LIBER QUARTERLY 18 (2), September 2008 – ISSN: 1435-5205. P238-254
http://liber.library.uu.nl/
Igitur, Utrecht Publishing & Archiving Services

Mapping out Map Libraries

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Abstract

Discussing the requirements for map data quality, map users and their library/archives environment, the paper focuses on the metadata the user would need for a correct and efficient interpretation of the map data. For such a correct interpretation, knowledge of the rules and guidelines according to which the topographers/cartographers work (such as the kind of data categories to be collected), and the degree to which these rules and guidelines were indeed followed are essential. This is not only valid for the old maps stored in our libraries and archives, but perhaps even more so for the new digital files as the format in which we now have to access our geospatial data.

As this would be too much to ask from map librarians/curators, some sort of web 2.0 environment is sought where comments about data quality, completeness and up-to-dateness from knowledgeable map users regarding the specific maps or map series studied can be collected and tagged to scanned versions of these maps on the web. In order not to be subject to the same disadvantages as Wikipedia, where the 'communis opinio' rather than scholarship, seems to be decisive, some checking by map curators of this tagged map use information would still be needed.

Cooperation between map curators and the International Cartographic Association (ICA) map and spatial data use commission to this end is suggested.

Key Words: data quality; map use; web 2.0 applications

Maps as Predictive Tools

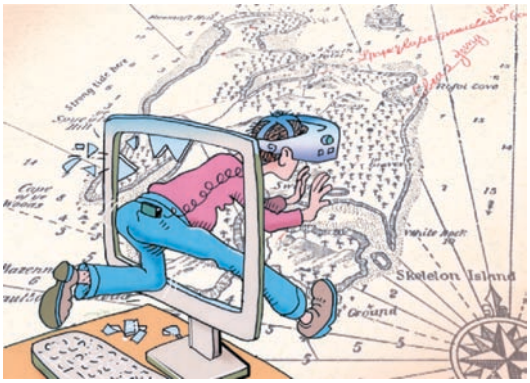
We view maps as models of reality. The map of *Treasure Island* (Stevenson, 1883) in Figure 1 is a model of a renowned but possibly fictitious Caribbean location. The map contains an indication of latitude and longitude, soundings, names of hills, bays and inlets, and every particular that would be needed to bring a ship to a safe anchorage upon its shores. There are several additions in red ink, made at a later date, such as three crosses — two on the north part of the island, and one in the southwest — and beside this last one is written in a small, neat hand, quite different from the other tottery characters, the words: 'Bulk of treasure here.'

While searching for the treasure with this help, we replace reality by this model, imagining ourselves in that model as in a sort of immersion, and we figure out here what to do in reality to find the location of the three red crosses on the map that show the location on the island of hidden stores of gold doubloons, bars of silver and arms, respectively. To find them, we must use the metadata, on the reverse side of the map (Box 1). As always metadata are not quite clear, but for those experienced enough in treasure hunting (in the views of R.L. Stevenson), they should be self-explanatory.

Box 1: Metadata on the reverse of the Treasure Island map (Stevenson, 1883).

Tall tree, Spy-glass shoulder, bearing a point to the N. of N.N.E.
Skeleton Island E.S.E. and by E.
Ten feet.
The bar silver is in the north cache; you can find it by the trend of the east hummock, ten fathoms south of the black crag with the face on it.
The arms are easy found, in the sand-hill, N. point of north inlet cape, bearing E. and a quarter N. J.F.

Fig. 1: Immersion in the map (drawing A. Lurvink).



However, when this map use story ends happily and the treasure has been found, the procedure depicted nonetheless confronts us with the most important characteristic of maps in general, namely that they display what is in store for us in a spatial sense. If we identify our position in reality, our orientation and destination, on a map, we can determine how we get from one point to the other, and what landmarks we will encounter on the way. This is true, assuming that the map is an accurate model of reality and we obtain the correct impression of reality from that map. After all, this is what cartography is all about, not that the map is correct but that what we expect in terms of reality from that map is correct. We can then take relevant and correct decisions.

