Objectivity in GIS: Do Cultural Differences Matter?

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1 Introduction

It is worthwile to revisit the debate on effects of cultural differences on GIS from the late 1980s for two reasons:

- It shows how we saw GIS in then. The contrast between the GIS vision of the 1980s and 1990s and today's GIS industry is striking.

- It points to questions of objectivity of GIS data, and leads to understand issues of objectivity as part of data quality. In a world of multiple data sources, some commercial, some national agencies, users must be able to assess the context in which data is valid. Eventually, methods to label datasets with the context in which they are valid will emerge.

2 Vision of GIS

The discussion on cultural differences in the late 1980s revealed a vision of GIS which was widely shared and led to National Spatial Data Infrastructures [Masser et al., 2008]. The vision is characterized by strong centralization:

- a few vendors of monolithic GIS software systems,

- a single major data provider, typically a national mapping agency, producing a large number of specialized elements, and

- a group of "spatially aware professionals" using GIS for, mostly, governmental purposes.

The current vision of web GIS, often surpassed by reality, is different:

- commercial and open source [Perens, 1999] GIS software cooperates based on interface standards [Buehler and McKee, 1996],

- many providers for the small number of generally used datasets, often commercially and globally organized, supplemented by specialized datasets from a wide array of sources (governmental, commercial and volunteers),

- an intermediate level of specialized application and service providers, and

- nearly everybody using GIS services in one form or the other.

Google Maps, with their flexible application programmer's interface, and car navigation systems, advocated in the GIScience community since the 1980s [White, 1987] are perhaps the most visible exemplar of the new (distributed) GIS, contrasting with the vision of the 1980s.

3   Cultural Differences Debate

The discussion of influences of cultural differences on GIS [Campari and Frank, 1995][Campari and Frank, 1993] [Montello, 1995] pointed to the fundamental question how culture influences GIS data. It can be re-read as the question whether a few authoritative data and software providers can produce "objective" GIS data? Objective for whom? This question becomes practically important, if a user has the choice between several data sources, some of them from public authorities, some of them from commercial sources, some of them from volunteers.

A GIS must be able to deal with the objectivity of datasets between the extremes of objective measurements and highly culturally influenced classifications. The literature on cultural differences does not give evidence for differences between people in how they perceive space. The other extreme is a verbal description of a situation, which is different from languages to languages and thus culturally influenced.

4   Objectivity of data

Objectivity is part of the quality of the data and needs methods for an abstract description [Frank, 1998][Winter et al., 2007]. Considering the chain of transformations that links reality to data [Frank, 2001] one can identify the places where subjectivity is introduced. The transformation starts with perception of reality by a human observer, followed by conceptualization and encoding steps:

- perception and conceptualization of physical reality:

  - the limitations of human senses while observing a situation (likely universal),
  - the (wider) physical environment of the situation observed (climate, ecology etc.),
  - the goals of the observers while observing;

- conceptualization and encoding:

- cultural interpretation of physical reality (e.g.,European view vs. aboriginal in Australia [Mark et al., 2007]),
- language used for encoding,
- communication goals (property registry vs. advertisement to sell).

Data, as socially constructed artifacts, follow Searle's formula "X counts as Y in context Z" [1995]. Data is valid only in the context in which it was collected and must be labeled correspondingly. To avoid misunderstandings and subsequent errors in interpretation, the use of data must be bound to the context in which it was collected. Data collected in order to administrate the execution of one law is not likely usable for purposes of another law. In Austria, for example, about half a dozen different legal definitions of forest exist, each defined and used in one law and applicable for its execution. As a consequence, there are also multiple different data sets, indicating which areas are forest (in the sense of one of these laws), each valid in the narrow context of the defining law.

5   Conclusion

The "data quality" discussion today focuses mostly on precision of observations and should be complemented with the instruction given to observers regarding, what they should observe (and especially what they can leave away). The classification of physical reality is a social construction and depends on the cultural (e.g., legal) context. Note that it is not possible to give a count of all adults in Europe, not for problems of counting, but of agreeing on who counts as an adult.

Interpreted datasets are more informative (in the sense of Shannon and Weaver [1963]) but less objective. An interpretation brings in a context. Mere reports of physical sensor data (e.g., remote sensing data) is more objective than a hotel advertisement on the web! Labeling datasets with context reduces misunderstandings and strikes the balance between the goals of providing maximum information and objectivity.

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