Interactive Urban Representation

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The project discussed here wants to investigate the use of multimedia as a tool to present and to analyze geographical information by making a interactive software for visualization and understanding of urban space of Salvador using thematic cartography, animations, remote sense images, photography and texts, allowing software user to build his personal cartographic visualization.

Keywords*: Hypermedia: urban representation; urban information; visualization; city modeling.*

Introduction

The project that we are discussing here it had as goal to build and to investigate forms of city representation and presentation of information that it facilitates broad and interactive space analyses. Cities today can become structures of great complexity and, in this case, they are represented by immense databases. Using GIS tools it can be obtained spatial information about it. In the case of this project the intention was to produce an application software that can be characterized as a visualization and analysis tool of the city of Salvador that it is immediately accessible to any user, even if they doesn't have any knowledge of GIS tools.

Visual presentation of space information it facilitates immediate understanding and visualization of spatial interrelations. The glance informs. The visualization of geographical information can be made not only in static maps, but using hypermedia systems that it allow integration of data from several sources and heterogeneous formats, and besides that, this interactive systems can leaves user to choice way, type of data and kind of presentation, according to his needs.

We produced an hypermedia application that it assists understanding of the intra-urban space of the Salvador city using interactive cartography, animations, three-dimensional digital models, images of remote sensing, pictures and texts and allowing to user of program to build visualizations so specifics as its demands of information were. A prototype of this application, that it can be seen in the figure 1, was presented in SIGRADI 2001 (Pereira, 2001).

Data and information

In the project it was looked for ways of to represent/present physical, environmental and socioeconomic aspects of the city. The first step was to transform urban space data in visual information in digital media. For this purpose it was used several GIS tools and the workflow can be summarized by figure 2. The second moment it was to build ways of presentation of this information. The ways of information presentation are several as well as it was used diverse media. The target was always to look for adaptation from media to the presented content.

The basic representation that it was used here it is based on the combination by the user of possible kinds of cartographically presented informa-
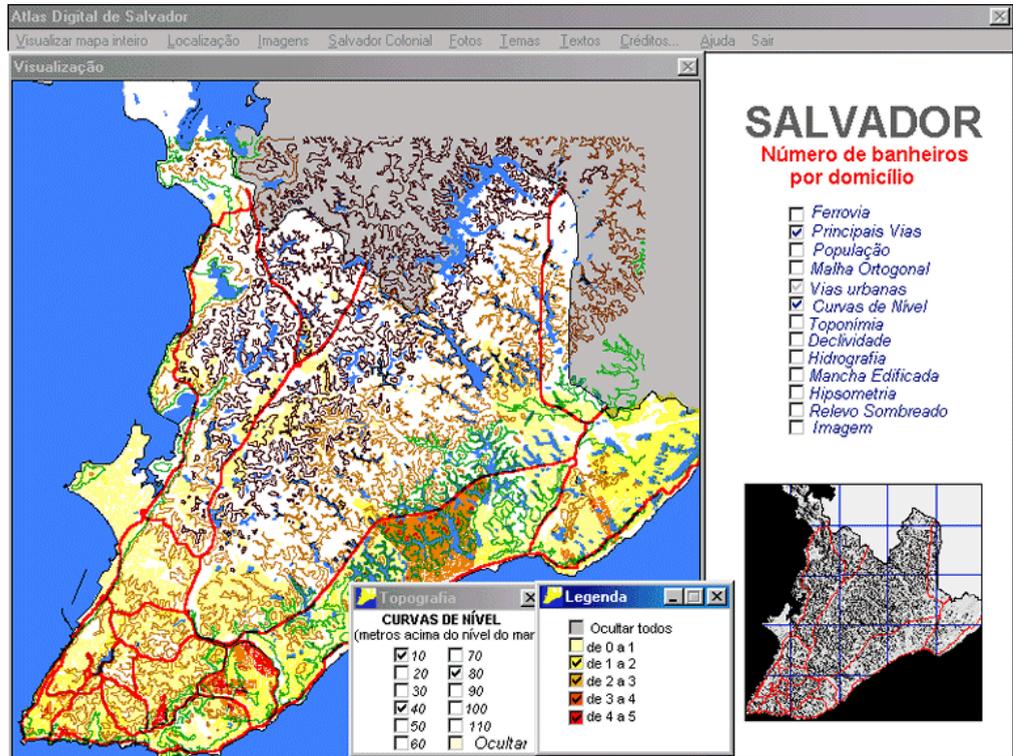
Figure 1. Prototype interface.

tion as interactive or animated thematic maps for instance. Besides the presentation of most themes using thematic cartography techniques it is also used animations, for example, animations of digital terrain models or buildings models. Several media can be selected, from maps, animations or images, to it explore easily visual information and to satisfy the demand of the user.

