

**Noizet H., Grosso E., “The ALPAGE project: Paris and its suburban area at the intersection of history and geography (9th-19th century)”, in digital proceedings of the 25th International Cartographic Conference (ICC'11), 3-8 July 2011, Paris (France).**

**Summary :**

Funded by the French National Research Agency, the ALPAGE project (ALPAGE is a French acronym for « diachronic analysis of the Paris urban area: a geomatic approach ») aims at producing data and tools to understand the long term relationships between spaces and societies in Paris. The main laboratories or institutions involved in this project are LAMOP (project leader), ArScAn, LIENSs, L3i, COGIT, IRHT, the Parisian topography centre, APUR. The above come together to collaborate on building a Geographic Information System for the Parisian area in the preindustrial period. The creation of such a GIS enables to reconstruct the oldest parcel plan of Paris, the Atlas made by Vasserot between 1810-1836, and to spatialise historical data from the Middle Ages and modern times (walls, aristocratic mansions, sewers, floods, manors, parishes, etc.). When linked with the old urban fabrics, these data show the diachronic structure of the urban morphology. Finally, an interesting development of the project, originally unplanned, has been to provide all this new knowledge to everyone through a digital webmapping platform : <http://alpage.tge-adonis.fr/>

**Background and objectives**

In consideration of the growing interest in urban space studies, the ALPAGE project (ALPAGE is a French acronym for “diachronic analysis of the Paris urban area: a geomatics approach”) aims at producing data and tools to understand the long term relationships between spaces and societies in Paris. This project is a three year research program funded by the French National Research Agency. It involves the work of 4 laboratories with the collaboration of various partners, bringing together more than twenty researchers and academics from social and human sciences and from the computer science field. The main laboratories or institutions involved in this project are LAMOP (project leader), ArScAn, LIENSs, L3i, COGIT, IRHT, the Parisian topography centre, APUR. The above come together to collaborate on building a Geographic Information System (GIS) for the Parisian area in the pre-industrial period. The creation of such a GIS enables to reconstruct the oldest parcel plan of Paris, the Atlas made by Vasserot between 1810-1836 (an example of a parcel plan is shown in figure 1), and to spatialise historical data from the Middle Ages and modern times (walls, aristocratic mansions, sewers, floods, manors, parishes, etc.). When linked with the old urban fabrics, these data show the diachronic structure of the urban morphology.



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the social uses of urban space. This idea of multiple urban temporalities and the interest to confront the short temporalities of social conventions with the longer temporalities of spatial shapes, have been studied, especially in the works of (Roncayolo 1996, 2002), (Lepetit and Pumain 1993), (Galina 2000) or (Chouquer 2003).

To study the link between spatial structures and social uses of the urban space, it is necessary to have on the one hand, layers of historical information which spatialise the social activity of actors living and involved in this urban space at different times, and on the other hand, vector layers of old parcels and not only the road network.

Based on a robust and referenced geographical database, the creation of this GIS has also the aim of creating new university research dynamics by proposing topics which can be achievable during the time of a master or a doctoral degree – time devoted to historical studies and not only to cartography –.

## **Results**

### ***Georeferenced and vectorised plans of Vasserot's atlas***

During the project, the 910 urban block plans of Vasserot's atlas have been georeferenced and vectorised (see figure 2). The georeferenced and accurate raster and vector data provided by the APUR (the Paris Urban Planning Agency) to the ALPAGE project, have been used as current referenced data framework.

The georeferencing and the vectorisation process of the 910 Vasserot plans – each plan is the drawing of a Parisian urban block – have been realised in accordance with the needs and the expertise of the historians, the geomatics technical possibilities, and the needs and the contributions of the automatic vectorisation process carried out by the computer scientists. As a result of this active collaboration between historians, geomaticians and computer scientists, this co-production of spatial reference data has allowed the project to take into account the natural and social dimensions of the Parisian urban space.

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Figure 2. Georeferenced Vasserot's atlas.

### ***Evaluation of the georeferencing process***

To accurately measure the geographic and geometric qualities of the old parcels reconstructed map, some evaluation criteria are defined. Due to the georeferencing process, a coefficient of distortion is firstly computed for each urban block. Then an evaluation of the shifts between georeferenced Vasserot's plans and the current APUR map is undertaken.

