

Time series on urban data

(ESPON M4D, Géographie-cités, June 2013 delivery)

1. Conception of the urban object over time

As a preamble to the question of times series on urban data, we will remind the steps that underlie the building of databases and that become fundamental

- when they concern the city that is a complex object
- and when they have to integrate the time dimension that needs an harmonisation of the objects.

We identify three steps: the conceptualisation step (what is a city?), the methodological specification step (which process for defining the city?) and the implementation step (how to process automatically the specification, using which sources?).

Furthermore the city seen as a geographical object is an evolving one from two points of views:

- It is the result of a dynamic process of concentration, which leads to a sprawl from the centre to the periphery. It's geometrical delineation is changing over time.
- the city definition evolves over time, based first on morphological considerations (continuity of the built area), then based on employment polarization (commuters).

Another complexity of this geographical object concerns the elaboration of statistics at the city level: it implies to consider the geometry of the city as an aggregation of elementary entities for which statistics exist.

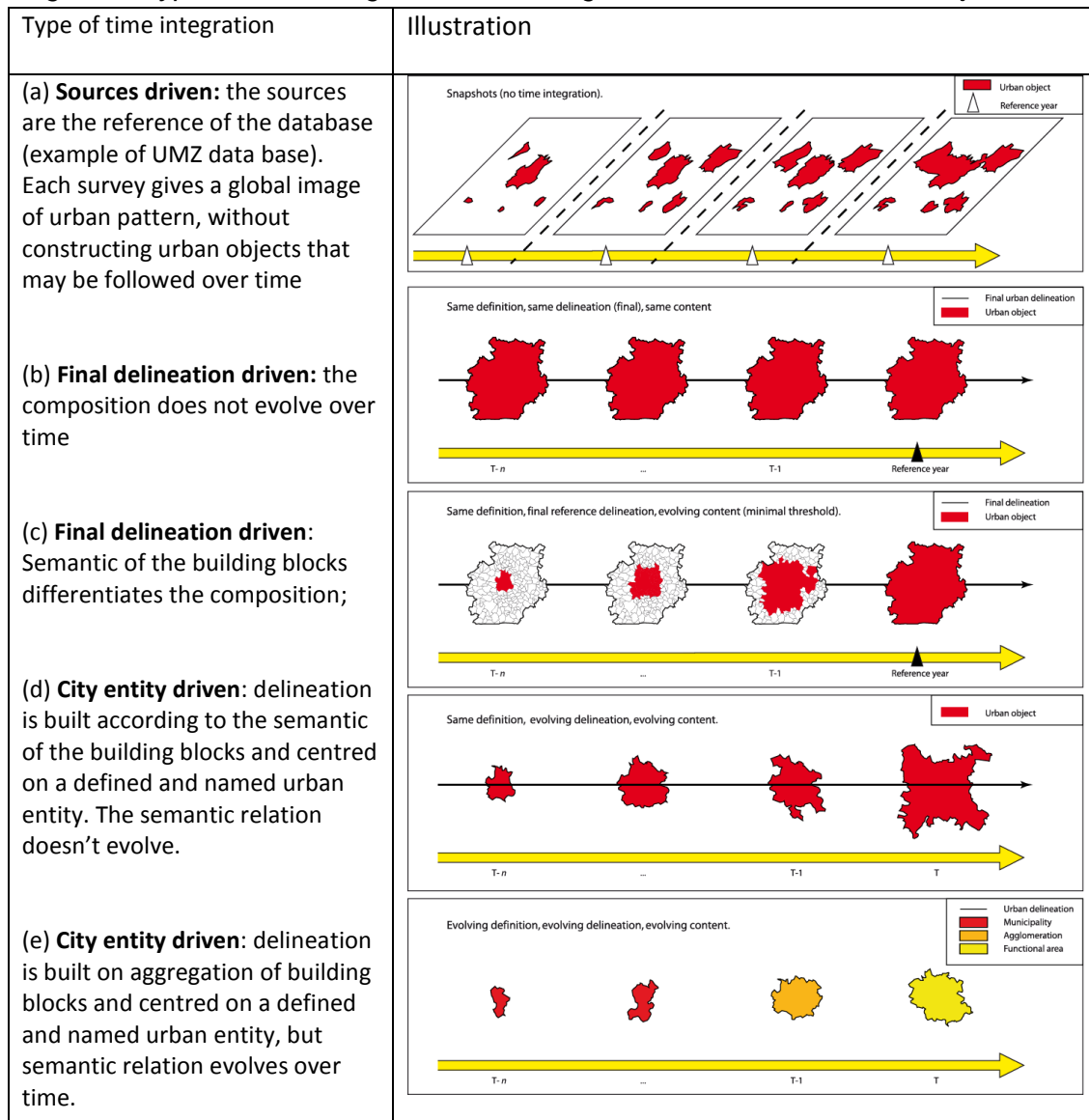
Thus it is obvious that a harmonized urban database has to be seen as a point of view on urban objects and their evolution over time, resulting from a complex compromise of measurements at two levels: measurement at the building blocks level and measurement in the process dealing with the aggregation of the building blocks.

