Neogeography Map Users and Uses

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ABSTRACT: In order to start filling an apparent research gap, this paper first of all gives a systematic overview of the different uses and users of neogeography maps, as well as of the different kinds of neogeography maps that exist. The second part of the paper reports on an online survey done with people involved as contributors and users in OpenStreetMap and in Flickr. The interaction with the OpenStreetMap interface was further investigated with 13 test persons (who also participated in the online survey) in a usability lab setting. This was done by applying a combination of use and user research techniques: thinking aloud, screen logging, video observation, eye-tracking and a post-test interview. The results will hopefully shed some more light onto the use of neogeography maps.

KEYWORDS:

neogeography maps, use and users, user research, volunteered geographic information

Introduction

When, in cartography and geo-information science, reference is made to the act of informal geographic data collection by volunteers, the use of terminology is often confusing, imprecise and inappropriate. Terms like volunteered geographic information, crowdsourcing, neogeography and user-generated geo content are often interchanged. Frequently, it is also not clear which human beings are meant when reference is made to "the user".

A more precise use of the terminology is required. User-generated content (UGC) refers to the data collected by volunteers. When these data have a geographic component, we should be talking about neogeography data or about user-generated geo content (UGGC). Crowdsourcing refers to the process of informal data collection by volunteers and geo-crowdsourcing to the informal collection of geographic data. Volunteered geographic information (VGI) refers to the meaning attached to the neogeography data by the users of these data. Next to these end users, the other human beings involved are the people who collect the neogeography data and contribute to the creation of so-called neogeography maps (which, therefore, may be used by those contributors themselves, but also by end users who did not contribute to the data collection at all). Citizen science and neogeography are umbrella concepts referring to the whole process of collecting, handling, analyzing, disseminating and using informally collected data and geographic data respectively, in order to distinguish them from scientific and professional domains that work with formally collected data.

As with formal geographic data, neogeography data are often collected, stored, analyzed and communicated with the help of map displays. These map displays are most often disseminated through the World Wide Web and we refer to them as *neogeography maps*.

Cartographers often complain about the quality of the cartographic visualization of these maps. However, complaints are only appropriate if they are based on a fair knowledge of the uses and users of neogeography maps and not just on graphical design characteristics per se.

Despite the recent abundant research attention for neogeography (maps), the problem is that we do not yet have a systematic knowledge of the uses of and the people (users) involved in neogeography (mapping). There is also hardly any evidence of actual research with (representatives of) real users.

This paper aims at trying to fill part of the research gap. First of all, an overview will be provided of the different uses and users of neogeography maps, as well as of different types of neogeography maps. Thereafter, the paper reports on an online survey done with people involved as contributors and users in OpenStreetMap and in Flickr. The interaction with the OpenStreetMap interface was further investigated with test persons in a usability lab setting. The execution of this user research will be described and the results will be presented.

Types and characteristics of neogeography maps

Common characteristics of all neogeography maps are that the mapped data have been collected voluntarily by non-professionals and that the World Wide Web is used as the medium to disseminate the maps. At the same time, so-called Web 2.0 tools are used to create neogeography maps.

Nevertheless, neogeography maps may be quite different. The differences are brought about by the theme or purpose of the map and by the way they come into existence. Many neogeography maps are so-called mashups, in which topic information is placed on top of an existing base map, which is already available on the Web (well-known examples of base maps are Google Maps, Yahoo Maps, etc.). In many of these mashups the topic data are shown by means of point markers (see e.g. Figure 1), but Web 2.0 tools allow to add line, area and volume symbols as well. Adding the symbols to the map may be done by the volunteer data collectors (from now on, referred to as contributors) themselves, or may be done automatically when contributors upload data collected by GPS devices (e.g. geo-tagged photos). Such mashups can be compared to traditional thematic maps, which are also characterized by one or more thematic layers on top of a base map. Other neogeography maps can be compared to traditional topographic and road maps, in the sense that there is no clear distinction between thematic and base map layers. Such maps provide general information about the topography of an area on the surface of the Earth. Examples of this type of neogeography maps are WikiMapia and OpenStreetMap (see Figure 2a).

