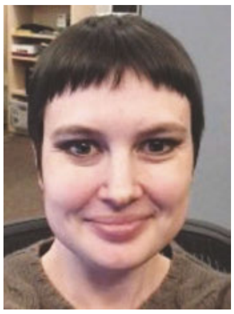
Geographic Knowledge Organization: Critical Cartographic Cataloging and Place-Names in the Geoweb†

Bradley Wade Bishop*, Heather Lea Moulaison**, Christin Lee Burwell*

*School of Information Sciences, University of Tennessee, 1345 Circle Park Dr., Communications Bldg. Room 442, Knoxville, TN 37996, U.S.A., <bbisho13@utk.edu>, <cburwell@vols.utk.edu>
**iSchool at the University of Missouri, 303 Townsend Hall, Columbia, MO 65211, U.S.A., <moulaisonhe@missouri.edu>

Wade Bishop is Assistant Professor in the School of Information Sciences at the University of Tennessee, Knoxville. His research focus is on geographic information (GI) organization, access and use, as well as the study of GI occupations, education, and training. He has other research expertise that includes physical access for users to U.S. public libraries (using Geographic information Systems (GIS)) and the evaluation of many other services and resources in academic and public libraries.

Heather Lea Moulaison is Assistant Professor at the iSchool at the University of Missouri. Her research focuses primarily on the intersection of the organization of information and technology, and includes the study of issues pertaining to metadata, standards, and digital preservation. An ardent Francophile, Dr. Moulaison is also interested in international aspects of access to information.



Christin Lee Burwell is a graduate student in the School of Information Sciences at the University of Tennessee, Knoxville. She is interested in metadata, cataloging, Geographic Information Systems and social justice issues in Information Science.

Bishop, Bradley Wade, Moulaison, Heather Lea, and Burwell, Christin Lee. **Geographic Knowledge Organization: Critical Cartographic Cataloging and Place-Names in the Geoweb.** *Knowledge Organization. 42(4)*, 199-210. 43 references.

Abstract: Providing subject access to cartographic resources is in many ways as fraught as providing access to any other human artifact, since places, spaces, and features on the land are conceptualized and named by people. Using critical cartographic cataloging, an approach comparable to critical cartography, we explore the potential of using multiple place-names in information systems to allow for multidimensional retrieval. Place-names are a social construct identifying and referencing locations. Cartographers and other geographic information professionals map these locations by encoding them into cartographic artifacts. In some instances the place-name metadata are created by knowledge workers; increasingly, they also can be created by non-expert end users on the Geoweb. Because queries begin with a place-name, personal lexicons of end-users have the potential to be used increasingly, both inside and out of traditional repository settings. We explore place-name biases and make recommendations to inform system design within the field of knowledge organization that accounts for the multitude of world-views in the emergent Geoweb.

† This article is based in part on: Moulaison, Heather Lee and Wade Bishop. 2014. "Organizing and Representing Geographic Information." In Wiesław Babik, ed. 2014. *Knowledge Organization in the 21st Century: Between Historical Patterns and Future Prospects: Proceedings of the Thirteenth International ISKO Conference, 19-22 May 2014, Kraków, Poland.* Advances in Knowledge Organization 14. Würzburg: Ergon Verlag, pp. 437-44.

Received: 6 March 2015; Revised: 9 July 2015; Accepted: 12 July 2015

Keywords: place names, geographic information, cartographic resources, critical cartographic cataloging

1.0 Introduction

Providing verbal subject access to cartographic resources is as fraught as providing intellectual access to any other human artifact. Cartographic resources, themselves, are complex. The Earth undergirds all activities on the planet, and the features of the many locations depicted in cartographic resources are interpreted by the Earth's inhabitants throughout time and space. Places on the land are deemed to be of interest (river, stream, creek, etc.) and are named (New York) colloquially as a kind of informal georeferencing by anyone using a name to refer to a place.

Both places and place-names are essential to designating the features of a location. A place is an area distinguished or separated consciously from other areas (Stewart 1975). The planet is therefore full of countless locations humans may consider distinct places and a boundless number of interpretations exist for the same places. To assist in orienting travel between different places and ascribing meaning to places, early inhabitants named features irrespective of any authority beyond their own. A place-name is a word or series of words that identifies physical or administrative features on the Earth, sea floors, or other planets (Randall 2001). Place naming results at a local level in endonyms, terms in the language of the people who live there, but that local knowledge does not always get captured in formal documentation of a description of the Earth or in the information retrieval systems where organizing at a granularity beyond local parameters occurs. When the interest in a place expands to tasks beyond simple travel like science, land management, or foreign affairs, the standardization of place-names and their exact locations has become more critical. For example, formal standardized naming of places has been vital for the success of many government purposes such as exploration, mining, settlement, homeland defense, emergency response, and taxation. During the formal documentation of space, georeferencing occurs that assigns coordinates to a place on the Earth by those with authority to assign names to bound places (Buchel and Hill 2011).

Any individual can name a place informally, but interpretations measuring the Earth carried out using geomatic processes require a formal place-name to differentiate between places. The authority of formal georeferencing comes from the work of the geo-professions that use scientific approaches to mapping, such as cartographers, surveyors, and so forth. In many ways, the work of these types of geographic information professionals starts the formal process of georeferencing by assigning or creating place-names. Just as with other knowledge workers, geographic information professionals are subject to licensing, receive extensive graduate education, and work with evolving standards that inform professional activities. In creating cartographic resources, cartographers and other geographic information professionals capture and designate places utilizing existing place-names from gazetteers, geographic thesauri, or other maps.

