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Organizing and Representing Geographic Information

Abstract
Providing verbal subject access to maps is in many ways as fraught as providing access to any other human artifact since places and features of the land are interpreted and named. Using critical cataloging, an approach analogous to critical cartography, we argue that the systematic use of place-names in systems allows for rich retrieval. Place-names are a geographic location that has been identified and referenced as a social construct; cartographers map these locations and information professionals provide access to the cartographic artifacts they create. Depending on the system, end-users may search via geographic coordinates, but there is a potential for a richer transaction if a variety of verbal place-names are accessible. Into the future, as content becomes increasingly digital, personal lexicons of place-names have the potential to be used increasingly, both inside and out of traditional repository settings.

Introduction

Providing verbal subject access to maps is in many ways as fraught as providing access to any other human artifact. The land under one's feet is interpreted every bit as much as the systems of government or the art objects found on it. Places and features of the land are interpreted (river, stream, creek, dry creek bed, etc.) and named (Saint Petersburg) both colloquially and potentially also by those in power. These interpretations and names can and do change over time due to culture and other changes in perspective. In creating maps, cartographers capture and designate places utilizing place-names; geographic information systems professionals designate locations of importance through the use of digital geospatial data. Then, in instances of curated geographic information in libraries, archives, and data centers, an information professional assigns prescribed access points using published controlled vocabularies. Finally, users access the maps describing geographic locations through the use of controlled vocabularies or, in specialized systems, geographic coordinates. Anecdotal reports confirm that users rely on place-names for map access. "In the Map Library most of our enquiries start with a place name. For the map curator, place access is of primary importance, more than the author or cartographer, even more than the title" (Williams, 2008, p. 20).

Based on the previous assessment, despite the concrete nature of the earth and the places on it, designating geographic places is a first-order classification act subject to human bias that must be repeated three times in offering access to maps: once by the powers that identify and provide place-names (bias #1), then by cartographers (bias #2), and then by information intermediaries through the use of controlled vocabularies (bias #3). Finally, end-users approach systems with their own biases in an attempt to access surrogates and ultimately, the geospatial data often captured in maps.

In light of the identified biases that emerge in representing and organizing geographic information, this paper seeks to answer the fundamental questions:

• In what ways might place-name biases affect end-users?

• Under what circumstances is it possible to alleviate some of the bias inherent in providing access to cartographic material through information systems?

Using *critical cataloging*, an approach analogous to critical cartography, we adopt a framework for inquiry that acknowledges the biases inherent in the provision of access

to map-based geographic information. Related inquiry has been carried out (i.e. Moulaison, 2010; Olson, 2003; Tennis & Adler, 2013). To our knowledge, although studies of geographic information have been carried out in the knowledge organization context, no study of the issues surrounding the subjectivity of assigning place-names and the potential for benefits this act may bring have been formally put forth. This conceptual paper aims to fill that gap.

In this paper, we first examine the notion of place-names as a geographic location that has been identified and referenced as a social construct (Goodchild & Hill, 2008). Next, we consider the cartographer's point of view and the notion of critical cartography. Finally, in approaching the issues of bias in place names, we put forth the notion of critical cataloging of geographic information. Examples from current metadata practice are explored and suggestions are made. In doing so, this paper embraces the necessity of overlapping and potentially biased place-names to each coordinate and proposes changes to systems that rely more strongly on visual representations and the graticule (i.e., latitude/longitude) organization of Earth uniformly through geodesy.

Place-names and Standardization
A place is an area distinguished or separate consciously from other areas (Stewart, 1975). Therefore, the planet is full of countless locations humans may consider distinct places. To assist in orientating travel between different places and ascribing meaning to places, early inhabitants named areas. A place-name is a word or series of words that identify physical or administrative features on the Earth, sea floors, or other planets (Randall, 2001). Accurate place-names are vital to commercial, military, and scientific purposes. In 1890 in the United States (U.S.), the U.S. Board on Geographic Names (USBGN) was created to make sure current names were accurately located. Similar agencies exist in other countries, and supranational groups also exist such as the United Nations Group of Experts on Geographical Names (UNGEGN). The goal of any of these organizations is place-names standardization, i.e. each named feature should have only a single name. Such a notion is not foreign in knowledge organization, as value vocabularies such as the Library of Congress Subject Headings (LCSH) list has adopted a principle of the use of uniform and unique headings (Chan, 1990).

