What is Time?
Indigenous Conceptualizations of Time and the Geoweb

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Abstract

Geospatial technologies have often been depicted as failing to take into consideration non-Western ways of conceptualizing space and time (Nadasdy, 1999; Rundstrom, 1995; Turnbull, 2007). In this presentation, we offer a critical examination of the Geoweb by taking into consideration challenges presented by indigenous conceptualizations of place and time. More specifically, we compare how the concept of time is modeled in conventional geospatial ontologies to that of indigenous conceptualizations. First, we show that the conventional categorization of objects between *endurants* and *perdurants* might differ from indigenous conceptualizations. Second, we discuss how the conventional time-space cube might be incompatible within these traditional ways of representing and understanding time.

The first author's research is on how the Geoweb could be an effective tool to integrate future aspirations of an Indigenous community regarding the tenure and development of their land. Based on respective work of the two authors with the Cree Nation of Wemindji, in Northern Quebec, we illustrate examples of Cree conceptualizations of place and time, throughout the presentation. We also draw examples from other indigenous communities for more robust comparisons to geospatial technologies.

Background and Relevance

The goal of studying geospatial ontologies is to explicitly relate geographic entities through formalized definitions and categorization. Critical GIS scholars have pointed to a need to 'open the black box' (Pickles 2004) of the technology or to critically engage with the way geospatial technologies are designed and materialized (Schuurman 2006). Agnieszka Leszczynski (2009a, 2009b) argues that the Critical GIS literature has focused on epistemological issues, but it is also necessary to consider GIS on an ontological level that exposes the architecture of thoughts behind the technology itself. Indeed, the original conceptualizations and models of space-time objects common to databases and geospatial technologies influence both the way we think about space and our ability to query, analyze and represent spatiotemporal data (Yuan et al. 2014).

In indigenous contexts, geospatial technologies have often been depicted as failing to take into consideration non-Western models of space and time (Nadasdy, 1999; Rundstrom, 1995; Turnbull, 2007). Indigenous ontologies are typically described as emphasizing relationships between concepts, processes and actions, cycles of activities, and involving complex relationships with other-than-human beings (Hallowell, 2002; Nadasdy, 2007; Scott, 2006). On the other hand, geospatial technologies emphasize a more static view of the world. Developments in geospatial ontology research over recent years have tried to resolve some problems of interoperability between these kinds of differences in terms of both the multiplicity of sources for information, as well as integrating various cultural perspective for this information (Agarwal, 2005). However, the conceptual differences between cultural perspectives are proving to be a persistent issue in this sort of research. Indeed, indigenous

concepts of space, and perhaps more obliquely of time, sit uneasily with dominate linear perspectives held in the west; where there is a clear "future" just "ahead". The simple disconnect between what we may consider being a common and well understood notion of temporal and spatial order, can lead the efforts of even the most well-meaning planners, government agencies, and resource managers down difficult paths laden with these issues of cultural interoperability; where the hypothetical of potential scenarios are not understood as a plurality of possibilities for tomorrow and where set objectives can be set by fixed steps to attain them.

This resonates with earlier debates regarding GIS as a tool or a science (see Chrisman, 2005). Siri Veland et al. (2014) reminds us that geospatial technologies as used in cases like shared planning between cultural groups can never simply be "tools". Because GIS, like many other western-developed technologies, inherently come with 'strings attached' that can weave very different conceptualization of the world. Thus, geospatial ontology research aimed at overcoming such cultural interoperability, especially in the contexts of Indigenous and Western planning partnerships, can offer distinct possibilities to bridge fundamental issues like space-time conceptualization and provide a venue for true dialogue to occur.

Conventional space-time ontologies versus indigenous ontologies

Formalization, as well as conceptualization, of ontology in GIScience has extensively been concerned with the problem of time and temporal references of geographic concepts. Indeed, integrating the conceptualization of time in data models is a very complex task that is by no means "solved". Additionally, geospatial ontologies have to manage concepts that: "interrelate, and participate in processes, are susceptible to changes, have variety of properties and values, that is, they have both spatial and temporal reference" (Tomai and Kavouras, 2004, pp. 288-289). One such contribution to the conceptualization of time in geospatial ontology was through making a distinction between continuant objects that endure through time and occurant objects that happen in a certain time (e.g.: processes or a specific event). Pierre Grenon and Barry Smith (2004) proposed a spatio-temporal ontology, called SNAP/SPAN, based on this very duality between endurant and perdurant. Through the employment of SNAP/SPAN, a distinction could now be established between the 'ocean' and 'tide' that was otherwise treated as being one in the same through previous geospatial ontologies (Agarwal 2005, p. 507).