For the majority of users of cartographic resources, the reliance on place-names for access is a constant; it derives from the same purpose to have named places—to distinguish between two places. Users with a relatively novice geographic background access cartographic materials through any number of terms, including generalizations of areas like west Texas. Conversely, some expert users such as Earth scientists, biologists, or geologists may use very specific geographic coordinates (i.e., latitude, longitude) or geologic terminology (i.e., sub-basin) to determine place. Overall, "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, 20). Metadata in retrieval systems can include a number of elements to describe cartographic resources, but place-names are of consistent importance for successful retrieval.

The importance of place-names to finding geographic materials is both inherent and acquired. Place-names are inherently important because people think in terms of them, calling for the creation of palatial information systems (Goodchild 2011); additionally, place-names have an acquired importance due to their cultural importance. In other words, place-names are the key access point to geographic information for users, and both organization and retrieval must acknowledge this. Formal place-names recorded by cartographers relate the cartographic resource to all associated documents with the same geography. However, web-based social resources such as shared mapping sites demonstrate that users interacting with geographic information utilize terms from their own lexicon. These local or informal place-names may intrinsically exist within the same geographic space as the formal place-names found in gazetteers. In negotiating retrieval of geographic information, formal, authorized place-name terms or latitude/longitude are required to describe objects in databases. A retrieval environment accommodating informal place-names across time and space could reinforce and promote retrieval beyond that which is currently available.

1.1 Biases Inherent in Cartographic Resource Description

Despite the tangible qualities of the Earth and its spaces, designating geographic places and subsequently naming them is a first-order classification act subject to human biases. This biased classification act is repeated at least three times during cartographic resource description and in other instances of making geographic information accessible through retrieval systems. The first bias is introduced by humans that identify and name places on the Earth. A second bias is introduced by cartographers who map based on the needs of their users, professional conventions, and documentation about the area. A third bias in organizing resources is introduced by information intermediaries through the use of existing knowledge organization (KO) tools. In instances of curated geographic information in libraries, archives, museums, and data centers, information professionals assign prescribed access points using thesauri, controlled vocabularies, gazetteers, dictionaries, and potentially classification schemes to resources. Although these biases are not the only hurdle when dealing with the retrieval of geographic information, they take on an added significance because of their relation to larger issues. Because bias is more likely to put specific groups at a disadvantage, groups that are already marginalized in a greater context, it demands additional scrutiny. Otherwise knowledge organizations run the risk of disenfranchisement in addition to just problems of ambiguity. These three biases, however, are not the only ones affecting retrieval of geographic information on the Web.

1.1.1 The Geoweb

The Geospatial Web (Geoweb) refers to a merger between the Web, geospatial technologies, and geographic information (Herring 1994). The Geoweb allows users to interact, collaborate and create content about locations regardless of where they themselves are located. Location-based information and location-based services are prevalent on the Web (e.g., Google Maps). Many applications modify answers to location-based questions based on a user's whereabouts. For example, there is a geographic information systems (GIS)-based 911 in the US, which finds one's location based on location-based information on a user's mobile device. Turn-by-turn directions given through GPS software in automobiles and on mobile devices are commonplace. Mobile advertising now targets advertising based on a potential client's location.

The advances in technology that allowed simple, web-based mapping applications in the late 1990s to evolve into the ubiquitous Geoweb tools that allow for new connections to each individuals' surroundings are summarized briefly here. Geographic information was created by a variety of professional groups, each with its own image formats, maps, and database schemes (de Carvalho et al. 2007). Sharing geographic information beyond the original creator faced many interoperability challenges due to the lack of shared standards between different organizations and/or between individuals within the same organization. In 1994, the Open Geospatial Consortium (OGC) (http://www.opengeospatial.org/) formed to address these challenges and began to build the standards that would enable more streamlined sharing of geospatial data through the Internet (e.g., Geographic Markup Language (GML), Web Feature Service (WFS), and Scalable Vector Graphics (SVG)) (Peng 2005). Another important advance that made the Geoweb operate more quickly when loading tiles of geographic information as users zoomed and panned over interfaces was AJAX (Asynchronous JavaScript and XML), which includes CSS. These tools along with other scripts and codes, standards, and programs made possible the small alterations of repositioning a user's place on a map or web page or any other dataset without the time-consuming process of uploading an entirely new page or spatial dataset (Stamey et al. 2007). In part due to the introduction of AJAX and other technologies with increasingly dynamic capabilities, Internet traffic increased and the new capabilities of the Internet became referred to as Web 2.0 (Stamey et al. 2007).

Unlike the static naming in print maps, most geospatial data on the Geoweb can be repurposed and its description altered by multiple users without any geographic training and in near real-time. The act of contributing geographic information online is commonly referred to as volunteered geographic information (VGI) (Goodchild 2007). End-users approach systems with their own place-name biases in their VGI and may attempt to find surrogate records of the geographic information using terms without consideration of their own biases. In the emergent Geoweb, the biases can be reimagined in different ways as the delineations between professional and novice and creator and user are tremendously blurred—everyone is a geographer, creator, and user, and everyone's designations for place have a potential to be recorded as part of the Geoweb.

1.2 Fundamental Questions Addressed

The purpose of this paper is to explore place-name biases in cartographic resources and make recommendations to inform system design with knowledge organization (KO) that accounts for the multitude of world-views in the emergent Geoweb. The biases from users, geographic information professionals, cartographers, and catalogers are inherent as any geographical structure includes topological features that allow for continuity, connectedness, and convergence of features in space (e.g., boundaries). For example, even though the place-name from an authority is external to the users, cartographers, and catalogers, the use of authority sources *does* reflect the imposition of that authority to name a bounded place (e.g., California) or point in relation to other places (e.g., park) in an effort to standardize and remove a multiplicity of place interpretations. In light of the identified biases that emerge in representing and organizing geographic information, this paper seeks to answer the fundamental questions:

1. In what ways might place-name biases affect end-users of the Geoweb?
2. Under what circumstances is it possible to alleviate some of the bias inherent in providing access to cartographic material through the Geoweb?

