

Comparative Precedents on the Study of Urban Morphology

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Abstract

The theories and practices of urban morphology have been widely discussed across disciplines. It is difficult to categorise the research of urban morphology across these many fields. Scholars express their understanding in different ways and from various perspectives. This paper attempts to synthesize comparative morphological precedents in the context of geography, architecture, science and philosophy. Examples are carefully selected to interpret achievement in particular fields. Conzen's and Caniggia's works are extensively recognised as the Conzenian and Caniggian traditions in aspects of geography and architecture. However, the most recent and successful 'Microsoft' of urban morphology, space syntax, has an approach to urban form that is different to any previous tradition. Through comparison of those emerged conceptions, this paper will reveal the emphases placed on morphology in different research areas. It is argued that these theories and methods are not exclusive and independent but essentially related which could be complementary for each other. Their mutual interplay on the future morphological analysis is expected.

Comparative Precedents on the Study of Urban Morphology

The study of urban morphology has fascinated numerous scholars since the formation of cities. In an early stage the pictorial records of urban settlement are astonishingly rich and varied, and convey the concept of urban morphology in embryo. Cartographical images are also crucial for analytical deconstruction of urban formation centuries ago. In the twentieth centuries, two mainstream schools have prevailed in this field of urban form analysis, lead by M. R. G. Conzen (1907-2000) and Gianfranco Caniggia (1933-1987). In the late of twentieth century, a new and innovative system of theories and techniques, known as 'Space Syntax', emerged for the quantitative analysis of spatial configuration and it has been celebrated for its scientific precision applied morphological studies.

Generally the genres of these studies can be categorised into four groups according to their concerns in diverse disciplines, namely geography, architecture, science and philosophy (FIGURE 1). In the field of urban geography, the Conzenian School acts as the representative idea yet the Caniggian School takes the central role in the respective of architect. Bill Hillier's Space Syntax investigates the morphology of cities from a wholly new view in a mathematical way that resembles a Science of power relations. Henri Lefebvre's (1901-1991) philosophy states that space is not a neutral entity but a social existence and attributes the space a social explanation. Hillier attempts to measure, even quantify that.

