

AN ELECTRONIC LENS ON DIGITAL TOURIST CITY-MAPS

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Summary

Tourist maps representing historic cities and their historic centres as well as sites with relevant interest are indeed popular among the wide public. Maps of this type are conventional obeying to the well-known traditional rules based on theoretical and practical experience. The same hold also for the tourist maps products of new electronic technologies. In this paper it is presented the possibility of coupling non-conventional map representations of historical cities' centres -as the maps of varying scale are- with their conventional counterparts, in the context of a two-window electronic imaging system of simultaneous navigation with urban tourist interest.

Introduction

Electronic maps are gaining today a major place in the field of tourist cartography, which is a privileged class of the so-called *everyday cartography*. The use of electronic digital maps by the wide public, present an increasing trend. The digital map products and the computer's screen are now easy tools in order to prepare a tourist visit or to organise an efficient and productive itinerary. This is especially interesting for visitors of cities with important historical background and of dense historical urban centres. The advances in digital image technology and the relevant implementations offer new possibilities and open new ways for the improvement of the digitally driven tourist maps.

The idea presented here is a synthesis of two components based on:

- a. The application of non-conventional map projections in urban vector and/or raster cartographic representations. These projections could be of "lens-type", which focus areas of particular interest without spoiling the spatial urban continuity.
- b. The implementation of a software specially developed for the simultaneous comparison of two thematically relevant representations (maps and/or images) with the use of two windows in which the same area is represented satisfying one-to-one correspondence of geometric elements shown in both windows.

The combination of the above two components is functioning in the following way:

In one window, a conventional representation gives the overall view of the area of tourist interest and in the second, a lens-type projection is focusing the particular site of interest within the general area without spoiling its spatial continuity.

Applying this process and navigating into the conventional visualisation of the indeed dense urban "textile" of a historic city centre, where it is usually difficult to resolve details, it is possible to see in the second window a focal expansion of the correspondent area.

The algorithms implement a type of non-linear magnification, which in this case becomes useful in order to obtain on one spot the quantification of the map themes and the spatial zooming of the map. In this way the low visual spatial resolution is replaced by a magnification focused on the desired site, in terms of a continuous variation of the map scale, without thus, isolating the surroundings which is still there in smaller scale.

It is possible to use not only modern maps but also a combination of an old map and a modern counterpart for certain applications of cultural interest. The method is of particular importance for historic cities like Venice, for which a number of tests performed, proved its high degree of utility and convenience for tourist use but also for "remote visitors" or users from the domain of education.

The lens-type representations

Non-conventional map-projections (logarithmic, bird-eye, etc.) have been used in many cartographic applications in a variety of scales. They are especially useful in large-scale maps for urban applications, where the distribution of geometric and/or thematic features and symbols is dense and not uniform all over the map area. The use of modern media in elaborating and visualising such maps offers new possibilities and makes the field of applications and the type of users broader.

Tourism operators and users are among those interested in such representations especially when non-conventional maps are the solution in tourist-cartography when properly designed and visualised. In many urban map-use applications, dense thematic information, given by specific symbols, is of main importance. Following a traditional thematic representation of such dense symbols and especially placing names, a visual confusion ('visual pollution') is the result in most applications.

This problem is solved in classical terms, by a partition and a consequent magnification of the area suffering 'visual pollution'. In this way, the overview of the whole area and its spatial continuity are lost. A local minor map is extracted out of the original map and a perception-discontinuity appears, implying problems in the planning process as far as the overall spatial perception is concerned. This tradition is a 'Procrustean solution', which restricts the map-user's view over the urban continuum.

The above problem, namely the partial magnification losing continuity, can be solved by a logarithmic azimuth projection associated with the regular azimuth equidistant projection with respect to a given polar point, the *focus* of the representation (Boutoura, 1994). The extension to a multi-focal projection is an easy

task when more than one *foci* are used to examine more than one concentration of dense thematic symbol placements keeping at the same time the spatial continuity of the whole area. The approach described above, can be applied also in raster forms both in the single-focus and in the multi-focus modes. Relevant tests (Boutoura et al., 1999) have proved indeed useful, easy to handle and generally advantageous due to the additional information a photograph is offering for visualisation and communication purposes, especially when applied in the field of tourism.



Fig. 1a. Venice: A conventional map projection



Fig. 1.b. Venice: A 4-foci map projection

The two-windows imaging

The two-windows imaging (2Wi) is an algorithm especially designed and developed to bring in an one-to-one correspondence, in couples and in all possible combinations, digital raster files of aerial photographs, ortho-photos, 3-d models, DTMs, modern / old maps and perspective images (Guerra, 1999; Guerra et al, 1999, 2000).

The scheme combines warping and morphing algorithms based on patterns or on finite elements controlled by the determination of groups of homologous points. The known use of such techniques can be found in computer graphics applications for the creation of series of images, in animation applications in geometric and topological image transformations and in the additive combination of image warping and cross-dissolving between transformed images.