Using critical cartographic cataloging, an approach analogous to critical cartography, we adopt a framework for inquiry that recognizes the biases inherent in the provision of access to geographic information. Critical cataloging, like critical cartography, does not refer to the act of cataloging but is a theoretical lens to analyzing knowledge organization of geographic information. Related examination has been conducted for other information types and formats (i.e. Moulaison 2010; Olson 2003; Tennis and Adler 2013). To our knowledge, although studies of geographic information have been carried out in the KO context, no study of the issues surrounding the subjectivity of assigning place-names and the potential for this act to benefit KO has been formally put forth. This conceptual paper's purpose is to fill that gap.

In this article, we first examine the notion of place-names as a geographic location that has been identified and referenced as a social construct either formally (geographic information professional) or informally (novice) (Goodchild and Hill 2008). Next, we consider the cartographer's point of view and the notion of critical cartography. In approaching the issues of bias in place-names, we consider the role of the information professional and of VGI, and we put forth the notion of critical cartographic cataloging. This article embraces the inherent necessity of overlapping and potentially biased place-names space on the Earth and proposes changes to information retrieval systems that will rely more strongly on visual representations on the Geoweb. At the same time, it promotes the continued use of the graticule/grid organization of Earth as space, removing the bias of any one particular preferred place-name term.

2.0 Standardization of Place-Names

In 1890 in the United States (U.S.), the U.S. Board on Geographic Names (USBGN) was created to make sure current place-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 authorized name. This discourages any multiplicity of place-names that may emerge in which a single place is ascribed more than one name. Such a notion of a preferred term is not foreign in KO, as value vocabularies such as the *Library of Congress Subject Headings* (*LCSH*) list has adopted similar principles to promote uniformity and unique access points for control (Chan 1990).

Selecting and naming places is a kind of moving target given the link between places and the biases of those doing the naming. Place-name change is therefore constant and inevitable, albeit more settled in some regions with more homogenized populaces compared to regions experiencing duplicative place-names as a byproduct of colonization, war, and other acts (e.g., Romanization of indigenous place-names). A stable version of a place's place-name will only emerge over time, with a standardized version appearing only when there is not conflict over possession. An example of rapid place-name change followed the dissolution of the Soviet Union, leading to several countries dropping components of their country's place-names, such as People's, Social or Democratic (e.g., Polish People's Republic to Republic of Poland). For a country specific example, the Ukraine changed 90% of its place-names including cities, bodies of water, and transportation, when the country became independent in 1991. To exert power over places, renaming occurs. Through time, people reclaim and repurpose place-names, although their activities are not always recognized globally (e.g., Bombay to Mumbai, Burma to Myanmar, and Zaire to the Democratic Republic of the Congo).

2.1 Temporality and Place-Names

It is therefore important to link to temporal resources to contextualize a given space or place name. Just like there is formal and informal georeferencing (coordinates and place-names), time can be expressed in both formal and informal ways. Formal involves specific dates, but informal period terms are also used. Even dates can be imprecise depending on the calendar used. Time period names can vary by culture and the same period can have many names, or one period name can refer to different dates depending on location (Buckland and Lancaster 2004). Certain historical events also have names of their own and can be linked to geographical and temporal name variants (Mostern and Johnson 2008).

Time period directories like HumanSaga of Wikipedia's List of Themed Timelines can help with disambiguation (Buckland and Lancaster 2004). HumanSaga is a database of historical events that allows for the creation of dynamic timelines (Chott and Henke 2000). Wikipedia's Timeline allows for the connecting of events before and after each other. However, just as in the case with gazetteers, this information would have to be linked to be of greater use.

2.2 Place-Name Challenges

In addition to single locations with multiple names there is the issue of toponymic homonyms. For example St. Petersburg, Florida and St. Petersburg in Russia. A study from 2008 found that the National Geospatial-Intelligence Agency's Geographic Names Data Base contains 340,360 toponymic homonyms globally (Caldwell and Shine 2008). Further, there is the problem of determining geo/non-geo and geo/geo ambiguity. Geo/geo ambiguity is evidenced in the St. Petersburg example above. Geo/Non-geo ambiguity involves a place-name that has a meaning that is not geographic (Amitay et al. 2004). For example, Virginia is a state in the United States, but is also a name. Turkey is the name of a country, but also a bird. This may not be a problem for well-known place-names, but could be a problem when looking at local nicknames or less well-known locals, or when batch-processing with a computer (e.g. Ann Arbor as author instead of city). Geo/Non-geo ambiguity is not a problem when context is available, but when it is not, particularly in data mining, less known names can also get left out. Without connection to the resources to conclusively distinguish between names in these cases the bias of the user takes over, leaving them with only the name associations with which they are already most familiar.

Naming issues go beyond homonyms and ambiguity when differences in place-names are linguistic, at times with political implications. Different spellings result from different languages, and few countries have only one official language. Even a translation of a place-name represents a different expression of the same place. Most government-sanctioned geographic naming boards do not allow any expression differing from the official term, thus eliminating the translations from use. The narrow body of water separating England from France is known as the English Channel in English, but as *La Manche* (the sleeve) in French. Whereas the French do not attempt to claim ownership over the channel through their sanctioned place-name, the English do. Similarly, the body of water bordered by North Korea, South Korea, Japan, and Russia is internationally known as the Sea of Japan despite Korean proclamation for the term East Sea. The ownership over the valuable resources in the sea is the focus, but the debate strikes a nationalistic chord with citizens of both nations and is played out most visibly in the dispute over the small islands called the Liancourt Rocks in this water body with competing names. This water body debate also suggests complications related to transcription or transliteration of non-Western to Western scripts and vice versa leading to place-name confusion (Smits 2014).