I used this Treasure Island example to hold a mirror for you, because this is what you do for your clients, for the potential map users that come to visit your collections: you assist them in finding the treasures they are looking for — the bits of spatial information they need, the patterns or correlations they want to study, the knowledge of areas to visit they want to gather prior to the actual journey. Of course you are not only helping your visitors with paper maps and analogue techniques, but with digital files and software to analyse the geo-information, for them to immerse themselves in. You offer them also digital atlases they can analyse with web-GIS (Geographic Information System), or you refer them to websites where large-scale topomaps, old or new, can be consulted. If necessary, some of you also assist them by showing them how to use these GIS techniques.

Metadata

The question can be asked whether the treasure map shown provided sufficient information for the map use task. As the red ink treasure information was added later, the original map might have been produced with other purposes in mind than digging holes in the ground, filling them with doubloons and retrieving them later. At least in this case the metadata have been written on the rear of the map. Usually, however, it will have been lost, because map and metadata were different-sized documents and were consequently separated in the map room, or just because it was never realised how important metadata were.

So if we use maps in order to predict a situation at a certain place and at a certain time, the success of the prediction depends upon the quality of the map — its suitability for an envisaged use – answering the questions of whether it is indeed accurate and precise, up to date and complete, whether it contains the right amount of detail, whether its area has been effectively measured, and whether reality has been modelled and categorised in a relevant manner. It is not so much the geometrical accuracy that will interest most map users, but relative or topographical accuracy. People will be interested in relative locations and in completeness and up-to-dateness.

In the Netherlands, our Topographic Survey maintains a high standard of geometrical accuracy for the data on its maps, but the few studies by other institutions of completeness and up-to-dateness of these object categories have not been received by the Survey favourably, unfortunately, although this would have contributed a lot to a useful discussion of its data quality goals. There have been studies of the rendering of specific object categories like conspicuous solitary trees (Veer, 1985) or boundary-fences, be they hedges or walls or otherwise (Bakermans, 1986) on large-scale topographic maps. Such studies have highlighted the importance of making the map user aware of the rules and regulations governing the actions of the topographers and cartographers, in the field or behind the drawing table or the work station, regarding classification, conversion, selection, generalisation and naming of objects, so that the user would know what to expect at a specific location on the basis of the map.

Knowledge of rules and regulations is not enough. The studies mentioned showed that knowledge of the degree to which these rules and regulations

were followed, and the geographic patterns in disregarding them, because of legibility constraints or differences in interpretation of the rules (Ormeling, 1990), are essential just as well. For about a hundred years our topomaps showed solitary trees and rows of trees. For a decade now they no longer do so, and for landscape reconstruction this source has been lost. It would be useful if we had information from when until when specific object categories had been incorporated in our maps.

If this is necessary for the use of past map series, it is all the more necessary for the current digital topographic files accessible through our libraries. What chance will there be that this kind of metadata relevant for current digital mapping operations is being kept and made available for the users? These cases of hedges and of solitary trees show that these rules and regulations, certainly for the national topographic map series, should be available wherever such series can be consulted. It is not enough for a map library to have a map series or a dataset, the rules and regulations for data collecting and for producing them should be available just as well. The users need that kind of information in order to find out beforehand whether the geospatial information they want to analyse is fit for use. On the other hand, I can imagine that a survey would be reluctant to make public such rules, meant for internal use, as this might make the survey accountable to outsiders as well. Peter Korsgaard will further elaborate on the metadata in his article, I just add a last example on languages.

Thanks to the forbearance of the then Topographic Survey I was able in the 1970s to see the internal rules and regulations for topographers collecting names in the field. These rules included the translation of geographical names in the Frisian language into Dutch. This practice was discontinued in 1980, and when one looks at topographic maps of the area, where the Frisian-speaking minority lives, names will be rendered in their Frisian version now instead of the Dutch. However, apart from some internal publications, it has nowhere else been documented when and where this translation practice was stopped. Later generations consulting successive map editions of large-scale topographic maps of Frisia will think that in the 1980s the Dutch-speaking Frisia province was invaded by Frisian-speaking aliens, causing a change in the Dutch-language place-names used since the start of mapping in that province.