These criteria allow a critical point of view on Vasserot's plans as a historical information source. Like any source, this one is not perfect. Indeed, certain plans have some important shifts. Based on the coefficient of distortion, 6.5% of these plans are potentially problematic.

Moreover, the comparison of the 5000 parcels which are both present in the Vasserot plans and in the current APUR data, show that the differences in position (X, Y) are only 1.5m on average, and the orientation differences are 2.2° on average. Therefore, the overall result is very satisfactory and the accuracy is more than sufficient to enable the realisation of a historical study, in comparison with medieval and modern written sources.

### ***Production of historical data***

During the ALPAGE project, 35 different historical vector data have been produced. These data can be classified into 4 main themes:

- Data in relation with the parcels: urban blocks and parcels between 1810 and 1836, urban blocks in 1300 and in 1380,

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- Historical topography: walls between the 10<sup>th</sup> and the 12<sup>th</sup> century, Philippe Auguste's walls, Charles V's walls, walls of the “Fossés Jaunes”, aristocratic mansions and town houses in 1300 and 1400,
- Historical dominions: neighbourhoods and arrondissements (i.e. urban districts) between 1790 and 1860, medieval regions, tax collection in 1300, parish taxes in 1300, manors in the 18<sup>th</sup> century (a manor is a tax which is applied both on land and on men), sewers in the 18<sup>th</sup> century,
- Road systems: roads in 1300 and in 1380, Bièvre (the Parisian part of the Bièvre river) between 1810 and 1836, the linear structure of the parcels between 1810 and 1836 which fits with the Roman urban orientation, floods in 1740 and in 1910.

The production of other data has also begun but is not yet completed, e.g. the churches in the Middle Ages.

Subsequently, to improve the understanding of Vasserot's data, other plans dated from 1300 to 1380 have also been georeferenced to allow for the comparison and confrontation with medieval texts. Thus, the geocoding on the Vasserot's road system of the taxpayers of the Parisian royal tax in 1300 has been possible. The geocoding of the 10.000 taxpayers has been possible thanks to the development of an *ad hoc* software module on top of MapInfo. This module allows us to realise an analysis of the socio-topography based on different economic information such as the name of the taxpayers, the amount of taxes, their business, etc., for each taxpayer located in a section of the road system in 1300. Nevertheless, the procedure was very slow to establish because we have had to previously set up a correct spatial reference system, particularly the road system in 1300.

All these data are referenced based on a ISO-19139 metadata (which is the standard used in the INSPIRE directive) system called ALPAGE-References, available online: <http://lamop-intranet.univ-paris1.fr/alpage-references/>. This metadata system enables the traceability or genealogy of data (date of creation, author, written source in link with the created object, etc.).

Finally, due to the quality and the collaborative process of the production of data created in the ALPAGE project, the question of data sustainability and diffusion has been raised early. These issues have been solved administratively and technically. Administratively, agreements have been signed with institutions providing data: the APUR, the French National Archives and the Ville de Paris. Then a consortium agreement has also been signed between the different partners of the project. Technically, some data are directly available for downloads in the ALPAGE website (<http://lamop.univ-paris1.fr/alpage/index.php/cartographie>) and all data are available online through the webmapping platform (more details are given below in the webmapping platform section).

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### ***Historical data analysis***

The type of results is twofold, both intrinsic to each data and linked to the possible combinations of these data.

A first level of results concerns the specific knowledge of each data: the walls are now mapped as accurately as possible, thanks to archaeological remains (Philippe Auguste's and Charles V's walls), to their traces in the former parcel system (the 3 medieval walls) or to specific surveys made on the ground (the walls of the “Fossés jaunes”) (see figure 3); all the aristocratic mansions in the late Middle Age are for the first time geolocalised and this mapping allows us to frame new working hypotheses about the nobiliary presence in town; the mapping of the different manors in the 18<sup>th</sup> century allows to measure precisely the distribution of seigneurial power.