While geography is logic based, language and translation are more fluid. This can lead to confusion when one method of translation is applied universally. The way place names and language have evolved means that sometimes translation is needed, sometimes transliteration, and other times names need to be directly transferred. A prime example is the city of Lille in France. In Dutch it is called Rijsel, and there is no standard translation into English. Confusion arises because the city was Flemish, becoming French in 1713. There are examples of English language maps using both variations, which would cause additional confusion to anyone comparing one map to another if there was no resource that contained and connected both (Castañeda-Hernández 2004).

Bias presents itself in the language used and the script relied on. When it is assumed that direct translation or transliteration will produce exact results, problems with ambiguity arise. Word for word translation will not always take into account homonyms and synonyms, creating problems for meaning. Currently many geographical thesauri developed in places where Latin script is dominant use transliteration of non-Latin scripts rather than the original language (Smith 2014). Translation is always tricky, but when scripts differ and transliteration is used, additional difficulties arise. When transliterating a Chinese place name into English, for example, it is easy to loose unique features that could aid in disambiguation (Kwok and Deng 2003). On the other hand, although authenticity is important, information is only as worthwhile as the ability to use it. Having a catalog or database produce results in a language or script that most local users would not understand would lead to frustration and confusion (Smith 2014). Therefore it would seem that striking a balance involves making sure that results are returned in the language of the query but are linked to examples of the original script to provide context and additional information.

Finally, the study of categories of landscape features, ethnophysiography, presents another challenge for the goal of place-name standardization. In a series of works on the Australian indigenous language Yindjibarndi, several places and associated terms found in Australia did not have geographic ontological equivalents in European languages (Mark et al. 2007). For example, arid landscapes, seemingly meaningless parts of the desert to Western speakers, retain meaning as different watercourses to the Yindjibarndi people. The *wundu* as a dry creek bed and the *garga* as a concavity in a hillside indicate the presence of water in torrential rains. Although not of great importance to survival, these places receive acknowledgment in the Yindjibarndi place-naming approach. Similarly, indigenous people in North America gave more detailed and multiple names to what Western peoples called simply a river, because more meanings were necessary to indicate shallows, better fishing, and so forth (Stewart 1975). Even attempting to identify places different enough to deserve a different place-name presents an issue for consistency between cultures.

Codes can alleviate at least some challenges presented by standardizing place-names. Specialized geographic codes exist to distinguish different areas of geographic information. Postal codes, area-based telephone prefixes, and even three-letter International Air Transport Association (IATA) codes for airports exist and facilitate designations in machine-readable ways. The International Organization for Standardization (ISO) also has a standard, ISO 3166, governing codes for countries and their subdivisions; it can be browsed for free online at https://www.iso.org/obp/ui/#search. Latitude and longitude are also code-based representations of location and seem to be among the most neutral ways to designate locations on the Earth. Codes, like other data, are not as human-readable as place-names, and are therefore not spontaneously human-understandable.

2.3 Place-Name Subjectivity

Each place-name has its own origin. A classification of place-names created by Stewart (1975) in *Names of the Globe* assists to generalize this subject and serves as a conceptual framework for understanding the complexity and the potential for subjectivity in place-names:

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

Although the categories are not mutually exclusive (and not intended for use by cartographers or catalogers), the Stewart framework is the most exhaustive and is useful to understand the variety of potential place-name origins and abstract beyond each place-name's unique story. Places-names may have attributes related to several of the framework categories, but only one standardized name. Some of the categories, when applied by different people over time, elucidate the challenges of standardization mentioned here.

2.4 Critical Cartography, Critical GIS, and the Creator Biases

Critical cartography is a critical theory approach to systematically examine the bias inherent in all elements of cartography, including place-names, projections (e.g., Mercator projection distorts size so Greenland appears as large as South America, a landmass which is in reality 8 times larger), orientation (i.e., North is up), and other infinitesimal design elements. Critical cartographer Brian Harley (2001) in a classic example showed how indigenous place-names and peoples were displaced in New England in part by their omissions on maps. John Smith relied on the Algonquian peoples to gather geographic information from their local knowledge and maps, but when producing English maps—regardless of the intention—Algonquian place-names and peoples were left as empty spaces. These blanks presented an unsettled land ripe for colonization. Furthermore, applying what Stewart (1977) calls shift-names, place-names transplanted from England to displace Algonquian place-names, may have made Massachusetts more familiar for foreign settlement.

Representations on maps are always a distortion of reality. The oft-cited deconstruction of a North Carolina state highway map revealed hidden ideological frames in this most mundane of maps where the state bird, Cherokee women beading, and ski lifts promote tourism and only depict positive state aspects (Wood and Fels 1986). Distorting distance in maps, whether the shrinking of an ocean or reduction of a continent, was a cartographic trick used to encourage new settlers to Canada. Since every map is a distortion of reality, the cartographer's biases are inherent to some degree in every map. Even maps and geospatial data produced by geographic information professionals carry the assumptions of scientific measurement in an effort to display an objective reality.