Map Users are Changing

It is not only place-names, but also map users that are changing. There is more digital expertise amongst your clients now, and they are increasingly spoiled by the user-friendliness of Google-Earth techniques. The most important change for them is probably the democratisation of cartography: more and more map users are generating their own maps from statistical files that are at their disposal, using software packages, unimpeded by a lack of cartographical expertise. The clients are increasingly expecting to get any geospatial information they need where they want and when they want it: ubiquitous cartography this is called.

Actually, this ubiquitous cartography is rather exaggerated by Google and its competitors: at the moment it is only aerial photographs, satellite weather information and road maps, and the latter only to a limited degree. This is not the kind of information people might journey to a map room to discover. Google Earth might well be extended in future with thematic information like vegetation, land use and land cover, even population density data, but at present, from the quality information aspect or the metadata point of view, it is still a rather poor resource.

Still, by supplying fairly recent aerial photograph and satellite imagery they have set a standard for up-to-dateness; thanks to Google map users expect recent data, want to be able to see the situation as it is now, and not as it was five or ten years ago. Sometimes, however, even Google cannot deliver, and other image providers step in: an example is the recent effects of the man-made mud volcano in East-Java (Porong River), the result of a gas drilling operation gone wrong.

Changes in Access to Geo-Information

Our map users are also subject to changes in the access to geo-information. When I started working in 1961, all the mapped spatial information of The Netherlands, such as from the Directorate of Public Works and Water Management or the Forestry Commission, or from the Soil or Geological Survey, was actually available to the general public. The map sheets on which

information was recorded concerning coastal defence, nature management or infrastructural matters were for sale, so that non-professionals had a realistic option of viewing these data and thus also having a voice with regard to its future development.

With the exception of the Topographical Survey, all of the above-mentioned institutions have now for some time switched over from map production to the establishment and maintenance of information systems from which their employees can obtain the data needed for their own use. In those cases these files have been made accessible to third parties, their use now does require a high level of technical knowledge and a well-filled wallet: it is usually only engineering firms that can afford to acquire the files they need in order to carry out their projects. There are certainly not many Dutch people who know how to work with the important digital geospatial files established in order to keep our intensively used delta running smoothly, such as the hydrological information system or the basic map on a scale of 1:1000. And thus has the provision of spatial information to the greater public been compromised considerably. This transformation from map use to geospatial data use has made us aware of the need to bridge the skills and knowledge gap, and map curators have a role to play here.

A recent inventory by one of our Dutch geospatial information agencies (DANS, Data Archiving and Networked Services, a subsidiary of our Royal Academy of Arts and Sciences) came up with the following impediments to the use of geo-information in research (Van der Vaart, 2008):

- costs;
- lack of expertise;
- lack of knowledge where to find it;
- lack of the proper software.

It would be my guess that map curators can help a lot in overcoming most of these impediments: they might be an agent in overcoming the costs would these be prohibitive for individual researchers, through a pooling mechanism, they would have expertise and the knowledge where to find the data, and they might dispose of the proper software. Indeed, when in June 2008, David Medyckyj-Scott from Edina addressed us in Utrecht about the DIGIMAP project in Britain, which entails making available Ordnance Survey files for universities, he made it clear that university map curators

have helped enormously in making a success of this DIGIMAP initiative, and he was very much concerned that the present decrease in numbers of map librarians in Britain would affect this programme.

Up until now we have mainly spoken about topographic information, but these form just a start for spatial analysis. Real analysis comes with combining topographic and thematic datasets. What files would researchers be most interested in if they could get them for free? In the Netherlands a recent survey showed that geospatial researchers and companies alike are interested in free access to the geospatial files listed in Box 2 (Geobusiness, 2008).

Of these, the monument register and physical planning register are freely accessible. Most of the others can be accessed if one brings a bag of money. The population register, real estate value register and the risk for dangerous substances register are only accessible for administration, and the information system on buildings still has to be completed.

At present, the government is considering making more of these information systems freely available. Apart from that, some information not directly required is made available through municipal or provincial websites. Some excellent examples are the cultural-historic files of Dutch provinces, or a trimmed-down version of their risk maps. However, the information offered

Box 2: Data files the geo-information sector in the Netherlands is eager to have free access to.

