

Chapter 12

URMOPRO: An Example of an Urban Ontology for the Formalization of Morphological Processes

Eduardo Camacho-Hübner

12.1 Context

The urban morphological processes ontology (URMOPRO) has been developed to find an intermediate level of abstraction between the quantitative measures and the conceptual frameworks needed to understand the observable changes in the cityscape (i.e. morphological processes). The domain of application of this ontology is urban morphology research.

12.2 Purpose and Aims

The primary purpose of this ontology is to structure the morphological knowledge to explore urban historical databases characterizing morphological processes. Two main aims can be addressed here: first, to define the hierarchy of concepts available from morphological literature to build a primary corpus; and, second, to explore systematically the relationships between these concepts in three main directions—temporal structure, geographical scale and levels of aggregation of morphological processes.

The secondary purpose is to use the ontology to develop an exploratory approach helping end-users to understand the relationships between the different levels of abstraction involved in the description of the city form and to explore new relationships using their own capabilities and experience in the field.

E. Camacho-Hübner (✉)
Région de Genève, Suisse
e-mail: eduardo.camacho-huebner@transitec.net

12.3 Scope

12.3.1 Conceptual Boundaries

Here, the boundaries of the conceptualization are understood not only as a technical matter, but as an epistemological issue of how our knowledge can evolve. The main question is to know how can we deal with the changes of users (point of view) and the changes of paradigm (conceptual changes).

The specific concepts describing the evolution of urban forms come from many different sources and are neither totally shared nor fully characterized by the researchers in this discipline. The way our comprehension of the complexity has evolved during the process of production influences the way we define the stakes of this comprehension. The main boundaries are therefore those of the evolution of the conceptualization of the city through history. Is it necessary to freeze the conceptual framework to test hypothesis or is it during the process of conceptualization that the relevant questions emerge to the observer of these phenomena?

12.3.2 Geographical Scale

The geographical scale of the ontology is an intrinsic problem of the definition of the processes we are interested in. All the usual scales of urban phenomena should be taken into account (from typological distribution of inner spaces to landscape), but we have to deal with the lack of knowledge of the relationships between these different scales. We are interested in the problem of geographical scale as a “conceptual shift” between the usual scales of analysis and the relevant points of view (emergent scale) necessary to grasp the phenomena related to the urban conceptualization. To study this, we have started by giving a maximum relevance to the cadastral scale in which the main relationships can be reduced to three main classes of objects as it is often described in the morphological literature (plots, buildings and street systems). Then we have elaborated a set of extensions from this cadastral scale to take into account the links between the processes observed and the evolution of forms at larger (i.e. typological scale) and smaller scales (i.e. urban fabric and landscape).

This approach has been a good starting point to keep the idea of changes of scale as a change of point of view and has therefore been useful to epitomize the question of what kind of process does the scale shift illustrates into the field of morphological analysis of the city.

12.3.3 Time Frame

The temporal question has also been a central point in the construction of historical process based ontology. The main idea is to explore the evolution and enrichment of

the conceptualization of the cityscape. Instead of defining a single period of validity or unalterable conceptualizations through time, we have introduced the idea of an epoch-oriented construction to seize the complexity of the relationships between the comprehension of an urban phenomenon at a given period of time and the universe of discourse produced at this same period of time to describe and typify this phenomenon. Thus, by leaving the scope open to complementary knowledge contributions or new rearrangements of concepts, we try to respect the ideas on the evolution of ontologies and concepts defined as the main hypothesis of this work. The formal modelling of these evolutions is still an open problem needing further developments.

12.4 Actors

12.4.1 Stakeholders

This ontology has been developed mainly for research purposes. But, even if at this stage it is still difficult to define other end-users than researchers, the main partner of this work is the heritage conservation department of Geneva in Switzerland – Direction du patrimoine et des sites.¹ This ontology might therefore be useful for conservation issues.