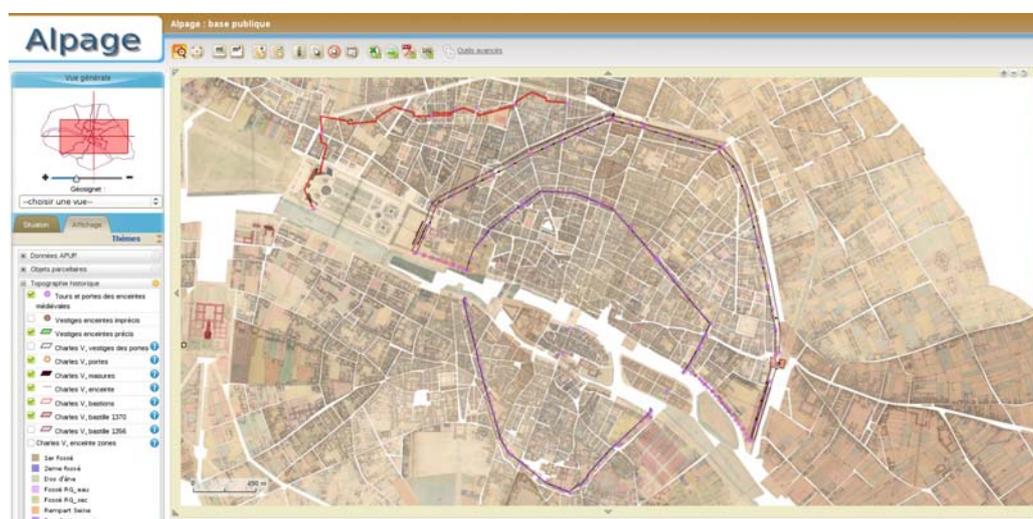


Figure 3. Map of the walls through the ALPAGE webmapping platform.

A second level of results concerns the possibility to realise some spatial analysis thanks to GIS, which enables to produce new knowledge, in particular concerning the manors. Indeed, the spatial combination of the road network and the manors in 1300 enables us to discover the hierarchy of the seigneurs (or lords) who had the role of road surveyors, by identifying the seigneurs who had a land right on both sides of a road. It also allows us to identify the royal part of the tax which can be defined as the the percentage of the area of the roads which have on their sides two different seigneurs, in the whole area of the road system. This part, unknown until then, is up to 64% in 1300, which reveals the overwhelming royal power at that time.

A second interesting spatial combination is the one between the layouts of the walls and the old parcels system that reveal that the defensive system goes beyond the localisation of the defensive structures. This phenomenon informs the rhythms of the urban growth, e.g. the late opening (in 1288) of the Chaume's postern in Philippe Auguste's walls has still an influence in the early 19<sup>th</sup> century, influence identified by the smaller density of the front parcels in Chaume's street. The influx of the 13<sup>th</sup> century have been focused on the Temple and on the Vieille du Temple streets which

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had from the beginning a passage through the walls. Therefore showing that the 13<sup>th</sup> century has been found to be a time which has durably structured the urban fabric.

Another interesting spatial combination is the one between the taxpayers in 1300 and the parcels system in the early 19<sup>th</sup> which fully confirms the interest of studying the link between spatial structures and uses in the Parisian urban space. For example, the number of taxpayers on both sides of Male Parole's street is very unbalanced, with 9 taxpayers on the northern side of the street and 21 on the southern side. In this socially well inhabited street in the early 14<sup>th</sup> century, this asymmetry could reflect an imbalance of urban density which can be partially found in the parcels system of the early 19<sup>th</sup> century, with 6 parcels on the northern side facing 11 parcels on the southern side. This suggests that social practices in the late 13<sup>th</sup> century have had influence on the urban fabric beyond the 13<sup>th</sup> century: this morphological differentiation of the Parisian parcels system is both old, as attested from 1300, and above all constantly reactivated by other social practices for more than 5 centuries.

### ***First morphological analysis***

This project has also allowed historians and archeo-geographers to study the geometrical characteristics of parcels through different criteria including density, shape diversity, and the geometric orientations of the road network and of the parcels. These identified morphological characteristics are then explained by social practices that redefine these shapes over a long term period (e.g. planning, reuse of old parcels shapes in earlier social contexts).