- address coordinates
- building information
- cadastral information
- ground cover information
- large-scale base map
- monument register
- national road file
- physical planning register
- population register
- real estate value register
- risk register for dangerous substances
- subsoil information register: soil, ground water, geology
- statistical data
- topographic map
- traffic information files

is more random than systematic. By the way, the same remark is valid for past geographies, that is for the old maps that map libraries make available on the web.

How is the public reacting to this decreased access to geospatial information?

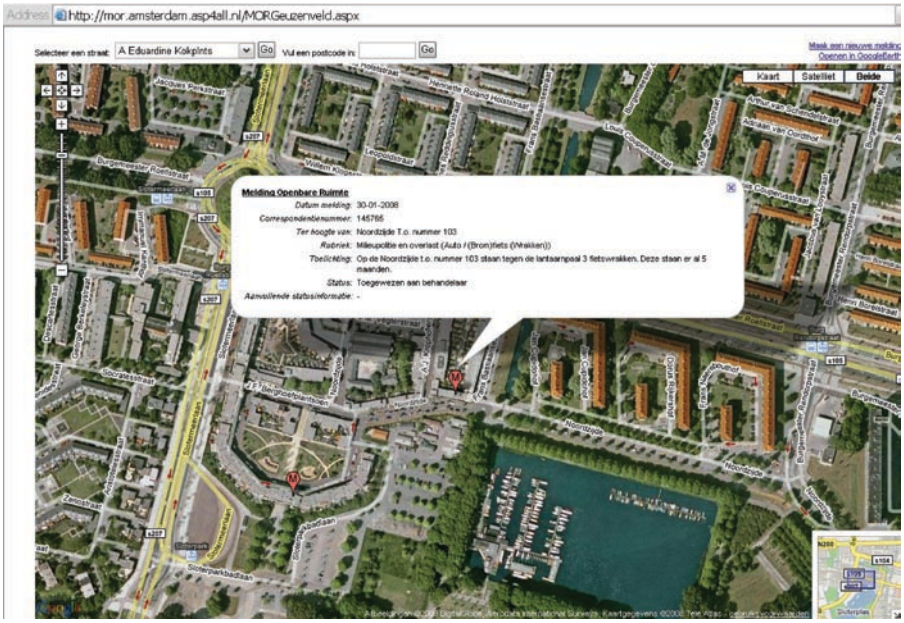
Reactions from the Field: Mash-ups and Web 2.0

Geospatial information being locked away increasingly in inaccessible information systems has led to the development of Public Participation GIS, an attempt to make GIS techniques and government data files clear and accessible to a broader public**.** This may result in the actual establishment of realistic possibilities for the general public to share again in decision-making, as the transparency of government decisions based on GIS activities becomes greater. In supporting these Public Participation GIS's lies one of the tasks of both the cartographer and the map curator of the future. I name them both because I think their work is going to overlap more and more. As map production has been democratised, cartographers increasingly instead of actual producers get the role of geospatial data brokers, consultants that inform their clients about the existing geospatial information and how to use that.

These users in our new Web 2.0 environment increasingly add their own information to maps — the use of mash-ups being a good example. Residents of the city district here in Amsterdam can do this if they wish to report vandalised street furniture for repair to the local authorities (see Figure 2). Of course, in order to do this they must be able to read a map and have some geographical knowledge.

Geotagging, or assigning geographic coordinates, for example to holiday photos, is the latest manifestation of people's desire to pinpoint their position. Flickr.com is a website where one can upload one's photos so that they may be shown to everyone, in their correct location. Last month, some 2 million geotagged photos were added to the site. This has led to a gigantic reservoir of photos of which it is known precisely where they were taken.

Fig. 2: Report based on the mash-up principle of the district of Geuzenveld-Slotermeer (http://mor.amsterdam.asp4all.nl/MORGeuzenveld.aspx) in Amsterdam.



These are examples of cartographic applications of Web 2.0, the platform on which people join forces to create their own information, of which Wikipedia is also a manifestation. It is participants who determine and control their own data; not data suppliers. Last week, Google released a new tool, Google Map Maker, with which people can use tracing tools to extend the often elliptic road maps it now provides under Google Map. This activity to have the general public updating your data is not called outsourcing but crowd sourcing. Microsoft Encarta once got university geography students worldwide to update its digital world atlas, under the so-called *map-bash programme*, and now this practice has gone one step further, with the general public expected to extend and update the maps Google offers. Before I comment on this trend and the way it might assist map curators, I will first have a look at whether map curators are being assisted by any joint cartographic research endeavour in their work.

