A Plenum Ontology of Spatial Change

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Entities are the key building blocks of most ontologies that have been formulated, both generally and more specifically in the area of geographic information. This paper proposes a description of a world where change, not entities, is the key ingredient. A major drawback of an ontology based on change is that it is not very intuitive. However, a fully coherent world can be constructed on that basis that is not qualitatively distinguishable from other worlds peopled with entities and their behaviors. Moreover, many common problems of representing spatial change and dynamics can be easily resolved in such a framework. A change-based ontology thus appears worth exploring, if only as a thought experiment.

The proposed framework revisits the distinction between atomistic and plenum ontologies, a question that has been debated since antiquity. I have written about this duality elsewhere in the context of the much more familiar issue of fields *versus* objects in geographic information science. Atomistic philosophies see the world as consisting of individual things, whereas according to the *plenum* ontology there are only fields of properties, of which the relatively stable spatiotemporal clusters constitute the things. While human cognition appears to have a strong predilection for the atomistic view and the entities and objects that view privileges, the question of whether the world consists of a plenum of properties or of distinct entities (fields and objects, correspondingly, in representations) is not empirically decidable. To some extent the answer is a matter of taste. 'Lumpers' like fields, 'splitters' prefer objects. It is also a matter of intentional stance or purpose. Contemplation, lack of cognitive discrimination, and detached study favor fields (hence their popularity in physical science). The intent to scrutinize, change,

move, posses, buy, sell, or control requires the manipulability of objects (hence their necessity in administration and management). People manipulate objects, but cultivate fields.

The plenum ontology proposed here generalizes some ideas developed in a series of papers by Claramunt and others on modeling spatio-temporal processes (see, for example, Claramunt and Theriault, 1995). That work builds up a hierarchical typology of spatial change for single entities and groups of entities. The approach is very attractive but only works for entity-based ontologies (and object-based representations). Also, it is not obvious how some of its aspects may apply to non-crisp objects. The framework developed here goes beyond that work in three ways; First, it embeds the Claramunt typology of in a broader hierarchy of change starting with a plenum of spatial attributes at the base level and constructing entities, phenomena and processes out of it. Second, it introduces relative frames of space and time built around the notion of *event,* defined as the smallest discernable relevant change in the system at the appropriate level of specification. Third, it places the four Aristotelian categories of change (generation/corruption, increase/decrease, alteration, and locomotion), and their possible combinations, at the center of the ontology, treating entities as relatively long-lived spatiotemporal manifestations in the plenum of change. As with other dual views, the change-dominated world thus described offers some fresh insights into the familiar entity-dominated world of naïve geography.

Reference

Claramunt, Christophe, and Marius Theriault. 1995. Managing time in GIS: an event-oriented approach. *Recent advances in temporal databases: Proceedings of the international workshop on temporal databases*, eds. James Clifford, and Alexander Tuzhilin, 23-41 Berlin: Springer Verlag.