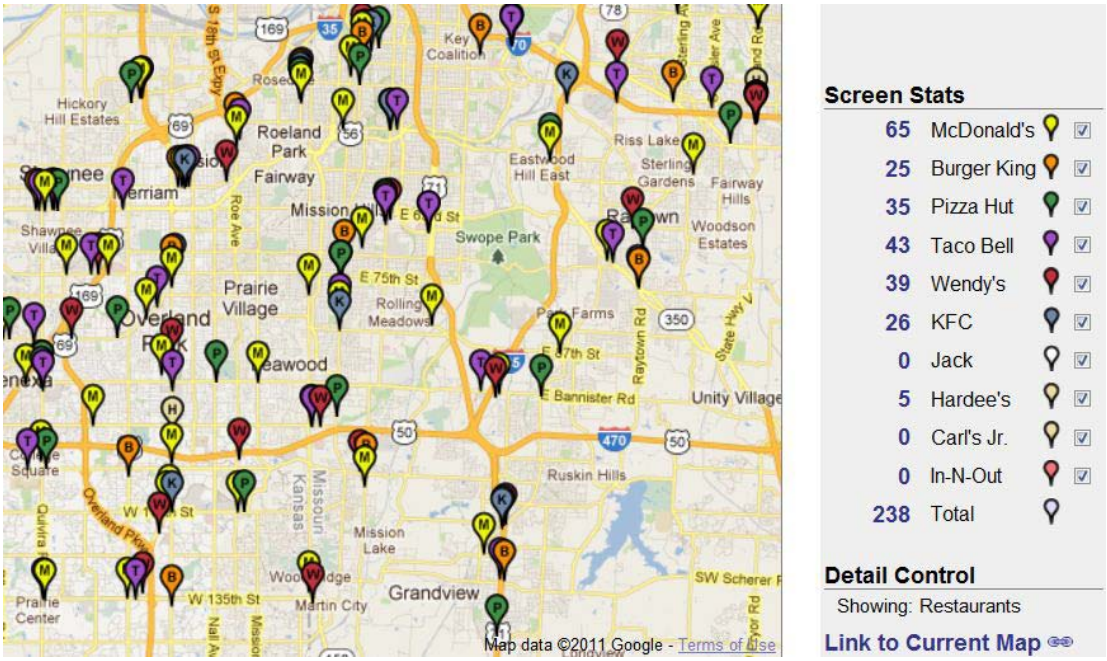

Figure 1: Fastfoodmaps.com – An example of a neogeography map mashup with a Google Maps base map.

The differences between neogeography maps may also be brought about by differences in cartographic and geographic science expertise of the volunteers involved in a neogeography mapping project. Sometimes, “expert volunteers” have provided a framework within which “amateur volunteers” can contribute their neogeography data. This is the case, for instance, with OpenStreetMap, which resembles a professional mapping undertaking, with the difference that it does not aim at making profits and that the data are collected by volunteers. It should also be mentioned that in some neogeography mapping projects moderators evaluate the inputs of the volunteers. This brings us to the uses and the users of neogeography maps.

Uses and users of neogeography maps

It often looks as if many neogeography maps are first of all meant to store the data collected by volunteers. As such, the neogeography maps are also seen as suitable means to organize collaborative work and share the data. For example, in Flickr a map covering the whole world shows where the uploaded photographs have been taken. This apparent focus on storing the data may lead to the poor cartographic visualizations in some neogeography maps (see paper Das et al. in these AutoCarto 2012 Proceedings). These maps are particularly difficult to interpret for end users who were not involved in the data collection. That is a pity, because the maps may provide very useful and up-to-date answers to relevant geographical questions of end users, like “What is there?” or “Where is this restaurant?”. In this way, neogeography maps may be used for tourism and way-

finding, but also in more serious situations like environmental crises. A famous example is the Haiti Crisis Map (URL1).

