

CITIZENS AS SENSORS: WEB 2.0 AND THE VOLUNTEERING OF GEOGRAPHIC INFORMATION

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Over the past few years profound changes have occurred that are likely in time to dramatically alter the production and dissemination of geographic information. In the past, the production of geographic information in developed countries was principally the responsibility of the national mapping agency, which was variously under civilian or military control. The agency conducted the necessary surveys, interviewed citizens to determine the names normally given to places, and compiled and disseminated the results as printed maps and more recently as digital data sets. But with time, governments became less and less willing to pay the ever-increasing bills for such services, just as demand for them was expanding. A variety of solutions emerged, known in many countries as spatial data infrastructure, and involving partnerships between different levels of government, and increasingly the private sector. These processes have been described by Masser (1998, 2007), Burrough and Masser (1998), Onsrud (2007), and Goodchild, Fu, and Rich (2007).

However, the advent of services based on Web 2.0 concepts provides a new, exciting, and at the same time problematic alternative. Google Earth is perhaps the best-known of these services, its client software having been downloaded more than 100 million times since its first release in 2005. Google Earth's Application Program Interface allows any user to create and publish new content, in the form of layers that can be viewed over the Google Earth imagery base. Tens of thousands of sources, many of them citizens with no prior experience in geographic information technologies, have taken advantage of this mechanism in recent months, so that today it is possible to find on the Web overlays depicting all of the places found in the life and novels of Jane Austen (<http://bbs.keyhole.com/ubb/showflat.php/Cat/0/Number/411188/an/0/page/0>), historic maps of many areas of the world (many maps from the David Rumsey collection, www.davidrumsey.com, are available in Google Earth's Featured Content), the campaigns of Alexander the Great (<http://bbs.keyhole.com/ubb/download.php?Number=126402>), three-dimensional representations of the buildings of central London (<http://bbs.keyhole.com/ubb/download.php?Number=420893>), and the subway system of many cities

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(<http://bbs.keyhole.com/ubb/showthreaded.php/Cat/0/Number/579229/page/vc/vc/1>). All of these are viewable using the intuitive interface of Google Earth. All of them have been volunteered, in many cases by citizens with purely altruistic motives.

This pattern of citizens volunteering information can be found in many other Web services. Wikimapia (www.wikimapia.org), for example, is a service operating on similar lines to Wikipedia, and allowing citizens to provide descriptions of places of interest to them, along with geographic coordinates. At time of writing there were 4.2 million entries, including descriptions of most of the buildings on the campus of the University of California, Santa Barbara, along with numerous places of interest in the surrounding area. Entries are vetted, again by a group of volunteers, and must meet a number of criteria. 4.2 million is an interesting number in this context, because it is roughly the size of the world's largest gazetteers, which are lists of recognized placenames with geographic locations. For example, the Alexandria Digital Library gazetteer (<http://middleware.alexandria.ucsb.edu/client/gaz/adl/index.jsp>) is approximately of this size, having been compiled from various official US Government sources. In effect, Wikimapia is a volunteered gazetteer, produced entirely by individual citizens, and providing much richer descriptions of places. Other sites in this genre include Flickr (www.flickr.com), with its collection of over 21 million (at time of writing) geo-referenced photographs; OpenStreetMap (www.openstreetmap.org), a site that is building a public-domain street map of the entire world through volunteer effort; and many more. Some require expertise and even equipment on the part of the user, but all are simple enough to attract participation by people with no background in cartography or GIS.

Surveys and summaries of the field are still few and far between. The Where 2.0 conference series (<http://conferences.oreillynet.com/where>) has become an excellent forum for what is increasingly termed neogeography. A book by Turner (2006) provides an overview, and more specialized books can be found, for example on using such services to produce novel maps (Erle, Gibson, and Walsh, 2005). Numerous sites such as Google Earth Hacks (www.gearthhacks.com) provide useful information on novel applications.

Every human is able to act as an intelligent sensor, perhaps equipped with such simple aids as GPS or even the means of taking measurements of environmental variables. The notion that citizens might be useful and effective sources of scientifically rigorous observations has a long history, and it is only recently that the scientific community has come to dismiss amateur observation as a legitimate source. The scientific observers of earlier centuries, such as Darwin or von Humboldt, were certainly amateurs by today's standards, with little formal training in measurement technique, little in the way of theory to frame their observations, and few advanced degrees. Today, practices that are often termed citizen science are widely recognized and respected in some areas, such as ornithology (e.g., the Christmas Bird Count, www.audubon.org/bird/cbc/). But in general it is only through such formal institutional frameworks as the Audubon Society, which manages the count, or Project GLOBE (www.globe.gov), which engages schoolchildren in environmental observation, that the contemporary scientific community is willing to accept volunteered information as reliable.

Nevertheless, it is clear from even the most cursory examination of some of these sources that most contributors are well-meaning, and that the vast majority of the information they provide

is of useful quality. The mechanisms devised to control the quality of Wikipedia entries evidently work at some level (Dee, 2007), and institutional frameworks such as Project GLOBE clearly provide additional assurances.

Moreover, such volunteering appears to provide the only feasible solution to what is in reality a dramatic decline in the supply of geographic information worldwide. Mapping peaked several decades ago, and in many parts of the world, including some developed countries, the rate of production and updating is now substantially lower (Estes and Mooneyhan, 1994), such that published maps are increasingly out of date. Despite massive investment, remote sensing provides only a partial solution to this problem, since many attributes, including placenames, cannot be seen from above. But 6 billion citizen observers, equipped with the means to upload their observations, could provide a very effective replacement. The willingness to do so is clearly there, as is the technology to integrate their inputs. But missing at this point are the mechanisms needed to ensure quality, to detect and remove errors, and to build the same level of trust and assurance that national mapping agencies have traditionally enjoyed.

REFERENCES

- Burrough, P.A. and I. Masser, (editors, 1998): *European Geographic Information Infrastructures: Opportunities and Pitfalls*. London, Taylor and Francis.
- Dee, J. (2007): "All the news that's fit to print out", *New York Times Magazine*, July 1.
- Erle, S., R. Gibson, and J. Walsh (2005): *Mapping Hacks: Tips and Tools for Electronic Cartography*. Sebastopol, CA, O'Reilly Media.
- Estes, J.E. and W. Mooneyhan (1994): "Of maps and myths", *Photogrammetric Engineering and Remote Sensing*, 60 (5), p. 517-524.
- Goodchild, M. F., P. Fu, and P. Rich (2007): "Sharing geographic information: an assessment of the Geospatial One-Stop", *Annals of the Association of American Geographers*, 97 (2), p. 249-265.
- Masser, I. (1998): *Governments and Geographic Information*. London, Taylor and Francis.
- Masser, I. (2007): *Building European Spatial Data Infrastructures*. Redlands, CA: ESRI Press.
- Onsrud, H.J. (2007): *Research and Theory in Advanced Spatial Data Infrastructure Concepts*. Redlands, CA: ESRI Press.
- Turner, A. (2006): *Introduction to Neogeography*. Sebastopol, CA: O'Reilly Media.