The purpose of a map is to represent graphically some feature on the Earth's surface (Crampton 2011). The person who designs the map, the cartographer, decides what will be included and excluded with limits of physical space on print maps as they abstract the real-world. 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, a cartographer is carrying out a first order act of classification. One method for cutting down on the bias of recorded geographic information is to pull from crowd-sourced resources. This creates access to vernacular and cultural variations of time and place descriptors that might otherwise remain only as local knowledge. Additionally the level of input increases when data can be collected from a larger pool beyond only authoritative sources, making projects possible that otherwise would be too large an undertaking from any one organization (Smith 2014). The modern tools of the Geoweb (e.g., Google Maps) reduce the space limits that drove some omission in the creation of print cartographic resources, but choices remain for those creating this new geospatial data.

Critical GIS continues the intellectual stream of critical cartography into the digital domain to reveal how geospatial technologies also work to exclude or disempower peoples and perspectives left off today's Geoweb tools. The geographic information professionals responsible for the creation and thus representation of geographic information are also products of some "social, political, and economic relationships, histories, and practices" (Elwood 2008, 178). Despite the ability for new online geovisualizations to escape the confines of the page that rooted print maps in one projection, scale, and orientation, limitations remain. A multitude of mashups exist to exploit Geoweb platforms and allow users to share geospatial data related to individual interests, but allowing access to differing place-names across the same spaces requires some control of the vocabulary used for retrieval beyond the community of creators. The complexities and subjectivity of the classificatory act in cartography remain in the digital environments, but with the first and second biases melding in most cases as the human ascribing place-names to locations and the cartographer now occupy the same body. The third bias for organizing maps and all geographic information remains in the context of the information retrieval system, but information intermediaries may utilize KO tools to improve system design for more inclusion of a near infinite number of interpretations of place.

3.0 Information Intermediaries and End-Users

Maps and geospatial data selected for inclusion in collections of libraries, archives, museums, and data centers require processing along with the creation of surrogates and/or metadata to make them findable. As part of their processing, objects in collections undergo further analysis by the information professional; he or she, as information intermediary, will organize and assign access points to geographic information according to a controlled vocabulary. In doing so, the information professional introduces the biases of whichever knowledge organization system (KOS) is used. 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). For example, maps created in Morocco include the disputed territory known as Western Sahara (former Spanish Sahara) as a province. The United States, however, does not consider the Western Sahara to be a part of Morocco. For catalogers of a Moroccan map including the Western Sahara, an additional access point for Western Sahara would need to be supplied even if the Moroccans creating the map considered it a province like any other and thus did not designate it separately.

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* (LC*C*) affect interpretations of places 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 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. With the Library of Congress *Classification* (LC*C*), geographically localized subject bibliographies are ordered "North America, South America, Europe, Asia, Africa, Australia, and Oceania"—in 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, 251).

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 places and the terms used to describe them. The intended users of value vocabularies and classification schemes likely benefit from the biases built into the tools if the user's and the scheme's world-views align. Further exploration is required to directly measure retrieval using these value vocabularies and to ascertain relevancy. The Geoweb allows the naïve end-user as well as the expert user to organize according to his or her own lexicon of place-names. For retrieval, however, the overlap is less clear.

3.1 Encoding Schema and KOS

In the encoding schema used in cartographic resource cataloging, location terms must be provided by information professionals. Metadata supports the storage, retrieval, and use of information resources in information retrieval systems. Ways in which the information is organized and the metadata schema used to structure records ultimately affect user access. For example, maps and geospatial data are generally assigned subject headings or descriptors of some kind for retrieval. Specialized geographic information schema used in the United States are currently based on ISO 19115, with some legacy systems remaining. These systems will likely not be used in traditional library environments. Encoding schema used by the LIS communities (MARC, DC, and MODS) tend to rely, endorse, and encourage the use of controlled vocabularies to categorize materials: specifically, the use of *LCSH* and the Getty's online gazetteer, the Thes*aurus of Geographic Names* (*TGN*) as a way of providing verbal subject access. 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 recognize either the importance or the complexity of place names" (Williams 2008, 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, 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). Strengths of *LCSH* include that the terms are meant to be used with visual materials such as maps, that current and historical headings 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).

3.2 Volunteered Geographic Information (VGI)

The Geoweb, unlike traditional KO environments, is not organized by information professionals. End-users and their use of online maps and geospatial data are changing, and "it can no longer be assumed that data will be used only by expert users" (Brown et al. 2013, 855) especially in light of Web 2.0 initiatives inviting any web user to supply place-name information or coordinates for their own content (such as the place their Flickr (http://flickr.com photos were taken) or in participating in marking up existing maps based on personal content (e.g. http://torontokissmap.com/ where users supply information onto an online map of Toronto). End-users may wish to download data or images uploaded by non-professionals through their GPS-enabled devices (Heipke 2010). The grass-roots act of verbally designating place-names, therefore, has been left largely to non-expert users of the Internet out of necessity and not driven by KO or geographers.

VGI, whether truly volunteered or gathered without the complete understanding of the users in the crowd, reflects spontaneous usage of place-names that are not created for the political or information-based reasons cited above, but for personal reasons. They carry with them the limitations relating to social tagging environments (Golder and Huberman 2006). VGI represents a new approach and corpus in which to identify a multiplicity of place-names. Heipke (2010) notes that "the once distinct roles of producer, service provider and user of geospatial data are substantially being blurred, as amateurs start doing the job of professional surveyors and distributors, and accomplish it rather well compared to traditional mapping products" (550). OpenStreetMap (https://www.openstreetmap.org) is an example of a crowd-sourced online product that promotes the application of local knowledge through the use of community contributions to map areas. At the risk of oversimplification, OpenStreetMap is a geospatial equivalent to Wikipedia. VGI datasets are commonly accessed and edited on the Geoweb. End-users of these Geoweb platforms will have similar expectations for access to geographic information through libraries and other information agencies. KO presents an opportunity to analyze and present potential solutions to the place-name problems.