Are Map Librarians Assisted by Cartographic Research?

Recent reports by the National Research Council (NRC) and the US Geological Survey (USGS) in the United States note that the interest in spatial data among the public continues to increase (National Research Council, 2003, p.93) but claim simultaneously:

> 'To date, virtually nothing is known about the usability of geospatial technologies. Even less is understood about the extent to which those technologies can be matched to human conceptualizations of geographic phenomena or about the use to which the information will be put. It will be necessary to develop new tools to track how individuals and groups work with geospatial technologies, to assess which approaches are most fruitful, and to identify the usability impediments imposed by the technologies. Such understanding will be vital for tailoring user-centred design and other usability engineering methods to the needs of general audiences working with geo-information.
> In particular, it will be important to establish which techniques can measurably improve how effectively and productively geo-information is used by the general public, students, and other non-specialist audiences. As noted previously, current HCI [human-computer interaction] research methodologies look at people's interaction with technology rather than at how technology is applied to support people's interaction with information.'

In order to respond to this and steer it, the NRC has prepared a list of research priorities: this means that

1) there must be better inventories of all the spatial data that is now already available, to support science and decision-making;
2) spatial data must be made accessible and usable for everyone;
3) accessibility must be guaranteed everywhere and all the time;
4) it must be made possible for people to work jointly with spatial data from various locations, with the aid of spatial information technology, in order to solve spatial problems. The latter is called *geocollaboration*, and people are developing techniques with which they can share their spatial files and digital maps remotely, view them simultaneously, process them together, and make joint decisions on the basis of these facts. In addition, all participants in a project must be able to show

each other their location and their spatial information on the same map.

I would argue that perhaps not the geocollaboration part, but the other points fit map libraries like a glove. Map curators are used to make available inventories, to making data accessible to their clients, and could easily be induced to offer their services on-line, to researchers working within their own organisation. I can access, for instance, anywhere in the world the more than 100,000 digitised topographic maps our Utrecht map room holds.

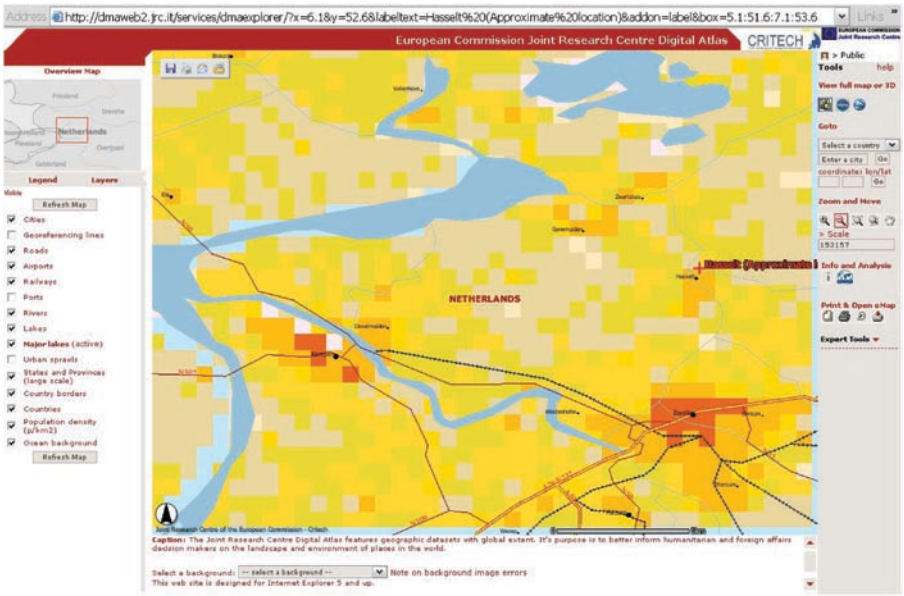
In addition to these National Research Council plans, we can view the research agenda of the International Cartographic Association (Virrantaus and Fairbairn, 2007). This is a programme that we have developed over the last eight years, the goal of which is to steer research efforts in the commissions of the ICA. This focuses partially on analysing large files with *data mining* or *change detection* techniques. The development of spatial analysis techniques, the establishment of the quality of our geographic files, and the assessment of the uncertainty inherent to analyses of combinations of files, the use of maps for ordering information are points that are high on the agenda. In ICA we have the Commission on Use and User Issues, which researches users, usability and the improvement of user skills. I hope a map library working group can be set up in this commission in order to cater for map use instruction packages or modules. Such instruction packages would have to be available in map libraries for those that want to consult specific map types. How necessary this might be we found out five years ago when prior to the holidays, this is before the arrival of TomTom, we did a course in map reading for a women's institute chapter. Here it came out that many design aspects and conventions we just take for granted were completely unknown to this user group.