Then the spatial dimension of these historical vectorised objects has been analysed, e.g. influence of walls and road network on the parcels, inheritance of past flows on the feudal domains and the sewers. It is therefore now possible to measure the resilience of a former meander on the material and conceptual space layout. Therefore, the urban parcels became a current object of history.

To be able to realise these two first morphological analysis, an open source module, called MorphAL (for Morphologic AnaLysis), has been developed as a plugin of the open source GIS software OpenJUMP (<http://www.openjump.org>). MorphAL has been released under a GPLv2 licence (it can be downloaded at <http://lamop.univ-paris1.fr/alpage/index.php/cartographie/>). In particular, MorphAL allows us to know if a parcel is close to the standard parcel defined by its rectangular shape (Boudon et al. 1977), by computing the degree of rectangularity of a polygonal geographic object.

The difference from the rectangular standard allows us to identify geometrically if a urban space has evolved due to a planning (e.g. around the Villeneuve du Temple which is a commandry of the Knights Templar) or on the contrary, is a conflict of shapes (e.g. Darnestat Street between Saint-Martin and Saint-Denis streets).

Resulting from the historical data analysis and these first morphological analysis, the structuring of urban morphology is a dialectical process based on continuous

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rearticulation of social synchrony and space diachrony, which creates structural effects, while the modalities of human occupation are constantly changing.

### ***Website and webmapping platform***

A website has been developed to render account the objectives and the results of the project: <http://lamop.univ-paris1.fr/alpage>. An interesting development of the project, originally unplanned, has been to provide all this new knowledge to everyone through a digital webmapping platform (see figure 4): [http://websig.univ-lr.fr/alpage\\_public/flash/](http://websig.univ-lr.fr/alpage_public/flash/). Data co-produced by researchers involved in the project are now freely visible and superimposed with current parcel data of the Paris planning agency. This webmapping platform may meet some expectations of the civil society members that have emerged during the project, such as redefining the scope of protection of the Marais according to the shape of the wall of Charles V.

From a technical point of view, this webmapping platform allows us to publish online new data, to manage metadata, and allows everyone to consult the published data. An online centralised database, entitled ALPAGE-References, enables us to reference the sources that aim to spatialise the historical objects.



Figure 4. Website of the ALPAGE project.

### ***Organisational aspect***

During the ALPAGE project, a collaborative working method has been progressively defined based on frequent exchanges among all participants. Nineteen meetings of one or two days and detailed written accounts concerning the discussions and decisions of each meeting have been completed. The 760 pages of these written accounts are available online: <http://lamop.univ-paris1.fr/alpage/index.php/documentation>. Two symposia were held, one on webmapping in June 2008 and published in the journal “Archeologia e calcolatori”, the other in June 2010 to communicate the specific results of the ALPAGE project and being published as a book in the Presse Universitaire de Vincennes.

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From a human point of view, our working group has gradually formed what sociologists of organisations call a "community of practice" (Ponon 2007), based on a mutual enrichment. Historians learned about GIS thanks to the geomaticians and the computer scientists, and the later learned about history thanks to the historians. Moreover, computer scientists developed ad hoc software for historians like e.g. MorphAL, described before.

### **Conclusion and future plans**

Firstly, almost all initial goals of the ALPAGE project were achieved. Only the data production of the hydrographic data, the churches and the geocoding of the taxpayers are to be completed. All data produced in the project are available online and reachable online through a webmapping platform.

This data can also be used in the fields of town-planning and land settlement. The old urban system as described in Vasserot's plans could be taken into account by urban planners when they undertake a project in the Parisian space.

Another aspect, beyond historical research, is that the webmapping platform can be used as a cultural and social vector. Indeed, anyone can now access to this information and even produce their own maps in respect to the ALPAGE cartographic and legal conventions.

Finally, the results and the experience of people involved in this project are that we aim to extend this collective work by developing the work begun on the parcel and medieval topography, but also by addressing new issues in fields such as hydrography and relief.

More information about the ALPAGE project is available online, including the webmapping platform: [http://lamop.univ-paris1.fr/alpage\\_english](http://lamop.univ-paris1.fr/alpage_english) (English version) and <http://lamop.univ-paris1.fr/alpage> (French version).

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