However, in indigenous contexts, fixing elements of landscape as endurants might be problematic. In the case of Australian indigenous views, scholars have shown that the storytelling processes involved in the knowledge about places and the interconnection of 'land' and 'sea' prove the endurant/perdurant categorization to be inadequate (Muller 2008; Muller 2014; Verran 2004; Veland 2014). Similarly, in the case of Eastern James Bay Crees, the conceptualization of hydrographic entities doesn't match the distinction between 'land' and 'river' (Wellen and Sieber 2013). For example, entities of portages on the land are part of the entity 'river' which would not conform to the conventional endurant/perdurant distinction.

Conventional space-time cube container versus relational indigenous ontologies

Geospatial ontologies are often based on a cube space-time representation, akin to Hägerstrand's time geography (Hägerstrand 1970). Yuan et al. explain that the space-time cube is : "a collection of lattice points, for example, with semantic properties at locations and then expand the lattice orthogonally to a cube to incorporate the temporal dimension" (Yuan et al. 2014, p. 2). This view depicts space-time as an object-independent framework; with the cube existing independently as a container populated with space–time objects (Yuan et al. 2014).

However, this model is not without issues as noted by Eric Sheppard who claims “debates in geography too often set time aside or position it as an orthogonal Newtonian third dimension. This essentially freezes our ways of thinking about the world” (Merriman et al. 2012, p. 9). Similarly, Antony Galton (2011) theorizes limits related to the ‘spatialisation of time’. Attributing to time the same properties of space fails capture the motion of the passage of time, which often seen as the most important attribute to depict how we experience the concept of time.

Therefore, new modes of representation are also necessary since we are finding incompatibilities with the space-time cube view and indigenous conceptualizations of time. At least, we are beginning to understand that some indigenous concepts of time are inherently related to place. This means that any attempt to create a geospatial ontology for such perspectives on aspects of the world will certainly require a more complex means of representation than simply adding a third dimension to a coordinate system of points or objects. Indeed, indigenous ontologies are often described as relational ontologies; where relationships between beings and entities are ontologically fundamental, dynamic and practical, as well as being in opposition to delimiting universal categories to describe the world (Howitt and Suchet-Pearson 2006; Ingold 2006; Suchet-Pearson et al. 2013). For example, the Runa communities of Equador hold a notion of the ‘living future’, where the future is interlinked with practices of everyday life and is also transcendental to themselves by being part of larger cultural relationships to animals and nature (Kohn 2013). Differences between the space-time cube and Cree conceptualizations can also be found. Indeed, Cree resources management practices show that temporality is part of complex web of relationships, where natural cycles like seasonality or changes to the environment are both a cause and a consequence of the movements and the behaviors of humans and animals (Preston 2002). Furthermore, the space-time cube emphasizes the attributes of linearity and duration, often represented with time intervals. However, time is not always perceived as independent of the events and objects. Sinha et al. (2011) show that in the Amazonian Amondawa language and culture, time is not based not on countable units, but on social activity, kinship and ecological regularity.

Conclusion

In conclusion, the ontological differences between geospatial technologies and indigenous conceptualizations raise the broader issue of “standardizing knowledge” for indigenous communities where place and time are deeply linked to abstract concepts of spirituality, sacredness, wisdom, morality, and well being (Basso 1996). The fundamental role relatedness has in many indigenous belief systems brings raise for concern that perhaps fixing indigenous knowledge systems into ontological categorizations in any form may be inappropriate.

Perhaps, future research towards the development of geospatial ontologies, based on human reasoning about time and space, might offer possibilities to bridge the gap between some of the differences we have discussed. For example, in opposition to the development of geospatial ontologies that would specify common concepts across different domains (c.f Smith, 2012), a place-based engagement perspective on indigenous geospatial technologies (Alessa et al. 2011; Veland 2014) would define concepts of place and time that are specific to a context and that corresponding to the local views of the world.

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