In some neogeography mapping projects the map end user is taken into account somewhat better right from the start. These usually are the projects in which expert volunteers have provided a framework and in which moderators validate the contributions made by (other) volunteers. Examples are the Dutch Cycling Route Planner (URL2) and OpenStreetMap (URL3) which are less criticized by cartographers than neogeography maps made by amateurs.

Indeed, the quality and usability of neogeography maps depends very much on the volunteers who were involved in the creation of these maps or in setting up the framework for neogeography map production. Not much is known yet about these volunteers and their motivations. A first attempt to identify several types of volunteers was made in an EuroSDR workshop on Crowdsourcing for the Updating of National Databases held in 2009 (Streilein et al., 2010, as referred to in Heipke, 2010 and Dasgupta, 2012). In the Workshop, the following groups of volunteers were distinguished:

- *Map lovers* who produce trustable and very valuable maps and data and make great efforts. Most likely, they are motivated by a strong interest in maps and geographic data.

- *Casual mappers* who are only willing to spend a relatively low effort for mapping (e.g. hikers, bikers and mountaineers). Probably, their motivation is that they very much appreciate correct and complete geographic information as well and want to share that with like-minded people.

- *Experts* are active people and leading map users in organizations like mountain rescue, fire brigades, disaster management, civil protection, traffic guides, etc. They are motivated by the feeling that they may make their work easier. They may contribute data themselves or they may provide frameworks for crowdsourcing. Although they may be volunteers themselves, they may sometimes also be regarded as professionals.

- *Media mappers* are sporadically activated by media campaigns. It are once-off mappers, especially motivated by competitions, mapping parties, etc.

- *Passive mappers* produce data (sometimes unconsciously) about their GPS device's position, time, direction and speed. The anonymized data may be combined with other geographical data (e.g. road network data) to provide information to other users (e.g. about traffic jams).

- *Open mappers* spend a significant amount of time and effort to build open datasets. They form part of the Open Source movement (reflected through bodies like the Open Source Geospatial Foundation (OSGeo, URL4) and the Open Geospatial Consortium (OGC, URL5) and they are motivated by contributing and

using good public data. OGC and OSGeo also provide platforms for the development of Web 2.0 mapping tools.

In the EuroSDR workshop also the group of *mechanical turks* was distinguished, but the people belonging to this group cannot really be regarded as volunteers because they contribute to tasks posted on the Amazon Mechanical Turk crowdsourcing marketplace for a monetary payment (Heipke, 2010).

As indicated above, for the purpose of our paper, in which we are focusing on neogeography maps, it is important to make another kind of distinction of the human beings involved. This distinction is not so much based on their motivation, but on the role they play with respect to the neogeography maps:

- *Contributors* are those who collect the neogeography data. In (actively or passively) uploading the data they may directly or indirectly help building the map displays.

- *Moderators* may be involved to process or validate the contributed neogeography data before they are actually displayed in a neogeography map.

- *Neogeography map designers* are the human beings who designed the neogeography map concerned. These may be the contributors themselves, but also one or more experts who provided the framework for the neogeography mapping project.

- *Users* of the resulting neogeography maps, or "consumers" of the neogeography information. In this respect, we refer to human beings who are not contributing neogeography data themselves, but who are only using the resulting neogeography maps.

- *Users and contributors* both contribute to the neogeography maps and actually use them to derive information from.

Not much research has been done with respect to these groups of people involved in neogeography mapping. However, it is interesting to make reference here to the "90:9:1 rule" postulated by Nielsen (2006) for open contribution systems in general: Nielsen stated that 90% of the users only consume the information, 9% contribute occasionally, and only 1% of the user community is constantly active with contributing information. Whether this is still the case now, and whether these figures are also valid for neogeography mapping projects, is not clear. This kind of lack of knowledge, and the fact that, as far as we know, hardly any research has been done with the involvement of neogeography volunteers was our motivation to execute a few user research case studies.

