The role of user generated spatial content in mapping agencies

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1. Introduction

Since its emergence, the World Wide Web (Web) served as a medium to deliver spatial information, and its impact on geographic information (GI) has been constantly growing. Today, this medium is going through a major transformation. The most striking element in the so called Web 2.0 is the new role of users. Users ceased being simply the consumers of information and instead are taking part in creating, sharing, consuming and disseminating information in the Web. Today's users populate the Web with many types of information from personal thoughts in their blogs, to videos broadcasted at YouTube, to articles in Wikipedia, with some of these integrated in high profile media outlets.

2. User Generated Spatial Content - UGSC

Spatial content has seen a major transition in Web 2.0. Numerous Web mapping applications have been created that allow users to upload, digitize, update or annotate spatial content. Google My Maps, Wikimapia or OpenStreetMap are just a few examples of a new reality in Web mapping described as neo-geography (Turner 2006).

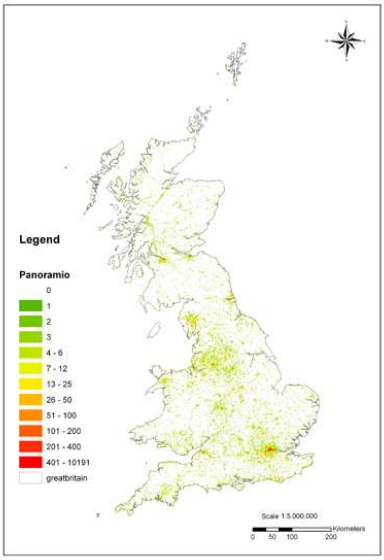
Although researchers have acknowledged the power of user generated spatial content, termed by Goodchild (2007a) as "volunteered geographic information" or VGI, still there is scepticism regarding the phenomenon itself. Starting with the word "volunteered" scholars (Obermeyer 2007, Sieber 2007, Williams 2007, Elwood 2008b, Bishr and Mantelas 2008) support that it can be misleading regarding the possible uses of such data and the intentions of the data providers. Additionally, the quality of such data (Flanagin and Metzer 2008) and its fitness for purpose (Haklay 2008) has drawn research interest, revealing that the use of UGSC can find implementations into many applications. On the other hand though, it must be noted that when examining the social aspect of the phenomenon (Goodchild 2007a, Haklay 2008) it is evident that only people from the privileged side of the digital divide can participate. Still, the inability of traditional methods of spatial data collection to effectively capture and attribute data that are not detectable remotely considerably enhances the importance of the phenomenon (Goodchild 2007b).

While some research was carried out about the quality of this data, an intriguing question is how traditional mapping organisations (such as national mapping agencies) can utilise this information. Do the procedures of building, updating and auditing spatial databases need to adapt to the new challenges presented by this evolution or should they stay solely in the hands of experts?

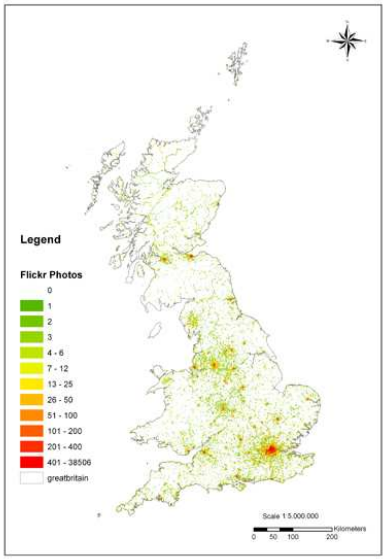
To answer these questions, we need to look at aspects such as user participation, bi-directional flow of information and other characteristics of UGSC and examine their impact and their importance in GI. The focus is on how a mapping agency can incorporate UGSC into well established mapping procedures such as data updating, change detection and map auditing.

The first step is to examine the nature of UGSC sources. Preliminary work indicates that the ubiquity of spatially-related Web applications can be grouped into two broad families: spatially implicit and spatially explicit applications. The sources which do not directly engage their users into posting

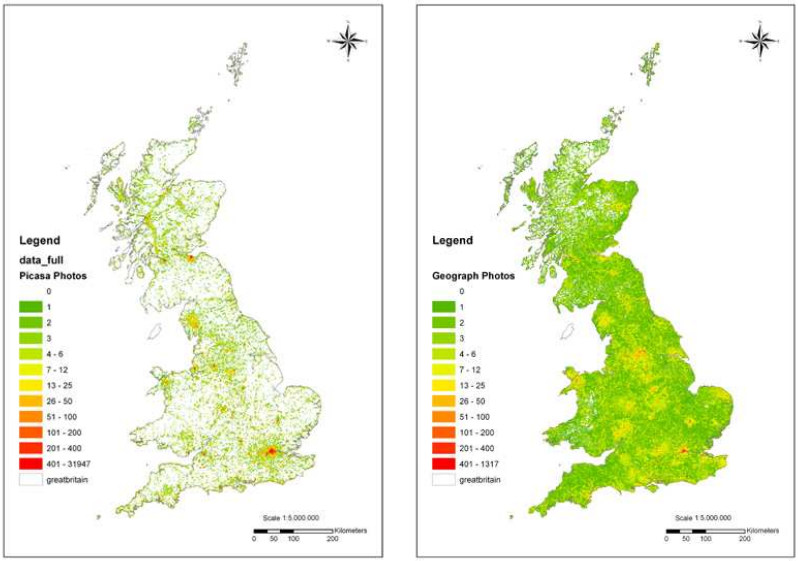
spatially-related content (e.g. Flickr or Piacasa Web) are considered as spatially implicit. In contrast, spatially explicit applications urge their users to upload or interact with spatial content (e.g. OpenStreetMaps or Geograph). The second step is to examine the nature of UGSC itself. Issues like spatial usability, distribution, intellectual property rights (IPRs) and data flow is examined. We define the spatial usability of content (picture) posted in a Web application as the ability to produce useful spatial knowledge and thus it should portray geographic features in a recognizable and conceivable way (e.g. a photo of a point of interest or a new building). For example, regarding the spatial distribution, Figures 1a, 1b and 1c shows the distribution in space of geotagged photos for UK from spatially implicit applications (Panoramio, Flickr and Picasa Web), in contrast with the distribution of a spatially explicit source of UGSC such as Geograph (www.geograph.org.uk) (Figure 1d). The findings show that spatially explicit applications can act as sources of GI with high and steady flow of information and with distribution that can cover the needs of a mapping agency.



