceptions. The 1972 UNESCO World Heritage Convention only categorized *monuments*, *groups of buildings* and *sites*. In 1992, *cultural landscapes* were defined; in 1994, *authenticity* was reassessed to become more geo-culturally inclusive; and in 2003 and 2005 respectively, *intangible cultural heritage* and *cultural diversity* were recognized by UNESCO conventions (Rodwell, 2007b). In 2005, *historic urban landscapes* came to the fore through the UNESCO Vienna Memorandum – essentially as a holding measure that responded to a specific set of circumstances at that time (Rodwell, 2006; Van Oers, 2006).

This progression may, in the overall scheme of things, be considered rapid, but in terms of the threats posed by negative pressures it has, especially since the early 1990s, lagged behind. The pace of change and the dynamics of development in historic cities have accelerated, as have demographic and socio-economic changes especially in many non-Western countries (including the Eastern Bloc of Europe); high-rise and iconic contemporary architecture are aspirational tokens of modernity to cities as diverse as Liverpool and St Petersburg (Rodwell 2007a, 2008b); additionally, international tourist numbers are forecast to double by 2020. In short, the challenges facing the tangible and intangible heritage of historic cities today threaten to be overwhelming and the instruments and tools to respond to them are lacking.

It is within this context that the UNESCO initiative on historic urban landscapes has gathered momentum. Since 2005, regional meetings have taken place in Jerusalem, St Petersburg (Rodwell, 2007a) and Olinda, all with the view to refining a definition of the term and elucidating a management tool kit. The current proposal is to submit a formal UNESCO recommendation on the safeguarding of historic urban landscapes for adoption by the UNESCO General Conference in 2011. This recommendation will apply to historic cities wherever they are in the world; concurrently, management guidance for cities that feature on the World Heritage List will be reformulated.

It hardly needs stating that the historic urban landscapes initiative is underscored by a high level of ambition. The concept is beyond the comfort zone of established, specialized disciplines: not least, traditional scientific approaches to the conservation of historic monuments as artefacts. The process to date, therefore, has involved many corporate and individual partners working to common purpose: debating how best to protect historic cities whilst not inhibiting their constructive, positive development.

Urban morphology – interpreted as a discipline that has the potential to embrace not simply a two- and three-dimensional methodology that studies and characterizes the physical evolution of historic cities, but one that facilitates a fuller understanding of their functional and socio-economic evolution – has a major contribution to make in the sustainable evolution and development of historic cities worldwide. Personally, I am very keen that the discipline is embraced and challenged by a wider audience.

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## Change of Book Review Editor

Dr Piper Gaubatz has completed her term as Book Review Editor of *Urban Morphology*. Her successor is Dr Ian Morley, Department of History, Chinese University of Hong Kong, Fung King Building, Shatin NT, Hong Kong (E-mail: ianmorley@arts.cuhk.edu.hk). Future correspondence concerning book reviews and books intended for review should be sent to Dr Morley.