

Chapter II

Cognitive Aspects on the Representation of Dynamic Environmental Phenomena Using Animations

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INTRODUCTION

Measurements from dynamic environmental phenomena have resulted in the acquisition and generation of an enormous amount of data. This upsurge in data availability can be attributed to the interdisciplinary nature of environmental problem solving and the wide range of acquisition technology involved. In essence, users are dealing with data that is complex in nature, multidimensional and probably of a temporal nature. Also, the frequency by which this data is acquired far exceeds the rate at which it is being explored, a factor that has accelerated the search for innovative approaches and tools in spatial data analysis. These attempts have seen both analytical and visual techniques being used as aids in presentation and scientific data exploration. Examples are seen in techniques as in: data mining, data exploration and visualization.

For complex tasks in environmental problem solving and decision making, visual approaches are often employed to complement the quantitative spatial analysis techniques. Selecting the right visualization technique is an important decision that environmental scientists have to make. Ideally, the technique should have central to its functions: the characteristics of environmental phenomena, (its form, data dimensionality, and data relations); the visualization goals that users seek to pursue and an enabling ability for the technique to overcome the mental roadblocks that normally crop up when data is constrained to specific applications or structures (Keller and Keller, 1992). But underneath these techniques are tools and interfaces

of varying levels of interactivity, graphic mix and dynamics, aspects whose cognitive influences in learning, problem solving, and decision have not yet been fully investigated. Most probably they could trigger different cognitive processes that in effect may result in different judgements (Zhang and Norman, 1994).

The way maps are being used at present is exemplified by the need for visualization tools that would foster a search for questions and hypothesis formulation. This is a shift from the conventional use of maps for presenting spatial facts and information. In geographical disciplines, there is need for tools that will enable users of Geographical Information Systems (GIS) to have a direct and interactive interface to their geographical and other (multimedia) data. One of the reasons is the change from a data poor to a data rich environment, but it is also because of the intensified link between GIS and application-based models. In view of these trends, researchers have focussed on providing tools that will enhance investigation amongst geoscientists in spatial data exploration through its emphasis on the purposeful exploration and search for patterns and relationships among a given data set.

In this chapter we look at a visual technique that is increasingly being used for the representation of dynamic environmental phenomena—the cartographic animation. By tracing some practical uses of cartographic animations in environmental studies, we review the intuitive and technical basis under which animations are chosen and used, and the benefits that users attribute to their use. The chapter also reports some criteria by which animation functionality is defined and its uses evaluated.

CARTOGRAPHIC REPRESENTATION OF THE DYNAMIC ENVIRONMENT

As the rate and extent of environmental change continues to increase, a greater awareness amongst governments, the public, and the scientific community is emerging. There is a need for higher quality data sets and representations that will help improve the analysis and interpretation of environmental patterns and trends. Aspects that are crucial to informing better user and policy needs. One step to managing this scenario is environmental mapping. According to Ormeling (1989), the objective of environmental mapping should encompass, to:

“... Visualize conflict situations, to provide insight in the possible impact of new man-made developments, to explain environmental situations, to compute surface areas, border lengths or ratios, to communicate views, to serve as arguments for decision support in order to solve concrete ecological problems, to serve as tools for analyzing the suitability of the environment for exercising specific functions, or analyzing the computability of socioeconomic activities....”

Some aspects of the mapping processes are seen in cartographic products that are being used in awareness campaigns for the public and politicians to highlight the problems facing the environment through use of factual representations of states and processes of environmental phenomena. Efforts of early involvement of the cartographic community in environmental mapping is seen in ICA (1980), Eurocarto (1988), and ICA (1989). Environmental cartography, as one method that is con-

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