4.0 Discussion

Given the importance of words in identity and retrieval, place-names remain the preferred method for designating geographic areas on cartographic resources in general as well as on the Geoweb. On print maps in particular, however, limitations on space on the map do not allow for multiple names to be associated with the same place. One term, preferably the authorized term in a given language, is selected by cartographers and subsequent map catalogers. In the past, a catalog could not hold exhaustive lists of place name, language, and script variants. Knowledge organization tools did not have the money to pay people to input that much data even if it was desired. VGI represents a new way to think about involving users in collection development and management by crowdsourcing possible place-names for given locations.

As ontologies develop, linked data could provide a possible solution to combining them across time and space. Linked data is one potential way for future systems to support the active use of a number of different vocabularies for retrieval. Linked data "create typed links between data from different sources" (Bizer et al. 2009), promoting the establishment of relationships between resources. Linked data principles require the use of standards such as Resource Description Framework (RDF) (Berners-Lee 2006). The GeoNames Ontology (http://www.geonames.org/), DBpedia (http://DBpedia.org/) and the CIA World Factbook (http://datahub.io/dataset/world-factbook-fu-berlin) are RDF datasets that include geographic information; "If the geo-semantic web is to become a reality then there will be a requirement to store, spatially index and manipulate spatial information in RDF" (Goodwin et al. 2008, 28). Work currently being done in linked data has the potential to link georeferenced place-names to local, informally used place-names from marked-up vocabularies in a systematic way, overcoming issues of place-name duplicity.

Linked data presently represent the direction in which library technology is moving. The *Functional Requirements for Bibliographic Records* (*FRBR*) is the entity-relationship model driving the content standard used in libraries, *RDA*, *Resource Description and Access*. *FRBR* relationships can be represented using (RDF), the data model developed by the W3C for sharing data, including linked data, on the Web (Ryan et al. 2015). The Bibliographic Framework Initiative (BIBFRAME), although still in development, puts focus on the data level rather than the record level for easier sharing and is designed to support RDA as a linked data-compatible schema (Kroeger 2014). The OCLC Online Computer Library Center has already been making use of Schema.org, the markup vocabulary used by Google, Microsoft, and Yandex, which improve data integration with search engines (Ryan et al. 2015). What all of this means is that catalogs could become compatible and connected to outside resources such as gazetteers and geographical thesauri, as well as the Geoweb, allowing for the provision of data beyond what would be feasible in a stand alone catalog. Linked data, however, is not well-suited to VGI content or other informally created content, which may include a greater amount of local or non-standard place-names. Although still in development, semantic web projects such as linked data will permit web-based systems to understand the semantics of terms in use and offer the potential to focus on relationships.

4.1 Critical Cartographic Cataloging

Critical cartographic 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 KOSs. Unlike radical cataloging (sometimes also confusingly referred to as critical cataloging (Berman 2013)), critical cataloging does not seek to alter metadata in information systems, but rather embraces the differing points of view represented by local or unauthorized place-name sources and the potential for enriched retrieval that they represent. With critical cartographic cataloging, redundancies based on authentic use of place-names have the potential to allow for richer and more robust naming of the location from the point of view of differing, diverse groups. The term *cartographic* allows the approach to comprise both print maps and digital geospatial data that result in cartographic resources.

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 cartographic cataloging, we can promote a multiplicity of authentic place-names reflecting actual usage while employing coordinates as a means of disambiguation. As with critical cartography and critical GIS, critical cartographic cataloging acknowledges that there is information about a society and its artifacts that may be emancipated using a lens that exposes the forces behind choices in cartography, map cataloging, and access points. At the same time, such biases cannot and should not inhibit access to relevant materials for end-users. The Geoweb permits more dynamic interaction, interaction that should be acknowledged and encouraged.

4.2 Making a Case for Ordering the Bias

Mapping and organizing on the Geoweb, with all the inherent biases from locals, mappers, information professionals, and Geoweb users, represent a wealth of place-name information. There is value in local place-names as they are windows on the society and the communities that created them. Place-names are much richer than latitude/longitude for describing a location, as the social construct of place itself is the only meaning attributable to any coordinate on Earth (Tuan 1977). By providing end-users with place-names selected by the controlled vocabulary creators, ones that are potentially unfamiliar, this may inhibit the ability for users to identify and retrieve resources based on more colloquial or less-favored place-names that, in their dialect, are equally valid.

Critical cartographic cataloging tenets imply that including and retaining a multiplicity of place-names is a beneficial method for permitting access to pluralistic versions of reality. Retrieval bias could be alleviated through the use of query-based systems relying on coordinates, but in those cases, place-names are lost and only the cartographer's bias remains. Nearly all users do not think in coordinates, but 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. The ability of users to search based on spatial footprint is reliant upon the incorporation of coordinates within metadata. Because users are most often unaware of exact coordinates it would also be necessary to build in search capabilities that allow for topographical relationships such as overlap, containment, in the neighborhood of, and connectedness (Hill 2006). This type of Geographic Information Retrieval (GIR) can be combined with text-based searching text searches as demonstrated by the ECAI Time Map project and the Alexandria Digital Library (Hill 2006). Employing the strength of *TGN* or other digital gazetteers in system design unlocks the potential for broader and more successful searches than constricting vocabularies. Locally created thesauri might also play a part. In-house controlled vocabularies can potentially be used to assign terms to cartographic resources, and could function as an additional method for providing verbal subject access. Finally, crowdsourced geospatial data, such as the terms provided through VGI, has the potential to be messy (Heipke 2010). Having input from such a wide variety of Web users is valuable, however, and should be harnessed for providing access to the contents of Web collections, given that user groups may come from anywhere.