The map is a graphic representation of part of the surface of the environment and it is based on abstractions and conventions and so it use suffers the limits of the media such an as cost, time of creation, representation possibilities, scales, etc. The largest motivation to one use forms of geographical information visualization based on information
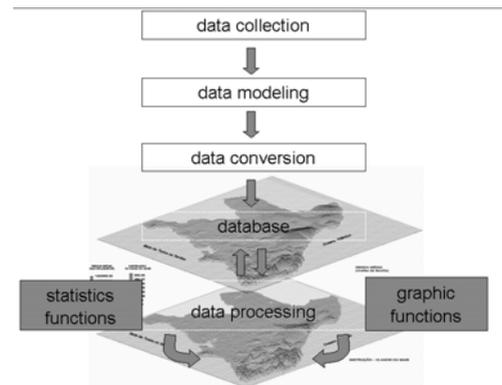
Figure 2. From urban data to visual information

technologies it is to extend the possibilities of representation of environment in several directions. To decrease the abstraction can be made representing the relief of a certain site as a three-dimensional model that can be examined from different points of view as an alternative for representation in a cartographic way as a map. A three dimensional model of Salvador was built as a form to complement the cartographic information and to represent the city with less abstraction.

This model construction it used the available data, that it were the building location, the topographic isolines and vertical aerial photos. The bi-dimensional cartography contained the location with plenty accuracy of the building projection; a digital terrain model builted from the interpolation of isolines, digitalized in previous phase of research; and a group of vertical aerial photos that it covered the city area. Other flat data – rivers, lakes, streets, were available in digital format.

Development process

This visualization tool was based on techniques of cartographic modeling (Tomlin, 1990). Salvador is represented by a cartographic model that it was created by a combination from several information plans that it can to join geographical information presented as thematic cartography, images – photographs or from remote sensing – or digital animations.

A map design – that basically is a representation of a certain geographical area – it is done based on a selective glance on the space to be represented. This look filters the information that will compose the map, emphasizing some and despising another. The user and author of the map were usually different persons, corresponding to the map author – the cartographer – the selection of which elements of reality would be presented and in which representation form.

The interface of a geographical information visualization system it should allow user to select which information is important for his reading of the reality. This can be based on an interactive choice of themes he wants to visualize, including the possibility of to overlay different themes.

Another important item is the scale. In ideal terms the visualization software should leave the choice of the most appropriate scale – without loss of the geographical reference – to user, since it is related not only to proportion between representation and reality but in this case it defines the detail level that representation can reach.

The information organization it should facilitate the integration of several themes, taking into account not only the thematic attribute, but also the fact that data are coming from different formats and origins. The presentation of geographical information can already be given through techniques of thematic cartography known – maps of ranges, points or isolines. These possibilities can be combined through an interactive overlap.

In the visualization tool information is joined as information thematic plans and themes that it can be overlapped and in this process it can to generate new information that was not part of none of the plans but it can be obtained from them. This analysis methodology is already being used to decades. The pioneer in this methodology was the American architect Ian MacHarg (1969) who demonstrated the possibilities in his classic publication Design with Nature.

The city model was imagined here not only as form of representing geometric aspects, but also, and mainly, of such geographical aspects as population spatial distribution, income spatial distribution or habitation conditions, for instance. This model was built looking for to be used in an interactive way. So the final form of representation it is defined by the user starting from the kind of information that he is looking for.

Figure 3. Terrain model of Salvador
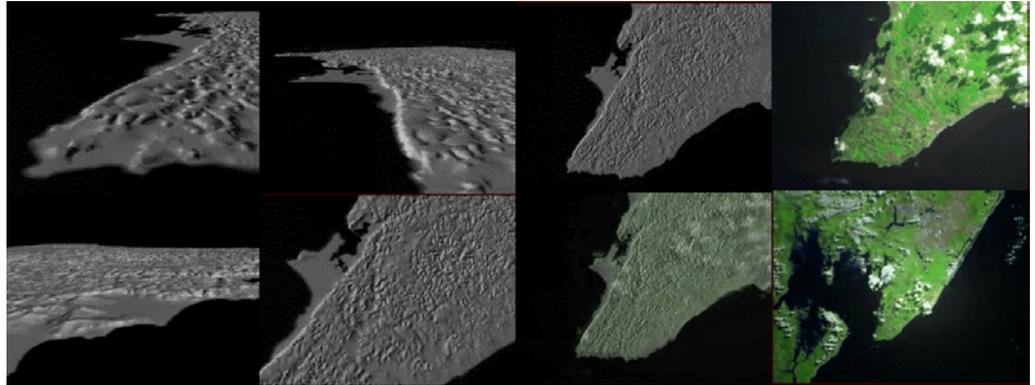
Besides the cartographic model, geographical information are presented in other visualization forms, for instance as a three-dimensional model, as we can see in figure 3. Considering that the available data didn't allow the construction of a precise model, in geometric terms, and that this goal was not the main goal, we opted for building a model that it is constituted in an approach of the reality, reproducing the topography of the city, that is quite lively, and also the basic building geometry classified by typologies that embrace certain areas. The lack of data about height of the buildings and our intention of trying to create an approached representation of the reality justified this choice.