12.5 Methods of Development

12.5.1 Approaches

Two complementary approaches were considered during the process of construction of the ontology: the top-down approach aiming to characterize the morphological processes defined in the literature (Fig. 12.1), and, the bottom-up approach, using the systematic exploration of the historical database to find out if new concepts and relationships were needed to grasp the complexity of the evolutionary processes of the city (Fig. 12.2).

12.5.1.1 Sources

The sources used for the top-down approach are glossaries and dictionaries of urban morphology and historical geography. These sources are (de Dainville 1964; Larkham and Jones 1991; Caniggia and Maffei 2001; Gauthiez 2003; Conzen 2004).

¹<http://etat.geneve.ch/geopatrimoine/viewer.htm>

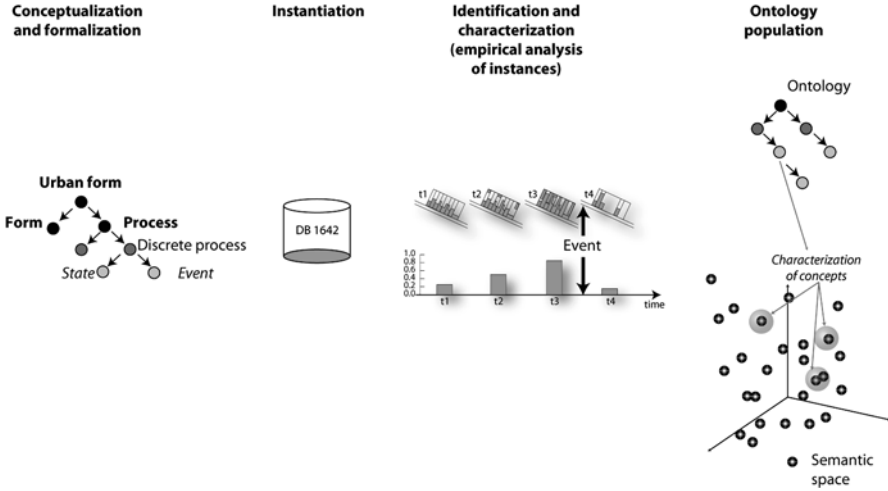


Fig. 12.1 Top down approach

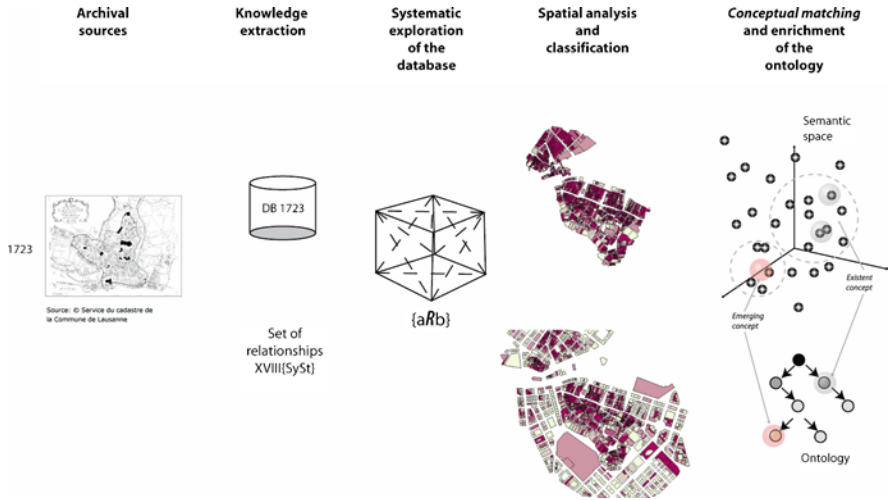


Fig. 12.2 Bottom-up approach

12.5.1.2 Tools

The URMOPRO ontology has been developed under Protégé version 3.1.1.²

²(<http://protege.stanford.edu/>).