Standards in place-names only emerge over time and when there is not conflict over possession of areas. With the Library of Congress Classification (LCC), geographically localized subject bibliographies are ordered "North America, South America, Europe, Asia, Africa, Australia, and Oceania" - a way that "reflect the order of the importance of these continents (culturally and politically) to the late nineteenth-century American political establishment" (Higgins, 2012, p. 251). Clearly, place-name change is constant and inevitable albeit more settled at present than during periods of colonization and wars. A clear example of more rapid place-name change is the dissolution of the Soviet Union that led to several countries dropping pieces of their place-names, such as People's, Social or Democratic (e.g., Polish People's Republic to Republic of Poland). When the Ukraine became independent in 1991, it changed 90% of its place-names. To exert power over places, renaming occurs and through time people reclaim and repurpose place-names although not always recognized globally (e.g., Bombay to Mumbai, Burma to Myanmar, and Zaire to the Democratic Republic

of the Congo). Different spellings result from different languages and few countries have only one official language.

Regardless of complications from political change and multiple languages, place-names used by information professionals result from those who create geographic information by selecting place-names to describe areas. On static maps in particular, limitations on space do not allow for multiple names to occupy a single place. Each place-name has its own origin; a classification of place-names created by Stewart in *Names of the Globe* assists to generalize across the globe and serves as a conceptual framework for this presentation's classification analysis:

1. Descriptive Names (e.g., Rio Grande, i.e., a permanent quality of a place)
2. Associative Names (e.g., Mill Street, i.e., name borrows name from proximate places)
3. Incident-names (e.g., Easter Island, i.e., something of note occurred and the name stuck)
4. Possessive Names (e.g., Pottersville, i.e., ownership of a place)
5. Commemorative Names (e.g., Washington, i.e., in honor of a person)
6. Commendatory Names (e.g., Happy Valley, i.e., *de bon augure*)
7. Folk-etymology (e.g., Mt. Maroon, i.e., new people in power mispronounce/misspell/misinterpret place-names)
8. Manufactured Names (e.g., Tesnus, i.e., new additions to the landscape of place-names)
9. Mistake-names (e.g., Nome, i.e., propagation of errors)
10. Shift-names (e.g., Cambridge, i.e., transplanted place-names)

Place-names are powerful, not only for the land they designate, but also what they represent. The World Intellectual Property Organization (WIPO) considers *geographical indications* to be a type of intellectual property, on par with copyright, patents, trademarks, and industrial designs (2014). Indeed, "appellations of origin are signs used on goods that have a specific geographical origin and possess qualities, a reputation or characteristics that are essentially attributable to that place of origin" (WIPO, 2014, ¶Geographical). In mapping, each type of place-name identified by Stewart presents unique problems for the cartographer as surrogate the information professional as the following sections outline.

Critical Cartography and the Cartographer's Bias

The purpose of a map is to represent graphically some feature on the Earth's surface. The person who designs the map, the cartographer, decides what will be included and excluded. Mapping a place becomes the ultimate reflection of the cartographer's bias since features and terminology known to her or him will be recorded and used to describe geographic location. By choosing which features to include, to exclude, and to name, the mapper is carrying out a first order act of classification.

Critical cartography is a framework for reflecting on the bias inherent in place-names, projections, and all other elements in cartography. Critical cartographer Brian Harley (2001) used maps to show how over time, indigenous place-names and peoples were displaced in New England and elsewhere simply by omissions, whether intentional or not the empty spaces invited colonization to fill these blanks on the map. Endless examples exist of similar replacements from boom town to ghost town and oft-cited deconstruction of a North Carolina state highway map, where critical cartographer

provides an approach to reveal those hidden ideological frames in which the cartographer works (Wood & Fels, 1986). The representation of geographic information, even in maps, can be fraught due to the complexities and subjectivity of the classificatory act in cartography.

Information Intermediaries and End-Users

Maps of high quality that will be of use are selected for inclusion in a collection. As part of their processing, maps in organized collections undergo further analysis by the information professional; he or she, as information intermediary, will organize and label the maps according to a controlled vocabulary. In doing so, the information professional introduces the biases of the knowledge organization systems. For example, as part of its general principles, the Map Cataloging Manual reminds catalogers that, "Despite what a place is called on a work, the classification reflects the geographical area depicted" (2014). Value vocabularies like the Library of Congress Subject Headings (LCSH) and classification systems like the Dewey Decimal Classification (DDC) and the Library of Congress Classification (LCC) used will affect interpretations of location in terms of the collection. One example is DDC, where Turkey as a whole is part of Asia; materials about Turkey in Europe, however are classed with Europe, affecting collocation and browsing of all materials about Turkey.