Case studies: OpenStreetMap and the Flickr world map

For our research we selected two kinds of well-known neogeography mapping projects: OpenStreetMap (URL3) and Flickr (URL6). OpenStreetMap (OSM) is an example of an Open Source initiative, focusing on the provision of free geographic information and neogeography maps as an alternative to official and formal topographic map production by national mapping agencies. Flickr is not first of all focusing on providing geographic information, but on sharing images. The map is only one of the elements of the Flickr website and not all users even know it exists. These two cases were not only selected because of the different roles played by the maps, but also because of the possibility to contact the people involved by means of their Webpage messaging tools.

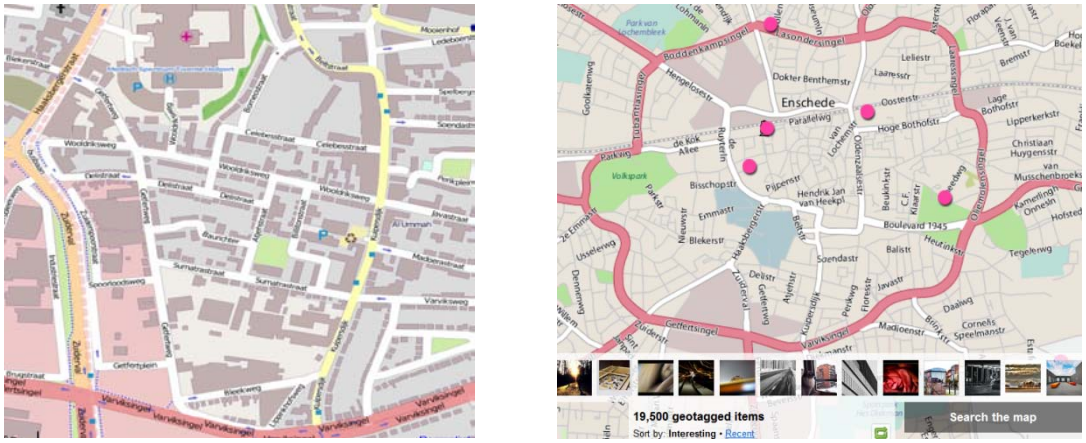

Figure 2: a.) OpenStreetMap (left) and b.) Flickr map (right) of part of Enschede, the Netherlands.

OSM is a free world map open for the public to edit, add information, extract and use information and tag places. The project was founded in 2004 by Steve Coast, then at University College London (Heipke, 2010). On 15 August 2012 it was reported on its own website that OSM already had more than half a million registered users (URL3). Users are required to register for contributing and downloading / extracting data from OSM, but no registration is required for just viewing the map, or to get, for instance, directions from the map. Data may be contributed through collecting GPS points, converting them to GPX format and uploading them to the website. It can also be done through tracing features on aerial photography provided by, for instance, Microsoft Bing Maps on the OSM website and by tagging and naming features on the basis of the contributor's local knowledge. Users are also allowed to edit and modify what others have already added. In this way, the quality and validity of the contributed data is ensured, as there are no moderators involved. Registered users can extract OSM map data for use in other projects. For instance, OSM was used as a base map layer on which volunteers mapped earthquake related data in the Haiti Crisis Map, already referred to above.

The Flickr image hosting website was also established in 2004 and was later taken over by Yahoo!. According to the website (URL6), the Flickr community now consists of over 1.5 million active groups and 70 million + photographers who are storing and sharing photos. Contributors may indicate whether their photos are for public consumption or not. The photos may be sorted and searched for by means of tags and through geo-tagging the locations of where the photos were taken may be plotted onto the world map provided by Nokia. This may be done automatically (if the camera devices provide GPS locations) or by dragging the photos to the area where they were taken on the Flickr world map. The Flickr world map may be viewed by unregistered users who may want to look up photos by their geographic location. As not all contributed photos can be displayed on the map at the same time, a moderator selects the most interesting images.