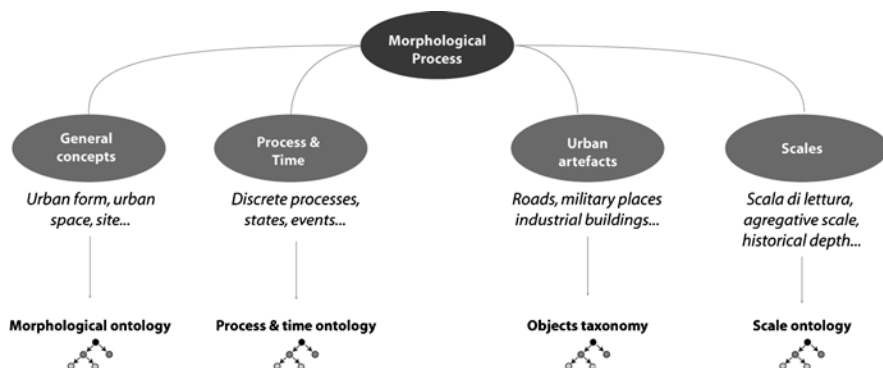


Fig. 12.3 Conceptual structure

12.6 Contents of the Ontology

The urban morphological processes ontology is structured as follow: general concepts of the morphological field, process and temporal structure of urban evolution and transformations, scale(s), secondary classification of urban artefacts (buildings, roads...) and relationships between concepts (mereological, temporal, topological and semantic relationships).

Figure 12.3 illustrates the structure of the first level of the conceptual mind map used to structure the ontology of morphological processes. Each branch resumes the main concepts related to the general description of the ontology, the formalization of the concept and the characterization of different cases observed in the database.

12.7 Usability

No usability tests have been developed yet. The ontology should be implemented in a next stage into an exploratory interface to help management and visualization of the morphological knowledge. Usability tests should be integrated to these future developments.

12.8 Benefits

The main benefits of this conceptualization are:

- Empowerment of the researchers in the field of the urban morphology by determining different levels of complexity of the urban phenomena.

- Definition of a common ground that helps dealing with the linguistic and semantic differences of the same discipline.
- Links between the highly cognitive and speculative tradition in the study of the city and empirical methods of analysis helping to characterize complex processes.

12.9 Lessons Learned and Perspectives of Improvement

As our work is the first step in the development of an ontology for the formalization of morphological processes, it is mainly determined by a qualitative heuristic approach. It is still too early to give a useful critique of the adopted method, but we can nevertheless highlight some of the difficulties encountered. Each one of these difficulties offers very interesting hypotheses for future developments and improvements:

1. Managing the right level of conceptual complexity between both contradictory points of view of the morphological approach: reductionism and relativism. These include temporal, scalar and cognitive issues determined by the contextual emergence of the knowledge.
2. Sources come from three main schools of morphology, mainly French, Italian and British sources. They are therefore charged with an important cultural load due to the fact that these schools depend on the territorial traditions of each country in which they have been developed. The resulting conceptualizations provide excellent examples of translation problems, not only from one language to another, but also from one conceptual framework to another.
3. Conceptual stability issues. As urban morphology has very strong historical roots, there is a high probability of redefinition of the conceptual framework, as far as new sources are studied or new points of view developed.
4. Finally, the capacity of innovation and/or redefinition of the urban form by addressing original or pioneering responses define the main limit to the completeness of the system of knowledge structured in an ontology.

References

- Caniggia, G., Maffei, G.L.: *Architectural Composition and Building Typology: Interpreting Basic Building*. Alinea Editrice, Firenze (2001)
- Conzen, M.P. (ed.): *Thinking about Urban Form: Papers on Urban Morphology* by M.R.G. Conzen. Peter Lang, Bern (2004)
- de Dainville, F.: *Le Langage des Géographes*. Picard, Paris (1964)
- Gauthiez, B.: *Espace Urbain, Vocabulaire et Morphologie*. Monum, Editions du patrimoine, Paris (2003)
- Jones, A.N., Larkham, P.J.: *Glossary of Urban Form*. Historical Geography Monograph no. 26, Geo Books for the Institute of British Geographers' Historical Geography Research Group, Norwich (1991)