The warping process is based on the analysis of spatial continuity and it is based on the image analysis in finite elements and in the transformation of elements in triangular, quadrilateral and polygonal grids. The relations between the source images and the destination images are defined point-wise or line-wise and the relevant algorithms are called point-based warping and feature morphing.

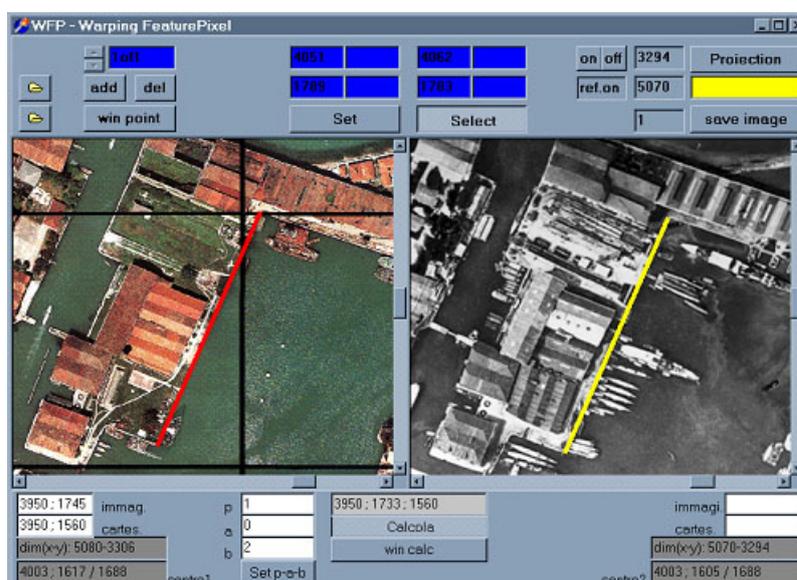


Fig. 2. An example of using 2Wi in representing two homologous images of Venice, referred to two different epochs.

Focusing electronic tourist maps

The lens-type map projections applied to tourist cartographic representations are then combined, within 2Wi, to various images from different sources representing the same area of interest. Applying this process the user can navigate into the

conventional visualisation of the indeed dense urban "textile" of a historic city centre, where it is usually difficult to resolve details, it is possible to see in the second window a focal expansion of the correspondent area.

The algorithms implement a type of non-linear magnification, which in this case becomes useful in order to obtain on one spot the quantification of the map themes and the spatial zooming of the map. In this way the low visual spatial resolution is replaced by a magnification focused on the desired site, in terms of a continuous variation of the map scale, without thus, isolating the surroundings which is still there in smaller scale.



Fig. 3. Venice. Piazza San Marco.

In Fig. 3, a two windows output is shown, result of the 2Wi software for the study, the definition and the visualisation of urban focal projections. The process allows the creation of a numerical mask used in the 2Wi software for the navigation and the logarithmic magnification of the image. In Fig. 4, it is shown the zooming option of first type of the type "linear plus non linear" focal representation. The *Basilica di San Marco* domes are shown in a linear magnification by 2.5 times. The non-linear magnification is used in the connection zone between the original map image and the magnified zone of the map. In this representation we have two different map scales involved, e.g. 1:500 and 1:2000) without losing spatial continuity.