Mapping and classification are cognitively interrelated boundary determinants and both act to assert common properties that are subject to the biases of the actor in question. Yet, the final subjective approach brought to the process is that of the end-user, a member of a certain culture with inherent biases about the nature of that which is mapped and the terms used to describe areas.

Critical Cataloging

Critical cataloging, an approach we put forth here, acknowledges the biases in all of the structures serving as a support for the study of *critical cartography* and may be useful as well in the study of knowledge organization systems. Unlike *radical cataloging* (sometimes also confusingly referred to as *critical cataloging* (Berman, 2013)), critical cataloging does not seek to change place-names in information systems, but rather embraces the differing points of view and the potential for enriched retrieval that they represent. Redundancies based on authentic use of place-names have the potential to allow for richer and more robust naming of the geographic location from the point of view of differing, diverse groups.

Knowledge organization has considered the information system as an artifact of a biased social construct. Like us, Drabinski (2013) proposes accepting the imperfections of the repository, working with them as a record of society's views at a given time. Drabinski (2013) draws her approach from Queer Studies, but the result is similar in spirit. In the instance of critical cataloging, we can promote a multiplicity of place-names while using coordinates as a means of disambiguation.

As with critical cartography, critical classification acknowledges that there is information to be learned about a society and its perceptions of location in the study of cartography, map cataloging, and access. At the same time, such biases cannot and should not inhibit access to materials for end users. In the following section, we describe tools information professional are using to provide access to cartographic materials.

Table 1: Capacities of encoding schema used with geographic information

Encoding Schema	Element permitting latitude/longitude info	Input standard for lat/long info	Element permitting place-name info	Input standard for place-name	Notes
Specialized schema					
ISO 19115 Geographic information ftp://ftp.ncddc.noaa.gov/pub/Metadata/Online_ISO_Training/	Extent: Geographic Element -- GeographicBoundingBox Geographic position of the dataset	decimal	descriptiveKeywords	MD_Keywords package	Also permits as Extent: TemporalExtent Time period covered by the content of the dataset
Content Standard for Digital Geospatial Metadata (CSDGM) (Legacy) http://www.fgdc.gov/metadata/documents/workbook_0501_bmk.pdf	Spatial Domain Bounding Coordinates	decimal	Keywords: Place	*not clear*	Keywords: Theme provides information on the kind of map or information on the map
Unspecialized schema					
MARC http://www.loc.gov/marc/bibliographic/ecbdhome.html	034 -- Coded Cartographic Mathematical Data 255 -- Cartographic Mathematical Data	decimal	651 (Geographic Name)	Controlled vocabulary: LCSH	651 Geographic Name is a repeatable field
DCMES http://dublincore.org/documents/dces/ http://dublincore.org/documents/dcmi-terms/	DC Terms (dcterms: namespace): coverage DC Element: coverage	DCMI Box DCMI Point	DC Terms (dcterms: namespace): coverage DC Element: coverage	LCSH and TGN recommended	All elements are repeatable
Metadata Object Description (MODS) http://www.loc.gov/standards/mods/userguide/subject.html	Subelement: <cartographics> <coordinates> "Contains a statement of coordinates covered by the resource."	*not clear*	Subelement: <geographic> Subelement< hierarchicalGeographic>	Subelement: <geographic>: LCSH, etc.	All are subelements of the Top-level Element: <subject>

Metadata for Maps

Metadata supports the storage, retrieval, and use of information resources. Both the ways in which the information is organized and the metadata schema used to structure records that permit retrieval affect user access. Although not all maps are classified for shelf arrangement using classification schemes like LCC or DDC, maps (both print and digital) are generally assigned subject headings or descriptors of some kind. Both information professionals and subject area specialists have created systems for

providing access to maps. Specialized geographic information schema used in the United States are currently based on ISO 19115, with some legacy systems remaining. These schema function essentially as both encoding standards and content standards. Table 1 summarizes capacities of metadata schema used in repositories to record coordinates and verbal place-names.