User research methods

Information from the people involved with OSM and the Flickr world map was first of all obtained through online surveys. Thereafter, some of the participants in these surveys were invited for a laboratory user test at ITC (University Twente) in which a combination of user research techniques was applied (screen logging combined with thinking aloud, video observation and eye-tracking during tasks execution, followed by an interview).

For the online survey, three questionnaires were designed and made available to potential respondents with the help of the SurveyMonkey tool (URL7). All three questionnaires were semi-structured with a mixture of both open-ended and closed questions. The first two questionnaires were directed to the users of OSM and Flickr respectively. Invitations to complete the questionnaires were sent to 30 randomly selected registered users of both neogeography maps who had set their location to Enschede (on the respective websites of OSM and Flickr). This was done because in the survey respondents were also invited to do a laboratory test at ITC in Enschede and we wanted to prevent that the test persons had to travel too far for this. In the end, 10 people completed the online survey for OSM (response rate 33%) and 7 for Flickr (23,3%). The third questionnaire focused on staff and students of the Faculty Geo-Information Science and Earth Observation (ITC) of the University Twente of whom it was not known whether they had experience with OSM and/or the Flickr world map or not. 417 Staff and students were invited and 94 of them completed the survey (22,5%). Participants were also asked whether they would be willing to take a laboratory user test as well. It was realized that with this third questionnaire some bias would be created, as all respondents had a relatively strong geo-information background and, perhaps, a personal connection to the researcher.

User testing in the laboratory was conducted with 13 test persons who indicated that they had been using OSM before. No laboratory test was held with users of the Flickr world map, because only 2 existing users were identified who were willing to take the laboratory test. This low response rate can be explained by a lack of knowledge of and interest in the geo component of the Flickr website. The purpose of the laboratory test was to find out how users work with the OSM tools and interacted with the interface, whether certain tools are missing and whether users came across difficulties when trying to execute the tasks given to them. The test persons were observed with the help of a

Tobii X60 eye-tracking system, which synchronously video recorded the thinking aloud of the test persons and logged the changes on the screen (URL8). The recordings were analyzed with the help of Tobii Studio 2.2 software. The test was followed by an interview which was used as a way to get additional information about the difficulties users encountered during the task execution.

For the laboratory test, the 13 test persons were divided into a group of 3 “expert users” (who had indicated in the online survey that they had experience with uploading GPS points or editing OSM map details and were using OSM for more than a year already) and a group of 10 “novices” (who had no experience in contributing to the data, but had used OSM for viewing and extracting data). Interestingly enough, 2 of the 3 experts only use OSM twice a year, whereas 60% of the novices use OSM at least once a month (mainly for viewing). The 3 expert users were all males and 2 of them had no experience in geography, information science, cartography or other related disciplines, whereas 9 of the 10 novices had such experience and 4 novices were female. In the laboratory test, the test persons were asked to execute three tasks: the first task requested test persons to edit map details, the second task was on contributing already available GPS points to the map, while the last task requested the test persons to extract data from OSM. Novice users were given a simplified Task 1, whereas experts were given an open task. The other two tasks were the same for both experts and novices. In general, the tasks could be completed by all test persons, the hard- and software worked fine and the test persons thought aloud in an acceptable way.

Results and discussion

Surveys

Only some results of this research project can be presented here. Reference is made to the MSc thesis of Moseme (2012) for more details. When first considering the results of the online survey sent to staff and students of ITC, it appears that 50% of the respondents (all with a geo background) never used OSM or Flickr. Only 11.5% had used OSM ánd Flickr before; somewhat more than 30% had only used OSM and 5% Flickr only. So, the respondents were more familiar with OSM than with Flickr. Most of the respondents to all three surveys who said they had experience with OSM and/or Flickr were male (more than 70% of the OSM users and more than 80% of the Flickr users). Besides, 75% of the respondents to the OSM questionnaire were between the ages of 26 and 40 and the trend for Flickr was similar, although its users tend to be somewhat younger. These outcomes are comparable to earlier research (Nedovic-Budic & Budhathoki, 2010; Stark, 2011), indicating that the dominant group of volunteers involved in neogeography are relatively young adult males. Another trend is that Flickr is used more frequently (mostly once or twice a month) than OSM (mostly once a month to twice a year). Daily use of OSM was not recorded, whereas Flickr is more of a social network site with 12% of the respondents using it daily. However, for this paper it is also important to mention that 60% of the users of Flickr do not use the Flickr world map. Almost half of this group was no aware of this feature (which is not a surprise, as the world map option is rather hidden on the Flickr website) and the other half was not interested in it or did not have the time to