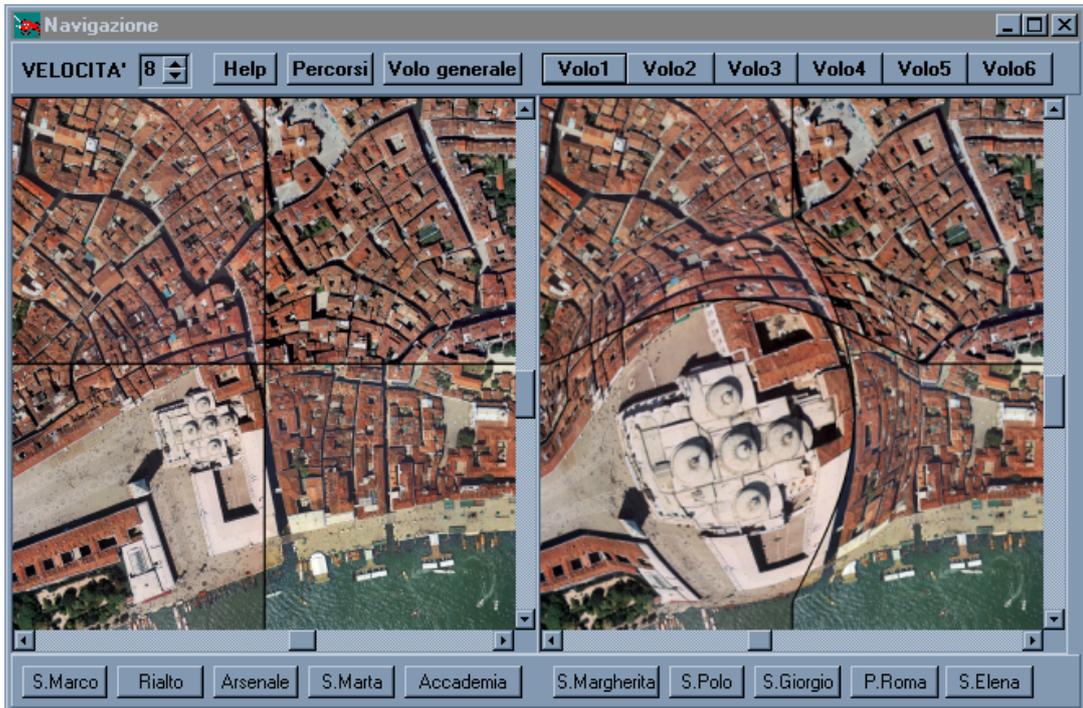


Fig. 4. Venice. *Basilica di San Marco*. Combination of linear and non-linear focal magnification within a unique 2Wi navigation environment

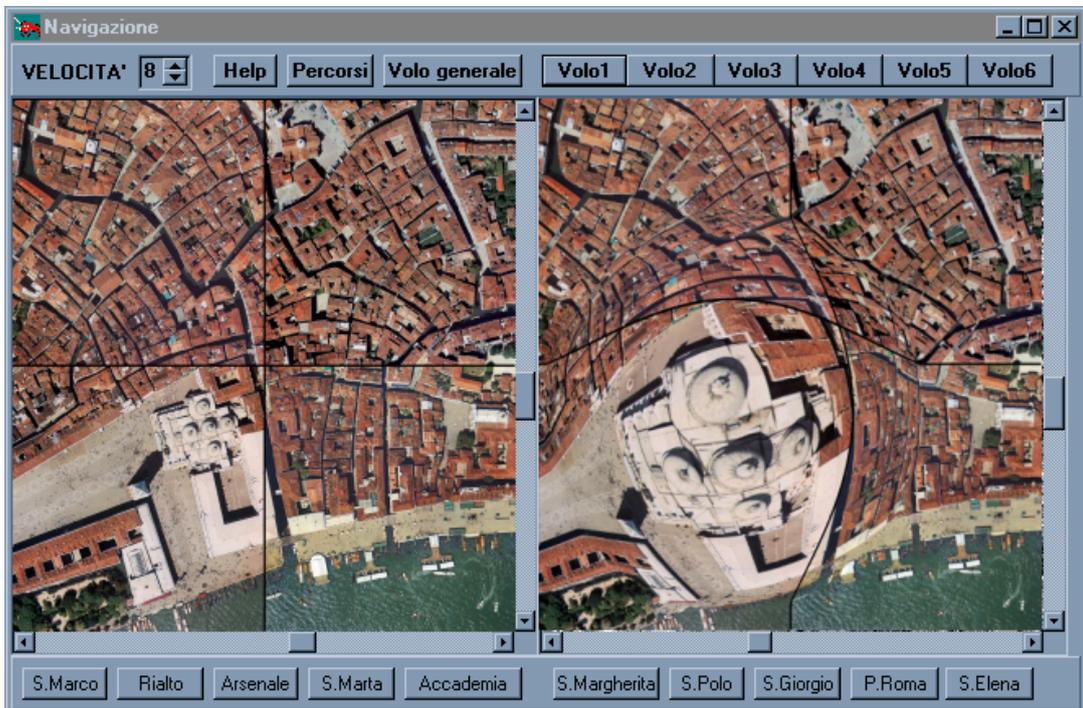


Fig. 5. Basilica di San Marco. Non-linear focal magnification

In Fig. 5 the domes of the *Basilica San Marco* are shown in a non-linear focal magnification.

Needless to say here, that it is possible to use not only modern maps and images but also a combination of an old map and a modern counterpart for certain applications of cultural interest. The method is of particular importance for historic cities like Venice, for which a number of tests performed, proved its high degree of utility and convenience for tourist use but also for "remote visitors" or users from the domain of education.

Concluding remarks

Non-conventional map representations and modern visualisation techniques can be combined in order to offer tools in general tourist electronic cartography with on-line or off-line use of screens in order. It is of particular interest the application of such implementations in cartographic representations depicting centres of historic cities with dense geometric and thematic information. Lens type of projections with one or more focal points solve problems of representing dense thematic information and the 2Wi type of visualisation permits a variety of alternative options in navigating the parts of cities with tourist interest combining the focal representation when appropriate. Research and applications in this field could also be applied in the www navigations related to tourist maps of cities along two main streams that of planning a tourist visit and that of educative use of city-maps especially when they represent particular historical and cultural heritage.

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