2. From conceptualization of « urban object » to the definition of the urban objects in a diachronic perspective

We present here an illustration of the different choices that precede the building of a time integrated urban database. The differences between these choices lay on the way trajectories of urban object are viewed. It could be: what is urban today, at time (t), and the trajectory is a retropolation from t_0 to t. Or it could be: what is urban at each period, and the trajectory is an integration of different conceptions of the city.

The different choices may be categorized such as in Figure 1, according to the reference selection for time harmonization. These choices will have some repercussions on the way the database may evolve in the future. For instance, in case b) and c), the whole database will be re-evaluated at each new update. Instead of d) or e), where trajectories integrate the different phases of evolution and may integrate directly new updates.

Figure 1: Types of time integrations according to the definitions of urban objects

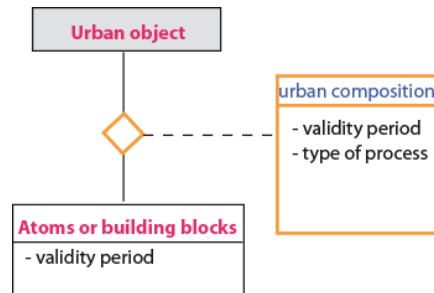


3. From definition of an « urban object » to implementation in a diachronic perspective: the sources of variability internal to the building process

Let's first consider the sources of variability of a given process for building an urban database *at instant t*. Variability is related to: the model associated to the definition, the parameters of the model, and the sources to which it is applied.

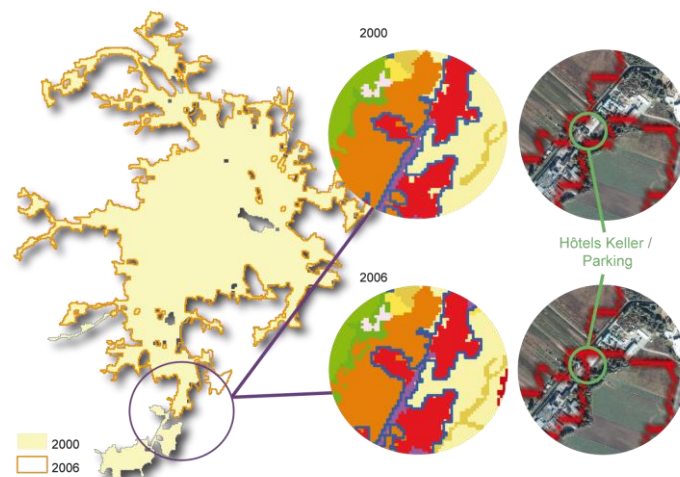
When building an urban data base *in a diachronic perspective*, given the same model, time will affect the sources and the parameters. So the conceptual data model for urban objects will be very simple as shown in figure 2. The complexity is in the building of the dynamic urban composition which lays on a harmonised process, and depends on the sources.

Figure 2: Time integrated in an urban data model



For instance, if the process depends on relations between places based on commuters, the threshold defining the intensity of the links may evolve over time. Another example is the fact that interpretation or quality of the sources may vary over time and induce evolutions that are not relevant. For instance, as shown in figure 3, a very local change in the sources may have a global change in the city delineation, whatever spatial treatments made. Here the morphological delineation of Wien appears largely reduced between 2000 and 2006 due to a change of interpretation in one or two pixels.

Figure 3: An example of variability of the sources (UMZ) inducing a non interpretable evolution of the city



In order to conclude, let us notice that there is most of the time a gap between the thematic questions raised by users, related to urban dynamics, and the answer possibilities given by the structures and contents of the urban databases. If we take, for instance, some frequently asked questions, such as “Is the urban sprawl intensifying in the two last decades or no?” or “can we estimate the rate of evolution of urban shrinking in Europe”, or more simply “Is the urbanization level still in an exponential growth or in stagnation in the three or four last decades”, we have to note here that the answers are not simple. They will not only depend on the availability of the data (population of building blocks at different dates, urban delineations covering the whole countries in a harmonized way) but also on the choice in urban definition (regarding time integration, see part 2), and on the variability internal to the building process of the database (see part 3).