Systems potentially supporting local knowledge and bias can better permit retrieval of place-names for a number of reasons. The ability for users to misspell terms is already an issue that information retrieval systems commonly overcome by suggesting spellings based on the contents of the collection. With folk-etymology place-names, the authority ascribing new place-names may actually be the result of misspelling, or otherwise misinterpreted place-names. The preferred place-name term in these instances depends on whether the user is from the current authority that misspells the name or the local group that retains a more indigenous place-name. In an effort to increase access, knowledge workers and the retrieval systems they use should use an inclusive approach that accounts for a duplicity of place-names in accordance with the tenets of Critical Cartographic Cataloging.

5.0 Future Work and Concluding Thoughts

In the future, as all cartographic resources become digital and systems are queried online, questions of the effect that technology has on place-names can be further explored. Does the globalization of information create an environment of homogenized place-names or preferred use of latitude/longitude information, as is seemingly the unstated goal of many value vocabularies? Or, conversely, will local perspectives thrive in globalized digital environments through the promise of infinite spatial ontologies made possible through linked data? What is lost by using the graticule as an organizational system versus other topologies that weight orientation based on factors beyond coordinates? Projects using VGI may in fact help perpetuate and record local place-names previously omitted from authoritative cartographic sources. What value can be identified in harnessing or even codifying it?

Given the variety of place-names possible, the EU Digital Earth project (http://digital-earth.eu/) allows many different layers to appear depending on user preferences. OpenGeoportal (http://opengeoportal.org), as do most Geoweb tools for downloading geospatial data, presents datasets available in the area of the map being viewed. This is regardless of place-names used in a search. Additionally, a map individualized for each resident of Earth could be created with augmented reality (e.g., Google Glass), thereby respecting individual tastes for place-names, representation, and remove any need for a map where the user is not the center of the universe.

In the aggregate, cartographic resources 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 KOSs are unavoidable and in fact required for classification to function. When these biases influence the way information is organized and accessed, however, certain groups of end-users, namely local, non-dominant group members, stand to be excluded or marginalized. Technology and digital data no longer require these distinctions to be made. Critical cataloging of maps and geospatial data acknowledges that biases exist, but unlike other critical theory, also provides recommendations on how to utilize emerging technologies to exploit retrieval systems and existing digital gazetteers for a more inclusive recall of place-names for potentially any type of user.

References

Amitay, Einat, Nadav Har'El, Ron Sivan and Aya Soffer. 2004. "Web-a-Where: Geotagging Web Content." In Proceedings of the 27th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval, 25-29 July 2004 Sheffield, UK. New York: ACM, 273-80.

Berman, Sanford. 2013. Not in My Library!: "Berman's Bag" Columns from the Unabashed Librarian, 2000-2013. Jefferson, North Carolina: McFarland.

Berners-Lee, Tim. 2006. "Linked Data." http://www.w3.org/DesignIssues/LinkedData.html.

Bizer, Christian, Tom Heath and Tim Berners-Lee. 2009. "Linked Data-The Story So Far." International Journal on Semantic Web and Information Systems 5, no. 3: 1-22.

Brown, Michael, Sarah Sharples, Jenny Harding, Christopher J. Parker, Nick Bearman, Martin Maguire, David Forrest, Mordechai Haklay and Michael Jackson. 2013. "Usability of Geographic Information: Current Challenges and Future Directions." Applied Ergonomics 44: 855–65.

Buchel, Olga and Linda L. Hill. 2011. "Treatment of Georeferencing in Knowledge Organization Systems: North American Contributions to Integrated Georeferencing." Knowledge Organization 37, no. 1: 72-8.

Buckland, Michael and Lewis Lancaster. 2004. "Combining Place, Time and Topic: The Electronic Cultural Atlas Initiative." D-Lib Magazine 10, no. 5. http://www.dlib.org/dlib/may04/buckland/05buckland.html.

Caldwell, Douglas R. and James A. Shine. 2008. "An Analysis of Toponymic Homonyms in Gazetteers: Country-Level Duplicate Names in the National Geospatial-Intelligence Agency's Geographic Names Data Base." Coordinates Series A, no. 6. http://purl.oclc.org/coordinates/a6.htm.

Castañeda-Hernández, Gilberto. 2004. "Navigating through Treacherous Waters: The Translation of Geographical Names." Translation Journal 8, no. 2. http://translationjournal.net/journal/28names.htm.

Chan, Lois Mai. 1990. Library of Congress Subject Headings: Principles of Structure and Policies for Application, Annotated Version. Advances in Library Information Technology, no. 3. Washington, D.C.: Cataloging Distribution Service, Library of Congress.

Chott, David and Jonathan Henke. 2000. "HumanSaga Development Project." http://www2.sims.berkeley.edu/academics/final-projects/HumanSaga/.

Crampton, Jeremy. 2011. Mapping: A Critical Introduction to Cartography and GIS. Oxford and New York: Wiley-Blackwell Publishers.

de Carvalho, Diego F., Júlio C. Estrella, André P. Freire, Rudinei Goularte, Regina H.C. Santana and Renata P.M. Fortes. 2007. "Functional and Device Interoperability in an Architectural Model of Geographic Information System." In Proceedings of the 25th Annual ACM International Conference on Design of Communication 22-24 October 2007 El Paso, TX. New York: ACM, 127-33.

Drabinski, Emily. 2013. "Queering the Catalog: Queer Theory and the Politics of Correction." The Library Quarterly: Information, Community, Policy 83, no. 2: 94-111.