geotag manually. If we focus on the purpose and use of OSM, Tables 1 and 2 show that OSM is used most often for private purposes and for entertainment and, more specifically, for getting directions.

Table 1: Purpose of using OpenStreetMap.

Purpose	*Number of responses*	*Percentage of responses*
For work	13	24.1%
For school	5	9.3%
For private use / entertainment	28	51.9%
For helping others	7	13.0%
For geocaching	1	1.9%
TOTAL	54	100.0%

Table 2: Ways in which users use OpenStreetMap.

Use	*Number of responses*	*Percentage of responses*
As a base map	7	13.0%
To calculate distances	1	1.9%
For getting directions	30	55.6%
For extracting data	12	22.2%
For storing data	3	5.6%
As environment for homemade games	1	1.9%
TOTAL	54	100.0%

As far as user satisfaction is concerned, it was interesting to note from our research that only 12% of the OSM users and 1% of the Flickr world map users indicated that they were satisfied with the quality of the neogeography data. Similarly, only 14% of the OSM users and 22% of the Flickr world map users were satisfied with the design of the map.

Of those people who are contributing to OSM, rather than just viewing the maps, 30% was not satisfied with the tools provided for data contribution. Among other suggestions for improvement, the respondents first of all noted that the tools are not user friendly enough for beginners. This outcome was confirmed by the results of the laboratory tests.

Laboratory tests

As indicated above, the laboratory tests were only done with OSM users as not enough Flickr world map users could be found to do a sensible laboratory test with them as well.

Table 3 compares the performance of the group of 3 expert users and the group of 10 novices.

Table 3: Summary of performance results.

Groups	*Tasks*	*Average time needed for task completion*	*Tasks completed*	*Tasks somehow completed*	*Tasks not completed*
Experts	All tasks	20:34			
	Task 1	09:49	100%	-	-
	Task 2	03:09	100%	-	-
	Task 3	03:24	100%	-	-
Novices	All tasks	28:53			
	Task 1	12:40	60%	30%	10%
	Task 2	05:40	100%	-	-
	Task 3	06:12	60%	40%	-

Table 3 confirms that novices have difficulties with the tools to contribute and extract data to and from OSM. Not only did novices need more time to execute the tasks, but some of them could not even complete tasks 1 and 3. Participants indicated that motivation is the key: if one is really willing to contribute, the use of OSM tools becomes easier.

Test persons who could not complete the first task had difficulties in:

- Finding the area of interest
- Starting and ending editing
- Finding the aerial photography to trace from
- Connecting roads

When searching for the area of interest in OSM, two sets of results were presented: one from OpenStreetMap Nominatim and the other from GeoNames. These results were different and test persons who chose to follow the GeoNames suggestion could not easily find the area required. Obviously, a solution is to harmonize the two databases. Additionally, it is suggested that OSM calls in voluntary moderators whose job will be to check and correct the entries of geographical names.

Some test persons also found it difficult to start editing: they could not figure out a way to start a new node and when they finally started it was also difficult for them to stop the

editing. The OSM interface does not provide enough help. An obvious solution would be to create a right mouse click command (start/end editing) or to add an icon to the already existing side window at the bottom right hand side of the map.

As with the editing tool, the test participants knew there was supposed to be an aerial photograph to trace features from but they could not find it and stayed in the "view mode". To alleviate this problem, a pop-up message could appear when users click on an un-editable map.