(a)



(b)



(c) **(d)**

Figure 1. The spatial distribution of (a) Picasa Web geotagged photos and (b) photos from Geoograph (source: www.geograph.org.uk)

Even spatially implicit sources provide coverage that, in some cases, can be adequate (e.g. urban and touristic areas as shown in Figures 1a, 1b and 1c). However, to discover the usable content of significant spatial value a more 'intelligent' filtering is needed in order to improve the low signal to noise ratio that characterises implicit sources. In that context, only 18.4% of 500 random geotagged photos uploaded to Flickr are spatially usable. In contrast, when the filtering incorporates tag evaluation the usability increases to 72.6%.

Spatial usability has been examined also for vector encoded data. A comparison between an Ordnance Survey (OS) Master Map dataset and roads from OpenStreetMap has revealed the potentials of UGSC to help mapping agencies to improve their spatial databases if embodied into their mapping procedures. Figure 3 show that such comparisons can reveal missing or misclassified entities in the spatial database of the mapping agency.

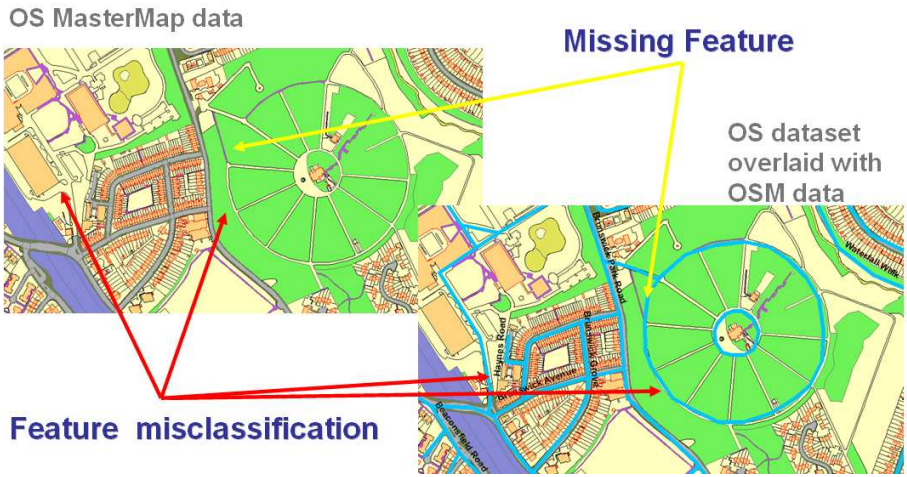


Figure 2. Comparison between Ordnance Survery MasterMap and OpenStreetMap road data

Ongoing research is focusing on the automation of harvesting and filtering of spatial content available on the Web and also on automatic comparison between UGSC and reference data from mapping agencies.

3. Mapping agencies and UGSC

In 1994, an interesting argument was raised by Estes and Mooneyhan (1994) stating that our world is far from being well mapped and that the popular notion supporting the opposite is mistaken. Despite the evolution of geospatial technology and space imagery, current observations (Goodchild 2007b) support the validity of this argument. In fact, mapping and map updating programs are experiencing serious delays in many countries. In that context the value of the UGSC phenomenon is something that mapping agencies can not afford to discard and thus questions can be raised about the best way forward in order to incorporate UGSC into their procedures. The gains of such an approach are that traditional mapping procedures can be further enhanced and existing mapping products can be enriched. For example, UGSC can enrich geographic products like gazetteers which traditionally were partially based on the local knowledge of individual (Goodchild 2008). Moreover, UGSC is expected to initiate the creation of a new breed of spatial data and knowledge taking advantage of the dynamism and temporal aspect of the phenomenon (Elwood 2008a). Finally, change detection which is a principal procedure of mapping agencies in their effort to keep up to date their spatial databases can be enhanced by UGSC. The argument is that either changes happen where people exist (e.g. urban areas) or first changes happen and then people's presence increases (e.g. the construction of a new recreation area). Either way, increased presence of people indicates that a change is likely to be recorded either from an explicit or implicit source. For the latter though, further research should be undertaken in order to examine if similarity exists between the spatial distribution of occurring changes and the clustered pattern of content from spatial implicit sources.

4. Conclusions

Although there are issues raised about the IPRs, quality and usability of spatial data available on the Web it is acknowledged that UGSC is a phenomenon with considerable impact on GI. Initial findings from the study of UGSC sources and the spatial content itself show both the value of the phenomenon and its potentials in assisting longstanding mapping procedures followed by mapping agencies in building more complete and innovative mapping products.

5. Acknowledgements

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Biography

Vyron Antoniou is a Captain in the Greek Army and since 1998 serves at Hellenic Military Geographical Service. Currently is an MPhil/PhD student at UCL in the Civil Environmental and Geomatics Engineering department. His research interest is in GIS and particularly in UGSC, spatial data transmission, spatial databases and web mapping.

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