Elwood, Sarah. 2008. "Volunteered Geographic Information: Future Research Directions Motivated by Critical, Participatory, and Feminist GIS." GeoJournal, 72, nos. 3/4: 173-83.

Golder, Scott A. and Bernardo A. Huberman. 2006. "Usage Patterns of Collaborative Tagging Systems." Journal of Information Science 32, no. 2: 198-208.

Goodchild, Michael F. 2007. "Citizens as Sensors: The World of Volunteered Geography." GeoJournal 69, no. 4: 211-21.

Goodchild, Michael F. 2011. "Formalizing Place in Geographic Information Systems." In Communities, Neighborhoods, and Health, edited by L. Burton, S. Kemp, M.-C. Leung, S. Matthews, and D. Takeuchi, 21–33. New York: Springer.

Goodchild, Michael F. and Linda L. Hill. 2008. "Introduction to Digital Gazetteer Research." *International Journal of Geographical Information Science* 22, no. 10: 1039–44.

Goodwin, John, Catherine Dolbear and Glen Hart. 2008. "Geographical Linked Data: The Administrative Geography of Great Britain on the Semantic Web." Transactions in GIS 12, no. 1: 19-30.

Harley, John Brian. 2001. The New Nature of Maps: Essays in the History of Cartography. Baltimore: The Johns Hopkins University Press.

Heipke, Christian. 2010. "Crowdsourcing Geospatial Data." *ISPRS Journal of Photogrammetry and Remote Sensing* 65: 550-7.

Herring, Charles. 1994. An Architecture of Cyberspace: Spatialization of the Internet. Champaign, Ill.: U.S. Army Construction Engineering Research Laboratory.

Higgins, Colin. 2012. "Library of Congress Classification: Teddy Roosevelt's World in Numbers?" Cataloging & Classification Quarterly 50: 249-62.

Hill, Linda L. 2006. Georeferencing : The Geographic Associations of Information. Cambridge, MA: MIT Press.

Kroeger, Angela. 2013. "The Road to BIBFRAME: The Evolution of the Idea of Bibliographic Transition into a Post-MARC Future." Cataloging & Classification Quarterly 51, no. 8: 873-90.

Kwok, Kui Lam and Qiang Deng. 2003. "GeoName: A System for Back-Transliterating Pinyin Place Names." In Proceedings of the HLT-NAACL 2003 Workshop on Analysis of Geographic References May 31 2003, Edmonton, Alberta. Vol. 1. Stroudsburg, PA: Association for Computational Linguistics, 26-30. http://clair.si.umich.edu/clair/HLT-NAACL03/georef/pdf/ws905.pdf.

Library of Congress. 2004. Subject Heading Manual. 1st ed. Washington, D.C.: Cataloging Distribution Service, Library of Congress.

Library of Congress. 1991. Map Cataloging Manual. Washington, D.C.: Cataloging Distribution Service, Library of Congress. http://www.itsmarc.com/crs/mergedProjects/mapcat/mapcat/classification_general_principles_mcm.htm.

Mark, David M., Andrew G. Turk and David Stea. 2007. "Progress on Yindjibarndi Ethnophysiography." In Spatial Information Theory, Lecture Notes in Computer Science 4736, edited by S. Winter, M. Duckham, L. Kulik and B. Kuipers, 1-19. Berlin: Springer.

Mostern, Ruth, and Ian Johnson. 2008. "From Named Place to Naming Event: Creating Gazetteers for History." International Journal of Geographical Information Science 22, no. 10: 1091-108.

Moulaison, Heather Lea. 2010. "Perspectives on Geographic Location: The Muslim West in Two Classification Systems." Proceedings of the ASIS&T 2010 Annual Meeting, American Society for Information Science & Technology 47, no. 1.

Olson, Hope A. 2003. The Power to Name. Boston: Kluwer Academic Publishers.

Peng, Zhong-Ren. 2005. "A Proposed Framework for Feature-Based Geospatial Data Sharing: A Case Study for Transportation Network Data." International Journal of Geographic Information Science 19, no. 4: 459-81.

Randall, Richard R. 2001. Place Names: How They Define the World—And More. Lanham, Maryland: Scarecrow Press, Inc.

Ryan, Catherine, Rebecca Grant, Eoghan Ó Carragáin, Sandra Collins, Stefan Decker, S. and Nuno Lopes. 2015. "Linked data authority records for Irish place names." International Journal on Digital Libraries 15, no. 2: 73-85.

Smits, Jan. 2014. "Geographical Thesauri: Choices to be Made in an Ever-Growing International Context." Journal of Map & Geography Libraries 10, no. 3: 329-46.

Stamey, John, Jean-Louis Lassez, Daniel Boorn and Ryan Rossi. 2007. "Client-Side Dynamic Metadata in Web 2.0." In Proceedings of the 25th Annual ACM International Conference on Design of Communication 22-24 October 2007 El Paso, TX. New York: ACM, 155-61.

Stewart, George R. 1975. Names on the Globe. New York: Oxford University Press.

Tennis, Joseph and Melissa Adler. 2013. "Toward a Taxonomy of Harm." Knowledge Organization 40: 266-72.

Tuan, Yi-Fu. 1977. Space and Place: The Perspective of Experience. Minneapolis: University of Minnesota Press.

Williams, Paula. 2008. "The Problem with Place Names: The Moulds May Change but the Jelly Remains the Same." Catalogue & Index 157: 20-3.

Wood, Denis and John Fels. 1986. "Designs of Signs/Myth and Meaning in Maps." Cartographica 23, no. 3: 54-103.