It was also observed that while tracing the roads it was very difficult for participants (both novices ánd experts) to connect roads into a junction. Also this problem may be solved by a pop-up window that reads e.g. "do you want to connect these roads?" that comes up whenever the user leaves two roads unconnected.

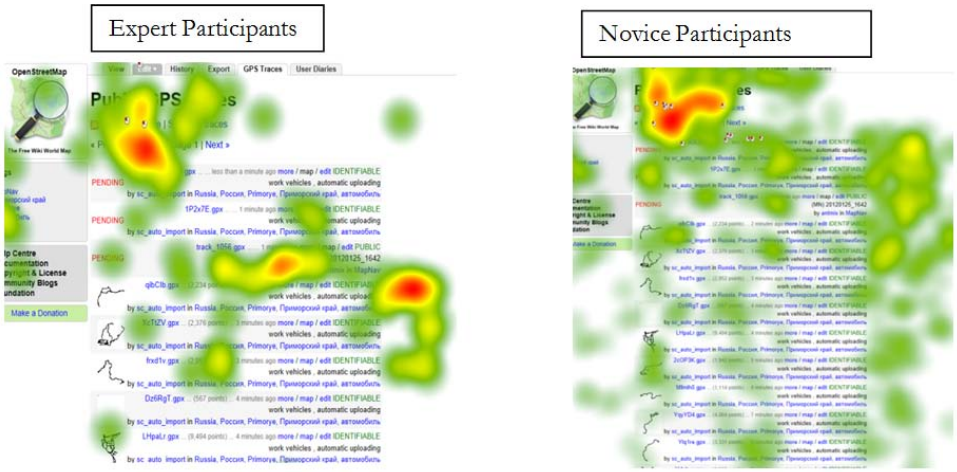

Figure 3: Eye-tracking heat maps for the GPS Trace page for the experts (left) and novices (right).

All test participants were able to complete the second task (uploading already collected GPS points to OSM). Nevertheless, the test persons frequently got lost on the "GPS Trace" page of the interface (see Figure 3). They needed quite some time to look for the correct tool to use. And while they were thinking aloud, they kept on asking about a list of uploaded traces and whether they were supposed to click on them or not. Participants also left the page, thinking they were not supposed to have been there. In short, participants got overwhelmed by what they saw on this page and the list of traces uploaded by other users distracted them. As a result, it became difficult for them to find the link for uploading data. A solution to make the link "upload GPS points" visible again would be to provide a separate link to the list of traces.

The fact that 40% of the novices did not complete the third task (extracting data) had not so much to do with the usability of the tools. It appeared that they did not understand the task correctly. Nevertheless, at the same time it became clear that the link "Export" could better be named "Extract" or "Download". This is terminology that appeals more to the user (whereas "exporting" is done from the provider's point of view). Besides, users also wanted the possibility to extract individual features, instead of complete areas only.

Conclusions

The previous section demonstrated that research with representatives of real users, or other human beings involved in neogeography, can lead to concrete recommendations to improve the usability of neogeography maps and the Web 2.0 tools to create them. It is clear that the research reported on in this paper was only limited in scope and did not have enough focus yet. Much more use, user and usability research is required, particularly research into the use of neogeography maps by the majority of users who did not contribute to the creation of these maps.

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URLs

URL1: Haiti Crisis Map http://haiti.openstreetmap.nl

URL2: Dutch Cycling Route Planner (also with English language interface) http://www.fietsersbond.nl/fietsrouteplanner/

URL3: OpenStreetMap http://www.openstreetmap.org

URL4: Open Source Geospatial Foundation (OSGeo) http://www.osgeo.org

URL5: Open Geospatial Consortium (OGC) http://www.openspatial.org

URL6: The Flickr website http://www.flickr.com

URL7: Survey Monkey (online survey software & questionnaire tool) http://www.surveymonkey.com/

URL8: Tobii hard- & software for eye-tracking http://www.tobii.com/

All URLs last accessed on 15-08-2012

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