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VGI at interface of Technoscience and Citizen Participation

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Conventional Mapping and Local Spatial Knowledge (LSK)

The use of local spatial knowledge derived from local people has always been an essential part of conventional mapping. There is nothing new in the concept or intent behind eliciting local people`s local spatial knowledge (LSK) and incorporating that into authoritative mapping exercises in topographic mapping, or national mapping agencies, etc. Externally-based surveyors and cartographers cannot possibly have sufficient localised local-scale grounded knowledge about objects and places, their dynamic changes over seasons or years, and especially their appropriate and recognised names. Map makers have always relied on local people's LSK, initially and for further fact checking, correcting, updating. Every conventional map requests the public users to report on this.

The decision however as to what to place on the map – the items, the precise positioning within the map (for the very many imprecise, fuzzily-located items), the prominence of the item, and thus even the symbolism and font size, etc., and, the decisions on correcting and updating, have been the preserve of the map maker. There are numerous critiques of what this means in practice, the role of maps and map makers in influencing political, economic, social and cultural realities. These methodological, epistemological and ideological arguments have been expressed frequently, sometimes very forcefully by i.a. Crampton, 2010; Rundstrom, 1995; Harley, 1989; Turnbull, 2007; Wood, 1992.

A primary critique concerns the names inscribed on the final maps – there is a broad concern about toponomic biases and control used unwittingly or more often deliberately to influence the map user in her/his understanding of spatial reality in

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terms of ownership, authority, legitimacy, alienation of land, etc. —toponomy— the nomenclature attributed to places and spaces. Wood, 1992; Kostanski and Clark, 2009; O'Connor and Kroefges, 2008; Scassa, *et al.*, 2015, among others, have pointed out how naming of places and then the permanent recording of them on legal maps is a mainstay of cultural and economic control, by colonial or federal powers —naming used as a deliberate weapon of the powerful.

"The times they are a changin`" for Authoritative Maps and LSK

There is a drive for more of people's participation in planning, design, policy, and, everything. This is contemporaneous with developments in citizen science and the shifts in what is accepted by increasingly sceptical 'citizens' as "authoritative knowledge" (Connors *et al.*, 2012; Dodge and Kitchin, 2013; Elwood and Leszczynski, 2013; Haklay, 2012). In Citizen Science, people from outside authoritative research generate content, including spatial information, to contribute to a growing scientific knowledge base. Citizen Science can bring people's participation and vulgar knowledge into political and epistemological conflict with established science.

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Purposes of VGI and GeoTagging

The purpose of the VGI always influences the degrees of spatial precision and of cognitive precision needed, and the spatial and temporal scales employed, which are important to conventional mapping. The 'purpose' will determine: Who will benefit? Who volunteers to provide information?, what procedures, processes and tools? The profound question is of course, 'who decides what is the purpose(s)?' (Rambaldi *et al.*, 2006).

The purposes do not easily fall into definitive broad categories, but in reviewing the range of actual applications of VGI from surfing the WWWeb (and c.f. Goodchild, 2009; Elwood, 2008; Connors *et al.*, 2012; McCall *et al.*, 2015; Sui and DeLyser, 2012; Haklay, 2012; Sui *et al.*, 2012; See *et al.*, 2016) we can identify significant categories of VGI purposes. Of course there are many overlaps between these

categories below and we do not attempt to prioritise them. The categories, with random examples (not necessarily the most well-known), are:

a. Environmental reporting on the quality of life - water quality, garbage, noise, air pollution, traffic, biking and walking, especially in urban areas.
   - EMUK, Mapa Participative Uribe Kosta (Basque) - to improve quality of urban life based on people's opinions and visions, simple things like street cleanliness and lighting <http://emuk.uribekosta.org/contenidos/?a=que-es>
   - Soundmap platform to capture the soundscapes of Mexico <http://fonomaps.herokuapp.com>
   - Repara Ciudad: reporting on the state of many street and pubic space conditions <http://reparaciudad.com/ cf. http://www.fixmystreet.com/>
b. Good governance in political health, land rights and tenure, and for monitoring services, Grievance and complaints reporting about public spaces, services, nuisances, etc. Transport has a significant share.
   - Map Kibera, Nairobi <http://mapkibera.org/mapasColetivos Sao Paulo <http://www.mapascoletivos.com.br/static/about>
   - BA Mejor en Bici.
   - <http://www.buenosaires.gob.ar/aplicaciones-moviles/bamejorenbici>
   - ParkScan San Francisco <http://www.parkscan.org/>
c. Disaster risk information such as water, pollution, fires, and weather events.
   - Locate and map automated external defibrillators (Merchant *et al.* 2013)
   - Brisbane City Council Flood Map <https://bnestorm.crowdmap.com/>
   - CreekWatch flash flood warnings, USA <creekwatch.researchlabs.ibm.com/>
   - FireMash5 report wildfires in Australia on Twitter <http://www.firemash.com/>
d. Fear maps – crime location, security and personal safety, violence (often a gender issue); health fears.
   - Gershad, Locate mobile patrols of Ershad, morality police in Iran <http://www.bbc.com/news/blogs-trending-35533287>
   - React - Be Safe, Skopje <http://reagiraj-bidibezbedna.mk/main>
   - Espantacacos, Guatemala <http://www.espantacacos.org/>
   - Cancertweets, Colombia, Twitter against cáncer.
e. Local and national culture promotion, but also VGI as infotainment and personal and social presentation ('vanity mapping') —absolute geo-locations are important in this theme.
   - NURNET portal, UGC of Nuraghi archaeological sites and cultural heritage, Sardinia <http://nurnet.crs4.it/nurnetgeo/pages/it/homepage/first/>

- CommonCensus web-driven regionalisation of USA based on affiliations with sports teams.
- City of Memory, New York City < http://cityofmemory.org/map/index.php>
- UFO sightings, UK <http://www.trendhunter.com/trends/britains-busy-skies-bizarre-levels-of-ufo-sightings>

f. Consumption and marketing, consumer information which may be commercially sponsored or may be countered by critical consumers. There are very many, such as a real-time map of nightlife hotspots in San Francisco, a free app. to instantly view where people are aggregating, displayed on a city street base map.

g. Updating, correcting, and expanding conventional map sources.
   - Cartografía participativa is the initiative of INEGI, Mexico calling for citizens' inputs (UGC) to identify errors and deficiencies in INEGI's standard maps. Requested inputs include: changes in the names and numbers of streets, new zones, new roads, reporting new services, health centres, schools, parks, markets, churches, gas stations, fire stations, sports grounds, etcetera.
   - <http://www.inegi.org.mx/cartografiaparticipativa/default.aspx>. (As of June 2016, there had been 1,875 reports uploaded in approximately 12 months.)

Critiques

1. Who is involved in VGI? Who are the 'volunteers' providing information? Obviously, they are people who have access to Internet or smartphone platforms for uploading, but significantly, they are also those people who have the other resources and skills needed. Time Is paramount of these, plus some basic awareness of the specific phenomena – crime, hazards, social hotspots, the music scene, demonstrations, restaurants, bargain shopping, noise and pollution spots, traffic jams – the range is limitless.

   Beyond this is the motivation to get involved in uploading or adapting or sabotaging the conventional spatial information, even though VGI requires much less motivation (and time) than working with traditional media like Green Maps or participating in a PGIS activity. 'Volunteers' are more likely to be the e-savvy young (males and females) with low time constrictions, or, oldies who have disposable time and the experiences (if they do not suffer from technophobia). Discussions about 'who can or should be the volunteers?' for local hazard reporting, raise worries that uploaded reports would be from a very small set of local people, or even visitors with smartphones, or kids with shallow local knowledge. These would not at all be representative of local needs and priorities. It is better for the 'volunteers' to be selected and organized as in NGOs, i.e. not uncontrolled volunteers.