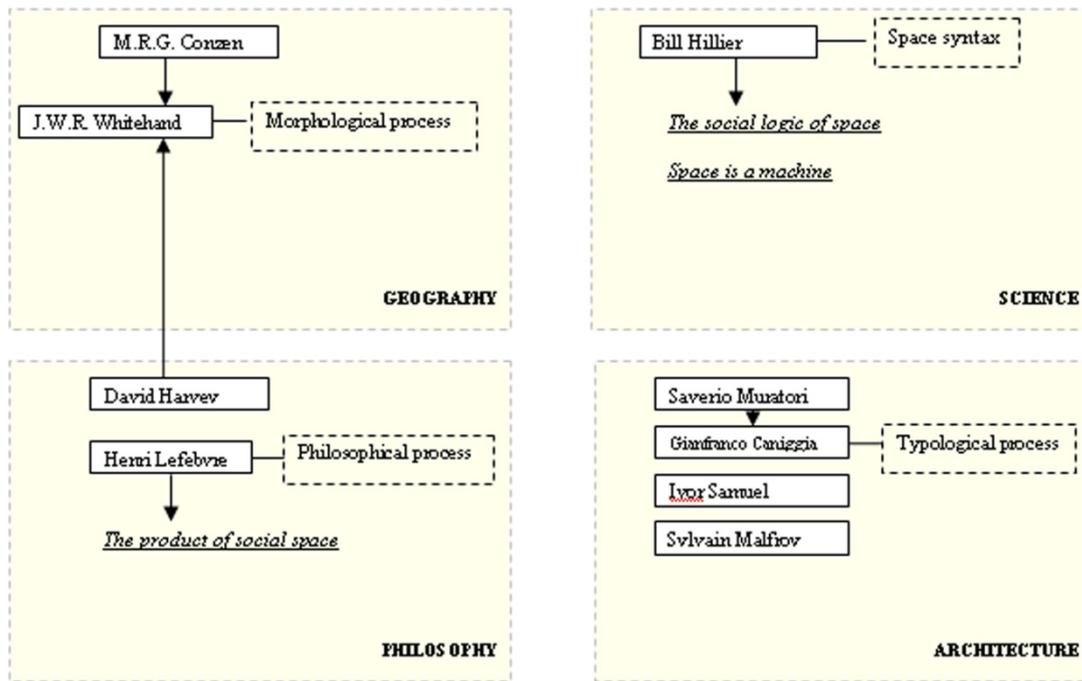


Figure 1
Genealogy of study in Urban Morphology

1.1 Urban Representation

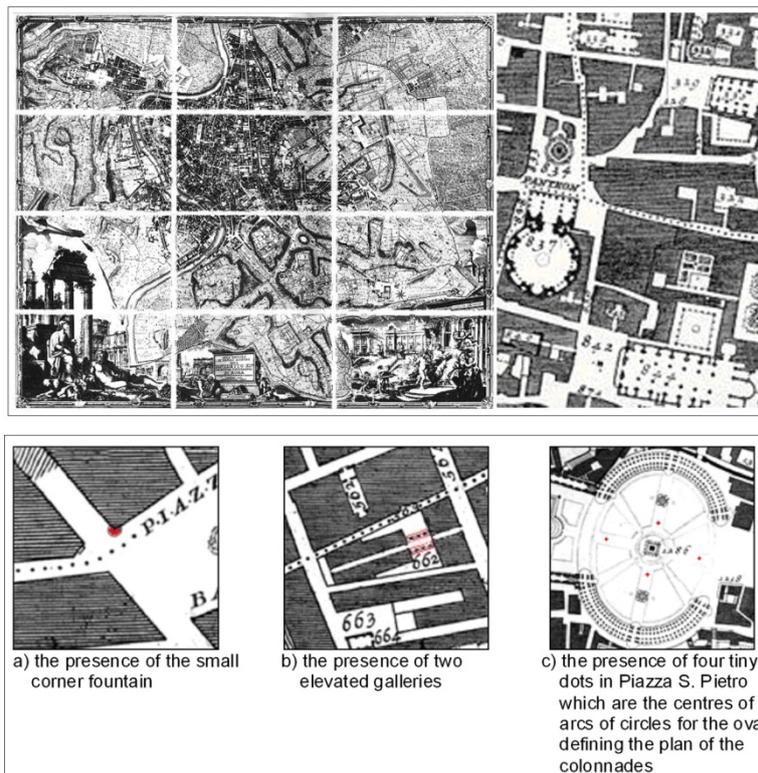


Figure 2
Upper Left -Nolli map (1748); Upper Right - Detail from the Nolli map depicting the Pantheon (12 copper plate engravings that together measures 176x208 cms and was published in response to the commission of Pope Benedict XIV to survey Rome in order to help create demarcations for the

14 traditional rioni or districts); Below-Representation of urban features in Nolli's map.

In advance of further morphological analysis, the first and most important consideration is how to represent the space in a discernible pattern. Ichnographies provide a concise way to depict urban fabric, while axonometrics and aerial photographs expand the understanding of urban space in the third dimension. A paradigm was set by Giambattista Nolli who undertook the survey of Rome from 1736 and engraved the entire city in 1748¹. His work is now universally known as the Nolli map (Figure 2). This set of maps has been deemed as the ideal figure-ground image for urban representation. This creative work was enlightened on Bufalini's map of 200 years earlier, however Nolli made a number of innovations. Firstly, he reorients the city from east (which was conventional at the time) to magnetic north, reflecting his reliance on the compass to get a bearing on the city's topography. Secondly, though he followed Bufalini in using a figure-ground representation of built space with blocks and building shaded in a dark poche Nolli represented enclosed public spaces such as the colonnades in St. Peter's Square and the Pantheon as open civic spaces. Thirdly, the map was a significant improvement in details and accuracy, even noting the asymmetry of the Spanish Steps. The influence of the Nolli map persisted well into 20th century. Indeed the Roman municipal government used it as a base map of the city until the 1970s.



Figure 3

Cartographical symbols from Nolli's map.

In Nolli's map various cartographic symbols are used to indicate a variety of features (figure 3), intuitively easy to understand, including drains (open and closed), soldiers' billets, cemeteries and separating boundaries between Rioni (dotted lines). Dark grey hatching is for modern building fabric, white for open space. Ancient monuments are rendered in darker grey or black indicating extant ruins, while a white outline suggests hypothetical plans of ancient monuments that no longer exist (famously Nolli incorrectly speculated about the orientation of the Theatre of Pompey rotating it 90 degrees off its true position). A series of textured s-shaped curves are used to indicate contours or slopes (contours were not in common use until the turn of the 19th century). In addition, gardens (and a variety of differing plant materials and cultivation patterns are noted), paving patterns, the river (and its direction of flow) are all carefully rendered. Nolli also adopted a numerical indexing system which includes 1,320 sites, topographically arranged by administrative region or Rioni.

