

Formal Ontologies for GIS: Current State and Challenges

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Ontologies clarify how the world is conceptualized; they are necessary for geographic information because geographic reality can be organized for different viewpoints. The construction of formal ontologies for GIS is crucial for interoperability: to achieve automatic detection of usable data sets on the web, we must express the semantics of query and data in a formal system. Ontologies will eventually contribute to the design of graphical user interface and the description of data quality as well.

Different approaches to describe ontologies are available: UML is very often used in the GI community but it lacks in formality; Protege is a widely used editor for formal descriptions of ontologies and has multiple plug-ins to perform formal consistency checks, e.g. for compliance with the standardized ontology language OWL. It is possible with Protege to integrate ontologies defined by others, which link a new ontology to common concepts; this is necessary for automatic interoperability. Tools to produce files which are useful for programming implementations exist.

The extension of GIS to include temporal aspects and processes poses a challenge to geographic ontology research. The current consensus of geographic ontologies for a static conceptualization of geographic reality is using varying terminology, but is typically structured, separating tier 1: field representations (thematic layers), tier 2: bona-fide (physical) objects and tier 3: social constructions (fiat-objects). There is not yet agreement on how to formalize the processes connecting the tiers, for example, to describe the methods used to identify the boundaries of a physical object like a forest. The relation between the current snapshot GIS and a process and time oriented GIS is not clarified ontologically. Missing is, for example, the introducing of the two-time perspectives for an information system (world time and database time) in the ontology framework.