Action-Driven Ontologies of the Geographical Space: Beyond the Field-Object Debate

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Extended Abstract

Recently, the idea of ontology has been an important field of research in GIScience (Smith and Mark, 1998; Fonseca et al, 2000). This paper aims to extend the current perspective of ontologies of geographical kinds, by including additional concepts: (a) the *dynamical* character of geographical entities; (b) the *intentionality* dimension of geographical space.

The dynamical perspective is stressed by the fact that, in real life, geographical entities are continuously being transformed and new ones are being created. Even more relevant to GIS-based ontology research is th the *intentionality* perspective needs to be explicitly taken into account in GIS ontologies. We need to capture the semantic impact of the user's intentions, in questions such as: "Why do we represent a soils map in a certain fashion?" "Why was this set of classes used to interpret a remote sensing image?". In this view, it is impossible, by simple enumeration, to establish a differentiation between the so-called *fiat* objects and *bona fide* objects (Smith and Mark, 1998).

Our basis for the definition for ontologies of geographical domains is the concept of "geographical space" as "a system of entities and a system of actions" (Santos, 1997). In this view, space consists of both "natural" and "technical" *entities*, and of the *actions* that transform these entities.

We propose the concept of "**action-driven ontologies"** to refer to knowledge discovery and representation schemas which aim at capturing the full extent of user intentions and the dynamics involved in the computer representation of geographical data. In action-driven ontologies, the emphasis is placed on the relation of the entities and intended actions to the possible representations of these entities and actions in an information system. In addition to the traditional questions such as "how are the objects of this domain related?", we need also ask "what do want to achieve with this representation?" and "what is the expected end result?".

In addition, the GIS community has established a domain knowledge expressed in spatial operations such as Cartographical Modelling, Spatial Queries, Spatial Statistics, Cellular Automata and Dynamic Modelling. Action-driven ontologies for GIS should capture, to some extent, these knowledge domains and should consist of three different components:

- A description of a set of entities, using concepts from the user domain and their relation to geometrical representations in a computer.

- A description of a set of actions, including both the knowledge domain vocabulary and its relation to the GIS operations and to the data which is produced.

- A description of the intended use of such information, including the final and intermediate products.

To illustrate the above concepts, we present examples of action-driven ontologies in the areas of Landscape Ecology, Population Studies and Soil Mapping.

Finally, we argue that action-driven ontologies should form the basis for a general model for spatial information data. Therefore, in the application domains where action-driven ontologies can be defined, it should be possible to define a unified perspective for modelling and analysis of geographical entities that could supersede the field-object dichotomy.

References

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