Geographical Names

Most of the queries made to map curators will be made using geographical classifications like those contained in UDC, or geographical names, and here you should be aware of the present EU attempts at standardisation, with some competing projects. We can discern Fuzzy Gazetteer, EuroGeoNames and DIGMAP:

Fuzzy Gazetteer: developed by the EU Joint Research Centre in Ispra, since 2003: a spelling tolerant global place name gazetteer, with a possibility to view the location of the searched place name on different map backgrounds for emergency purposes. These are for instance geological maps, population density maps (Figure 3) and current weather maps. It can handle variations in spelling, thereby making the searches more robust. Sources are DEM from USGS, Russian military maps, Landscan world population data, NASA Landsat mosaics and a Global discovery vector dataset. Fuzzy Gazetteer is connected to the Joint Research Centre's Digital Map Archive Explorer. It is the result of research collaboration with Hof University (Germany). The background maps stem from the Centre's Digital Atlas, which features geographic datasets with global extent. Its purpose is to better inform humanitarian and foreign affairs decision makers on the landscape and environment of places in the world. That is why there is so much emphasis on different thematic background maps.

Fig. 3: Query answer with demographic (population density) background from Fuzzy map.



EuroGeoNames: Names server developed as an eContentplus project for geographical information, aiming at the development of a European geographical names infrastructure and services based upon the distributed kept and maintained national names data bases, which also will contain variant names, such as exonyms and historical names. The project started in 2006 and should be completed in 2009, be it not yet for the whole EU. It works with unique object IDs, matched to unique name IDs. This project is a precursor of the INSPIRE project, and has helped to set its gazetteer standards. The names server will cater for all the official languages of the EU, and will have also language minority variant names.

DIGMAP is being developed as an eContentplus cultural project, which pursues the purpose of becoming the main international information source and reference service for old maps and related bibliography, it also was started in 2006. Its first purpose was to find all the maps that rendered a specific area by looking for documents with the same geographical coordinates, but it is also focusing on a multilingual geographical thesaurus. Text mining services can link geographical entities to the DIGMAP gazetteer. As at some point researchers would want to link the old names to official current ones, I would hope that some linkage between DIGMAP and EuroGeoNames can be established, as at this moment DIGMAP uses the GeoNames server which gets its modern official European names in its turn from a US Government server.

Finale

Finally, while trying to map out what is expected of you and what is happening in the geo-information environment you are operating in, I have stated some requirements for map curators in this article. Box 3 lists them. The first one might not be quite serious, but of course all of you know that from time to time you must let the general public believe you do have treasures or treasure maps in your collections, in order to generate interest. You are expected to handle GIS software, and indeed ESRI offers courses for you, but the main impediment is that there just is no time, even if you know that it would help to bridge the gap. You must also know what is in your own collection, and what can be accessed on the web. And apart from that you are asked to play a role in making geospatial files accessible to the general public and support Public Participation GIS initiatives. This is just too much, as you won't have the time and money to pursue all of these activities.

