

A 3D GIS PROTOTYPE FOR MILITARY APPLICATIONS

Fabien RAMOS

*Aerospatiale Matra - Matra Systèmes & Information (MS&I), 6, rue Dewoitine, BP 14, F-78142 Velizy-Villacoublay Cedex
(France).*

IGN/COGIT, 2, Avenue Pasteur, 94160 Saint-Mandé (France).

Phone : 33 1 43 98 83 24 Fax : 33 1 43 98 81 71 Mail : Fabien.Ramos@ign.fr

The paper focuses on the problem of 3D modeling data within a Geographical Information Systems (GIS) and introduces a multi-dimensional GIS prototype.

A huge community of geographical and spatial data users as geologists, militaries, town planners or communication and utility managers are interested in a GIS being able to handle the third dimension. Several research teams have been involved in that issue and therefore some interesting 3D topological models have been developed for a few years. The purpose of this paper is first to provide a quick overview of those models' main features, i.e. to understand which solutions were brought to solve problems like 3D space partitioning, holes, cavities or non-manifold structures.

The conceptual topological model we chose for the development of a 3D GIS prototype is then described. The data structure being used for this prototype is based on the couple (face, oriented arc) presented by Arnaud De La LOSA in his full 3D topological model [DELALOSA 1999]. Some enhancement have been done in order to allow 2D data handling.

We choose to focus on two of the main characteristics of our prototype in this paper:

- The concept of "hyper-primitive". Usually data capture of ground information and "on-the-ground-structures", as buildings or roads, are carried out independently. Consequently lots of incoherence between the two types of object ("ground object" on the one hand, "on-the-ground-objets" on the other hand) are introduced and it is not unusual to see houses "flying" above the ground. Therefore we suggest, and explain, the concept of "hyper-primitive" to overcome this difficulty. Resolution constraints according to the type of objects are also analyzed in this part.
- Request capabilities. The second point is about the range of request capabilities available in our 3D GIS and the solutions we accept to implement in our request system. Beside geometrical and topological classical requests, we focus on issues which are closely linked to the third dimension. Our work deals with requests related to visibility notions (is the vehicle seen by the radar? what is the surface in the shot of the camera?) but also with trajectory computation, without a graph support, according to terrain constraints (nature of the ground, bridges and rivers, buildings) or in aerial environment (what is the lowest air lane?). Real time needs for our 3D GIS are taken into account for the request model implementation.

This prototype is carried out in partnership with IGN/COGIT and MS&I within the framework of a study related to military applications, but can easily fit to other fields of interest.

[DELALOSA 1999] Arnaud de la Losa, Bernard Cervelle, 3D Topological Modeling and Visualization for 3D GIS, Computers & Graphics, volume 23 (1999).