The buildings elevation is resulted of designation of land occupation patterns, which it were based on previous studies developed by the City Planning Office. These patterns were defined through interpretation of vertical aerial photos from Salvador and they defined urban areas occupied by constructions of homogeneous characteristics. To each area it corresponds a typology and an elevation pattern. The typologies classification is possible in Salvador, because the urban space reproduces several forms of social and spatial segregation that are reflected in the form of land occupation, witch it is tied perfectly with the cartography presented.

The next step it was to extrude of the buildings projection starting from defined heights and then this spatial objects were linked with the land surface model.

The aerial photos were geographic referenced and geometric corrected. It was used for this a vectorial database and after the registration of images a mosaic of photos it was made and integrated in one only image that was attached on the land surface model.

Project results

The final product is a software dedicated to the information visualization about the city of Salvador. The application interface that we created it was based on a group of windows that interrelate. The interface is more flexible that previous prototype (Pereira, 2001) and it allows user to choose the presentation form.

The main window is the visualization window in which the user integrates information that interest him through a selection of themes they wanted to be visualized. The form of visualization of these themes can be differentiated and form of presentation of each theme also, accordingly user's interest. The themes are plans of information that can be visualized simultaneous or not.
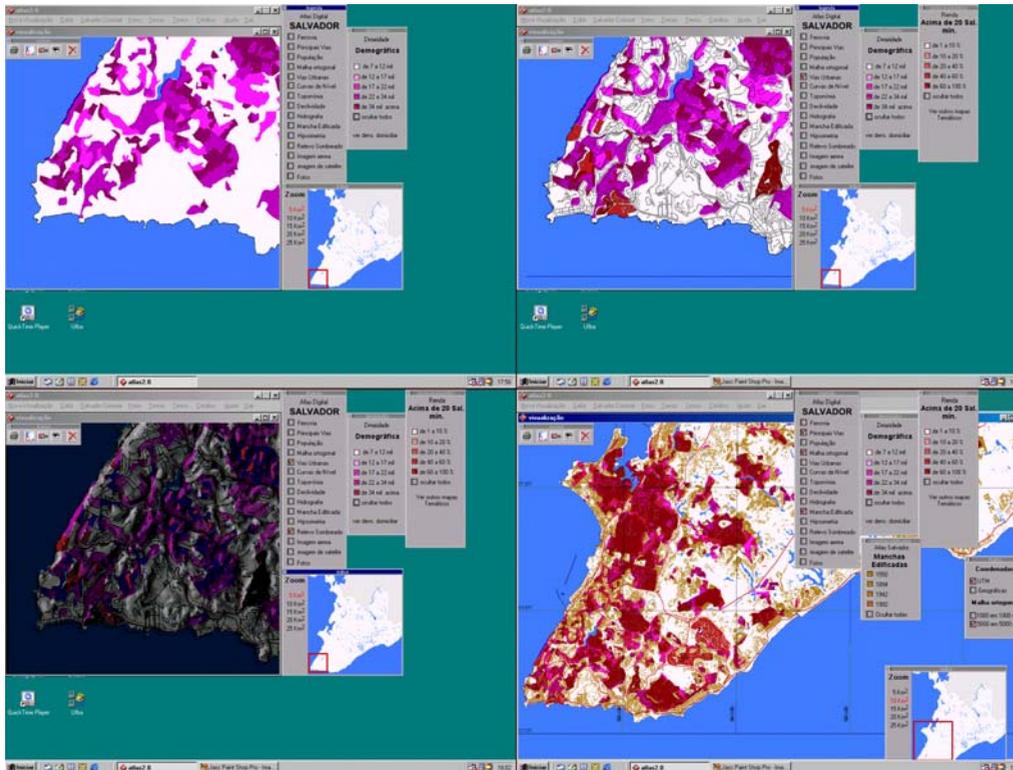
Figure 4. Interface and information visualization

Besides the main window, secondary windows are ways of management of themes and legends presentation that will be visualized. The visualization scale and the area of the city to be analyzed are also defined starting from the interaction with a window index where a view of the totality of the urban space it is defined, and also the region visualized and the detail level. The figure 4 presents some examples of possible visualizations.

Final Remarks

Hypermedia systems have a great potential to transmit spatial information to professionals or inhabitants, so they can easily understand their environment, by conveying diverse information in one single document, producing a specific urban visualization.

Next step to our research is to integrate three-dimensional models as an interface to access other urban information, which now it were mainly accessible, in our system, through a cartographic model. This will reduce abstraction and give system users a feeling that they can explore urban space in a more deep level. Great limitation nowadays is size of database – we are talking about a city with 2.5 million inhabitants – but we believe this will overcame by technology advancements, in a short time. However there will

be need for more research in integration of 3D city models and interactive systems, that let us open possibilities to several kind of uses in urban design and planning.

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