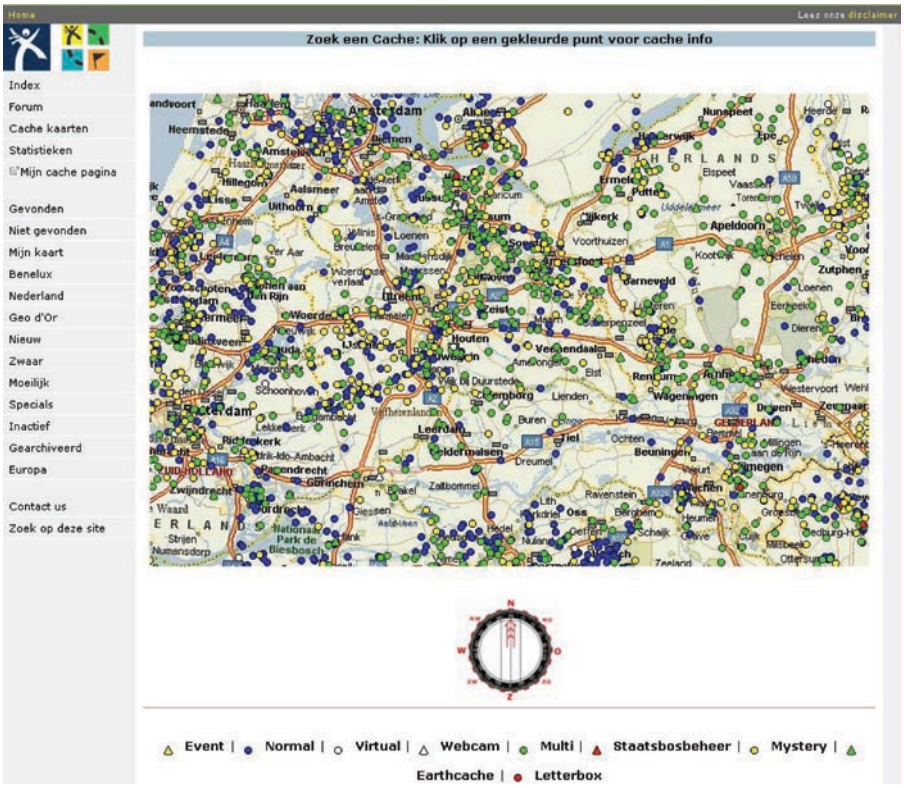
Box 3: Requirements for map curators.

- ability in treasure hunting;
- knowledge how to handle GIS packages;
- awareness of data contents and quality of major holdings (metadata);
- ability to bridge the skills and knowledge gap;
- awareness of current geospatial information on offer from the web;
- awareness of digital atlases and their modus operandi;
- support Public Participation GIS initiatives;
- awareness of eContents, Inspire programmes.

What we need to do to ease matters for the map curators, is to harvest all the map use experience of our clients, their knowledge about data quality, object categories, completeness, level of detail, the fitness for specific uses of the map holdings, or any scraps of literature about the use of these map documents or files. So my suggestion would be to go crowd sourcing, to allow map users to tag items in your digital map collections, and add, in a fixed spreadsheet form, all their experience in using this material, and to post these, to be incorporated subject to your approval. If all their knowledge could be systematised, per map series, or per purpose, without this taking the map curator's time, it could be a tremendous bonus for future map or geodata users. Imagine that we can build a Web 2.0 application into which this map use knowledge can be inserted by the map users, so that all could profit from our collective experience.

In order not to be subject to the same pitfalls Wikipedia suffers from, some other system of checks and balances should be applied. My experience with the material incorporated into Wikipedia and such is that these are heavily based upon generally accepted notions and publications and not on results of new scholarship. This experience is based only on the Wikipedia material on the history of cartography, and cartography itself, as these are the only fields I can judge a bit. But if we can work around these drawbacks and find better procedures, and thus can pool the experiences of all our map users, I am sure many more treasures will be found (Figure 4).

Fig. 4: Modern treasure hunting: geo-caches in part of the Netherlands (http://www.geocaching.nl/maps/DisplayCachemaps.php?action=nederland).



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DIGIMAP project, http://www.ukoln.ac.uk/services/elib/projects/digimap/

DIGMAP, http://www.digmap.eu/doku.php

EuroGeoNames, http://www.eurogeographics.org/eng/03_projects_EuroGeoNames.asp

Fuzzy Gazetteer, http://dma.jrc.it/fuzzyg.asp

ICA, International Cartographic Association, http://kartoweb.itc.nl/icavis/index.html

NRC, National Research Council, http://sites.nationalacademies.org/nrc/index.htm

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