Nolli presented a treasure of information by his figure-ground maps in 1748. They combined a sophisticated iconographic schema, a precise technical scale and accurate north arrow, illustrative

cartographic symbols, detailed numerical indices and textual labels that provide an exhaustive explication of Rome and its social, artistic and scientific context. However he did not attempt to analyse deployment of urban features, the relationship of solid buildings and open spaces, and the possible social meaning underlying the images. Nevertheless he provided par excellence a base map for representing urban fabric through which we might get a better perspective of review on contemporary urban form. In the next section we would like to refer to some studies which focus not only on the reproduction of legible maps but also analysis of urban transformation.

1.2 Morphological and Typo-morphological Analysis

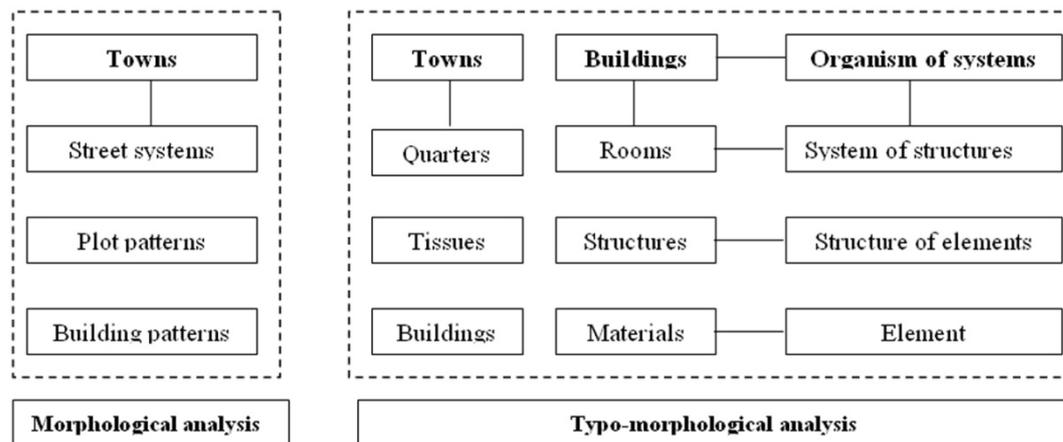


Figure 4

Left - Hierarchical level of urban system in the morphological analysis; Right - Typo-morphological analysis.

Major practice in the analytical aspects of urban morphology began in European countries in the twentieth century. In the light of hierarchy of built form, the methodology in the precedent research subsumes morphological and typo-morphological analysis (Figure 4). The system of morphological analysis regards the street system, plot pattern and buildings pattern as an integral part of the town plan which took form and was transformed in the process of urban evolution. It started from the point of the geographer's view and had a focus on the explanation of those urban elements which are integral to the urban structure. The typo-morphological analysis, however, is different in regard to the classification of the hierarchy of subdivision in the urban system. Typo-morphological approach took elements, structures of elements, organism of structures as the components of the urban structure when applied to individual buildings and towns. For individual buildings, the elements represent the building materials, the structures of elements correspond to the walls and the organism is thus the entire buildings. For towns, the subdivision is similar with that of the morphological analysis, which is the buildings, urban tissues and the arrangement forms of urban tissues in a region or district. The morphological subdivision is usually adopted by geographical researchers, but the typo-morphological subdivision is taken by architectural generation.

These two types of morphological investigation that are characterised as the study of urban space and architectural typology give emphasis to the analysis of town plan and internal structure of urban fabric respectively. For example, Conzen (1960) and his study in town plan analysis of Alnwick; Saverio Muratori (1960) and historic typological research in the lagoon town of Venice; Caniggia (2001) and the interpretation of basic building Alinea Editrice in Firenze; Bruno Fortier and the atlas of Paris (1989).

Conzen's contribution is principally on the use of town plans as a source for historical morphological research. From a geographer's perspective he insisted on looking at the buildings and plots at the same time as an integrated entity and defined the street, plot and building as a

plan unit. This plan unit is recognized as a unitary area in respect of their ground plan that is distinct from neighbouring areas. These units are explicable in terms of the circumstances of their development through a long period. By employing the concept Conzen developed the important ideas of 'burgage cycle' (Gauthiez 2004) and 'urban fringe belt' for the planning process.



Figure 5

Quarter of S. Bartolomio in the city of Venice, in 11-12th, 14th, 16th century, and current situation (1950c).

The historic typological study of Venice was held in the four-year term (1950-54) leading by Muratori. Here he re-examined the first urban surveys of the city and construct the first systematic survey of a town's historic building internally. It made a comparison between the centuries on the internal structure of architecture in selected urban quarter (FIGURE 5). Though this is a gorgeous study about the Lagoon city, it seems in this research architectural typology was the only concern yet there was nothing about the building function.