In the schemas described in Table 1, location terms must be provided by information professionals. In the specialized schema, the option to enter keywords freely suggests a rich source of biased information could be entered over time. Eencoding schema used by the LIS communities (MARC, DC, and MODS) tend to rely on and endorse the use of controlled vocabularies to categorize materials: specifically, they use LCSH and the Getty's Thesaurus of Geographic Names (TGN). These vocabularies do not allow for flexibility on the part of the information professional or on the part of the end-user. Williams (2008) identifies weaknesses associated with these controlled vocabularies. LCSH, a vocabulary used throughout the world, does "not seem to recognise either the importance or the complexity of place names" (Williams, 2008, p. 21). Although authority records for locations can provide additional information for the information intermediary, a single term is provided in the metadata being created in accordance with the LCSH principle of specific entry (Chan, 1990, p. 3-4). LCSH practice requires that only the most specific term(s) addressing at least 20% of the work be applied (SHM, 2004, §H 180 Assigning and Constructing Subject Headings). With TGN, strengths include that the terms are meant to be used with visual materials such as maps, that current and historical heading co-exist in the system, and that the place-name is in either the language of origin or optionally in English. Drawbacks to TGN include its unfamiliarity in LIS systems and the somewhat long and unwieldy strings of terms (Williams, 2008). End-users of systems employing either vocabulary are nonetheless unable to search within the system for arcane, purely local, or discontinued terms, or ones otherwise deemed as being out of favor of the mainstream. Table 2 summarizes TGN and LCSH access to place-names.

Table 2: Value vocabularies: verbal access to place-names

Controlled vocabulary	Vocabulary allows a multiplicity of place names over time, by variant groups, etc.	Place names are associated with latitude/longitude in authority records	Notes
Getty Thesaurus of Geographic Names (TGN) http://www.getty.edu/research/tools/vocabularies/tgn/	Yes. Each entry is hierarchically placed. Changes in power affect both place-name and hierarchy.	Coordinates given for each location, but not for each place-name	Locations have one master record associated with a single place-name
Library of Congress Subject Headings (LCSH) http://authorities.loc.gov/	Yes, but limited; available via USE/UF mechanics	034 - Coded Cartographic Mathematical Data (R)	Authority records include terms in other languages

Discussion and Future Work

Historical patterns of mapping and organizing, with all their inherent biases from mappers, information professionals, and users, primarily codify place-names. There is value in local place-names as they are windows on the society that created them and are much richer than latitude/longitude for describing location. By providing end-users with place-names selected by the controlled vocabulary creators, ones that are

potentially unfamiliar, we may inhibit their ability to identify and retrieve resources based on more colloquial or less-favored place-names that, in their dialect, are equally valid.

Bias can be alleviated through the use of query-based systems relying on coordinates. Map-based query using a resource similar to Google Maps would allow end-users to select areas on the map as a way of searching the database, but alleviating all bias regarding location cannot be a recommended practice due to the extent to which naming is fraught. Critical classification tenets imply that including and retaining place-names is a beneficial method for permitting pluralistic versions of reality lead to broader and more successful searches. Since it is possible for in-house controlled vocabularies to be used to assign terms to maps, creating and retaining collections of variant place-names to be actively used could function as an additional method for providing verbal subject access.

In the future, as data becomes increasingly digital and as systems are increasingly queried online, questions of the effect of technology has on place-names can also be explored. Does the globalization of information create an environment of homogenized place-names or preferred use of latitude/longitude information? With smartphones, most citizen-scientists' data automatically retains coordinates based on their GPS location. Or, conversely, will local perspectives thrive in globalize digital environments? What is lost by using the graticule as organizational system versus other topologies that weight orientation based on factors beyond latitude/longitude? Projects using Volunteered Geographic Information (VGI) may in fact help perpetuate and record local place-names. Given the variety of place-names possible, the EU Digital Earth project allows many different layers to appear depending on user preferences. OpenGeoportal (opengeoportal.org) presents datasets available at the extent the user searches a web-based mapping application regardless of place-names used in a search. Additionally, a map for each person could be created with augmented reality (e.g., Google Glass), thereby respecting individual tastes for place-names and representation. Wearable technology like Google Glass represents an individualized lens on the world, but it is still possible that place-names are omitted.

Conclusion

In the aggregate, maps and their organization from a variety of cultures throughout time may actually be the only option for understanding and implementing a standard for organizing the world. Biases in place-naming, cartography, and knowledge organization schemes are unavoidable; when these biases influence the way information is organized, however, certain groups of end-users stand to be excluded. Critical cataloging of maps acknowledges that biases exist and that they have a potential to be useful if exploited to the fullest in the retrieval system.

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