First Nations and Spatial Ontologies: an Emerging Research Area

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Abstract

This presentation reports on research into creating and evaluating geospatial ontologies for First Nations and Aboriginal peoples. We developed a linguistically based, bottom-up method for ontology formalization with Cree peoples.

Background and Relevance

In the next ten years we will see the emergence of the Semantic Web, which will transform much of the Web by using a type of metadata called ontologies (Berners-Lee et al. 2001). Ontologies are formal models of knowledge, and using them as a type of markup will enable computer agents to aid human Web users and serve to make Web content more accessible. GIScience has adopted ontology as a significant research area, and intends to apply Semantic Web technologies to the Geo-Web (Agarwal 2005; Egenhofer 2002). Doing so will require some shared upper-level ontology of geography to act as a bridge between more specific ontologies. Candidates such as SNAP/SPAN have already been proposed (Smith and Mark 2003; Gregnon and Smith 2004).

Though they represent a significant cultural departure from Euro-Canadians, First Nations and Aboriginal Peoples in Canada have used Geomatics Technologies and the Web for many years (Poole 1995; Niezen 2004). The ontology work that has been conducted with First Nations in Australia and the United States shows that geo-ontologies made from their concepts would be different from those made from Western ones (Mark and Turk 2003). There has been no ontology work involving Canadian First Nations, and no formal ontology work with indigenous peoples anywhere. There is some danger that indigenous concepts about geography will be left out of the Geospatial Semantic Web vision. This paper represents the first attempt to create a formal ontology with an indigenous group.

Methods and Data

Our work was conducted with the Cree of Northern Quebec. We used a linguistic approach to create an ontology of hydrography. We began with a dictionary review (Bobbish-Salt et al. 2005) to locate nouns and noun phrases denoting hydrographic concepts, then augmented and explored this list using interview and participant observation methods. The noun phrases were treated as classes in an ontology formalized in a bottom-up manner. Class meanings were fleshed out using topological (connection and containment) and mereological (part-whole) relationships.

A set of 619 Cree placenames was included as instances, or examples of the classes. This aided greatly in verification of the ontology and largely consisted of asking if certain placenames could be described with the Cree word they were classified as, or of another word would work better.

Results

The results show that, as found elsewhere (Mark and Turk 2003), there is no simple way to map categories from the indigenous ontology directly to one made from Western concepts. Our results further this conclusion by showing that indigenous concepts are difficult to formalize for a number of reasons, including:

- People from different generations and familiar with different areas may use different terms to describe the same landscape features, or have totally different landscape features. This may be solved with synonymy and/or a class attribute signifying a certain class is used by certain peoples.
- No words for intermediate, or somewhat abstract categories, such as watercourse, were found. This may make it cumbersome to map an upper level ontology to a domain ontology formalized from indigenous concepts, and certainly made it cumbersome to formalize at all.
- It is difficult to determine what is a common name, or instance, and what is a class with few instances.

Despite these difficulties, and also through them, a Cree ontology of hydrography was formalized that makes clear the differences between Cree and Western spatial ontologies. The ontological investigation also found a geographic predicate unique to the Cree: the use of the diminutive with landscape features. Crees often name things in pairs and indicate pairing using very similar names for the two features, one being the diminutive form of the other. This is to indicate one land or water form is the smaller version of the other. This relationship is only used with two members of the same class.

Verification showed that most of the classification of the placenames into Cree categories was fairly accurate, though other aspects of the ontology, such as the relationships used to define each class, evaded verification.

Conclusions

A linguistically based, bottom-up method for ontology formalization with indigenous peoples was developed and found to work well, though improvements are possible. The addition of instances aided greatly in verification and in interpretation of the Cree words used for the classes.

Formalizing ontologies with indigenous peoples is more complex than it may have appeared at first, and this study found numerous difficulties in doing so. Nonetheless, this is an important research area for indigenous peoples as well as many other minority cultures, lest they find themselves shut out of the Semantic Web.

Future work could concentrate on formalizing spatial predicates, or relationships, with indigenous peoples.

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