In Caniggia's work the main concern was to transmit Muratori's ideas in architectural terms, starting from the conviction that their diffusion was somehow obstructed by comprehension difficulties inherent in Muratori's thought. Caniggia therefore tended to simplify and reduce the theoretical system, highlight its more directly operative aspects. In this sense, significance lies in the use and importance in his writings of the terms and concepts of 'type', 'building fabric' and, above all, of 'basic building', intended as the formative matrix of specialized building. It was not by chance that Caniggia used the last expression instead of 'architecture' (Cataldi, Maffei and Vaccaro 2002).

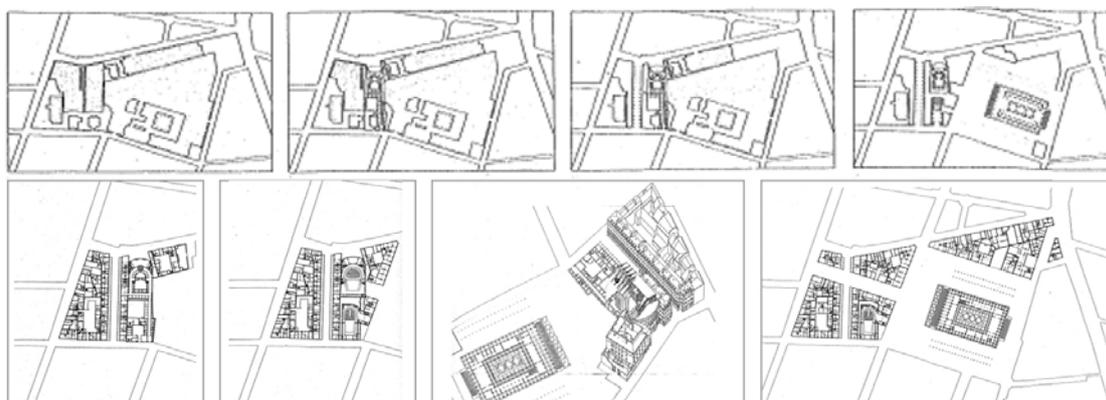


Figure 6

The quarter of the Bourse from Atlas of Paris.

The most challenging piece of Fortier's Atlas of Paris (figure 6) is the rudimentary thought on the relationship between urban form and architecture, though he was neither fond of the typomorphological approach nor interested in the relationship between 'morphology' and 'typology'.

Starting with the urban evolution of the site around nineteenth century before considering the major architectural features, Fortier studied some twenty small fragments of Paris internally in minute detail even by axonometric image, involving a passage, a hotel and a bridge. This study is a kind of those by Muratori and Giancarlo Chastel which is to define what a city is made of rather than the analytical work of how things changed — its formation and transformation through nineteenth century. Unfortunately Fortier did not give too much explanation on the geometrical beautiful plan with architectural detail about the reasons of its urban evolution and never really developed the idea of the typo-morphological relationship.

1.3 Space Syntax and Urban Morphology

Space syntax is a theory for the investigation of society-space relationship recent developed by Hillier (1984). It provides a theory of interpreting the social relation and spatial form through a series of derived maps. This theory unravels the hierarchical level in a certain area or inside a building. It established 'a descriptive theory of how spatial pattern can, and does, in itself carry social information and content'. The work of Hillier contributes to occupy the absence of 'a consistent descriptive account of the morphological features of man-made space that could be lawfully determined by social processes and structures'. He develops a 'shape-free' methodology of drawing to represent the spatial relations which could render nearly obvious the observable facts that had previously appeared puzzling or anomalous. He did also try to explain interface maps in terms of social structure. It is argued that 'while different in kind, a further instance of the principle that spatial organization in society is a function of differentiation principles of social solidarities in relation to one another, whether this is a complementary relation or, as now, a class relation' (Hillier 1984).

The method of analysis in Hillier's theory uses the generative syntax to establish the description of spatial order. A model for syntactic representation, analysis and interpretation-alpha analysis has been proposed to represent the continuous open space graphically and describes the spatial problem in a structured and quantitative way. The procedure for analysis is set out to derive a series of map (convex map, y map, axial map, interface map, converse interface map, decomposition map and its converse) on the basis of an accurate map with all entrances to buildings marked (Figure 7).



Figure 7

Syntactic represented maps, based on a small town in the Var region of France; showing convex map, axial map, y-map, interface map and converse interface map respectively.

The numbers on these maps are the numerical side of the syntactic analysis which might quantify the results of visual maps. This method is not only used to analyse the grand plans for urban space but also to experiments with individual.

The theory of space syntax has been immensely influential and there is tendency to study the urban morphology of cities by virtue of this method in diverse concerns, sometimes integrated with

GIS (Jian and Claramunt 2002).

Kubat, for example, applied syntactical analysis to Istanbul's old centre in the context of several cultures: Roman, Byzantine, Ottoman and Turkish. The result argued that spatial continuity in the layout of this symbolic city was obvious over a long period and influences of different cultures by representing and analysing the open space map, axial map and convex map of Istanbul in 1922.

Portaa, Crucittib and Latora's concern is to analyse urban streets by means of 'space syntax' methodology. Rather than in previous works what some structural properties were derived from the primal graph representation of urban street networks, they introduced multiple centrality assessment (MCA), providing in-depth investigation of centrality in the primal approach, which provides a different perspective from space syntax. This experiment was carried out on four 1-square-mile samples of urban street systems over primal and dual graphs and the results show that it is possible to distinguish between homogeneous and heterogeneous patterns.

Jiang and Claramunt made an attempt to integrate space syntax into GIS. They proposed an alternative model of space for the application of space syntax principles with the aim of improving the axial line representation. They applied this model to a Swedish city to verify their method, which surpasses the traditional axial line technique.

It is undeniable that the appearance of space syntax is a revolution in the field of urban morphology and illustrates the relationship of social power and spatial form through a set of 'shape-free' maps. The quantitative analysis gives a scientific and apparently convincing explanation for the meaning of urban space in terms of social hierarchy that was transferred through a sense of qualitative analysis.

1.4 Comparative Conclusion and Forward Glance

The previous morphological studies could be interpreted as Image Representation, Spatial Interpretation and Social Cognition after their research emphases. The pure Image Representation existed before twentieth century. At that time the analysis of urban morphology has not emerged yet, though the idea of urban form has begun to appear. In this stage the images of city were only produced to record the reality faithfully. Although these fine works did not imply any critical analysis, it presents the original urban form which provides evidence and possibility for historical research on urban morphology in later year. Actually an understandable representation of city image is the first and vital step to employ morphological analysis as did in Nolli's Map.

In the twentieth century the research of urban morphology came into a prosperous stage. Most of theories and methodologies evolved in this period. They are developed in parallel in various fields. Scholars from Geography, Science and Architecture share the theme of 'Spatial Interpretation', which is investigating the urban form from the spatial layer only. They examine on the physical form of cities and attempt to find a regular pattern of urban growth, for an instance the 'Burgage Cycle' and 'Fringe Belt' from Conzen's theory. The social relation of urban space is not their concern even it has influenced on the formation of city. However, in this aspect, the philosophers run to the other extreme. David Harvey (1935-) and Henri Lefebvre induced social theories for urban space but with no consideration of a certain space. This Social Cognition actually has been well-developed by those philosophers and could be applied on the social reading for urban physical form. Unfortunately no such precedents appeared to integrate those theories and methodologies which relate the transformation of urban space with its social relations. The current studies confine themselves to respective discipline with the isolation of spatial analysis from social aspect.

Reviewed on the precedents, there is already the empirical and practical accumulation for the collaboration of urban morphological study across disciplines. The future of morphological analysis has solid foundation for both spatial analysis and social reasoning. This is supposed to be a comprehensive program which is starting from the representation and spatial interpretation, then reaches to the social meaning.

Notes

- 1 Also Giovan Battista Nolli, who was an Italian architect and surveyor. He is best known for his ichnographic plan of Rome (the Pianta Grande di Roma).

References

- Caniggia, Gianfranco, and G.L. Maffei. 2001. *Architectural composition and building typology: interpreting basic building*. Firenze: Alinea.
- Cataldi, G., Maffei, G.L. and Vaccaro, P. 2002. Saverio Muratori and the Italian school of planning typology. *Urban Morphology* 6 (1): 8.
- Conzen, M. R. G. 1960. *Alnwick, Northumberland: a study in town-plan analysis*. G. Philip.
- Fortier, Bruno. 1989. *La metroole imaginaire: un atlas de Paris*. Mardaga, Bruxelles.
- Gauthiez, B. 2004. The history of urban morphology. *Urban Morphology* 8 (2): 78.
- Hillier, Bill, and Julienne Hanson. 1984. *The social logic of space*. Cambridge University Press.
- Jiang, B., and Claramunt, C. 2002. Integration of Space Syntax into GIS: New Perspectives for Urban Morphology. *Transactions in GIS* 6 (3): 295.
- Muratori, Saverio. 1960. *Studi per una operante storia urbana di Venezia*. Istituto poligrafico dello Stato: Libreria dello Stato.