2. Who checks the spatial information in VGI?, and How? The accepted procedures, criteria and parameters for checking accuracy, precision, scale, etc. (Goodchild, 2009; Flanagin and Metzger (2008), thus whether 'crowd sourcing' in VGI results in 'crowd wisdom', are contested. The generation of masses of real-time observations from myriads of local people means that verification, validation and crosschecking of the exploding input material are a big challenge. In other Web 2.0 fields, peer reviewing and a hierarchy of managers may be able to deal with it. But, we cannot rely solely on the authority of the academy and governing agents.

   The key value in this, where we rely on other people's LSK, is reciprocated trust. Local rural communities may trust traditional leaders and some NGOs but rarely trust Government, teenage tweeters trust their own peer review of cool places, and mapmakers trust surveyors and satellite images. How do responsible planners and mappers know how to trust the volunteers in VGI - the authorities frequently believe that information collected from locals is not sufficiently reliable. And how can the volunteers in the community know they can trust that their uploaded LSK will be used carefully and wisely, and, securely for them? (Elwood, 2008; Flanagin & Metzger, 2008; Sanvig Knudsen and Kahila 2012; McCall *et al.*, 2015).

   The degree of trust between givers and receivers depends on the (a-)symmetry of the power relations, the credibility of the exchanged information, and the reputations of both the volunteer providing the information, and the agency receiving it. Reputation is built upon the history of past interactions between the groups an perceptions of the other actor's "abilities and disposition" (Resnick *et al.*, 2000:46). 'Reputation' then is used to estimate the risk of future interactions.
3. Who owns the output products? What is the purpose of generating, analysing, and disseminating the specific geo-information products? For whom are they useful? These are the ownership issues. The maps / GIS products should be clear, understandable, testable, and convincing to the users and for their purposes, as well as meet the normal information criteria of relevance, reliability, internal and external logic, replicability, and coherence.

Conclusions. The rewarding characteristics of VGI for mapping

VGI works with large samples of people and thus is very amenable to statistical analysis (although biased towards certain groups), and it registers high to very high frequency. The very fast response time can render VGI extremely valuable, especially for time-critical, geo-referenced community mapping and maintaining currency of information during emergencies (Goodchild, 2009). VGI is voluntary (at least at initiation, although it can become more opportunistic) and it is difficult for

individuals or groups to dominate. Therefore it can be empowering for society on a macro (political) scale, but not usually at the individual level.

The detracting characteristics of VGI can be summarised (from McCall *et al.*, 2015) as: VGI engages only at very low to medium degree of participation, with little interaction between senders and receivers. Therefore it is more likely to be a one-way flow. The process is usually not transparent, the actors are unknown, and manipulation of actors' inputs is feasible. It is mainly descriptive and unlikely to provide rich and deep information.

Creating Trust requires other forms of Validation

What is the degree of trust in who will keep, share, use, and own the information which citizens have uploaded? Local communities/ citizens in many countries, (Mexico is an example), do not have much trust in authorities. People do not believe in the declarations of anonymity for information uploads, thus they do not trust who will use or be given access to their information.

An alternative approach for creating trust in VGI for mapping is from Wikipedia, with its continuous peer reviewing and a hierarchy of managers (Rowley and Johnson, 2013); or CouchSurfing <http://www.couchsurfing.org/about/safety/>, which relies on three checks, including endorsements by known members and a follow-up questionnaire (Rosen *et al*., 2011). The approach in the Extreme Citizen Science https://www.ucl.ac.uk/excites is "WebPGIS", in which people can improve and update current information, and validate or review information uploaded by others.

Mapping agencies already recognise that UGC of LSK can be economical, saving valuable staff and time, c.f. INEGI's Cartografia participativa above. However, for VGI-type inputs of geo-information to become part of the cartographic `establishment` requires: (a) acceptance by established (mapping) agencies that theirs is not the only authoritative spatial knowledge, and that citizens have genuine, reliable and pertinent LSK to offer, (b) effective methods to cross-check and allocate this VGI, (c) some kind of locally significant incentives for citizens to make the efforts to upload good LSK, and importantly, (d) acceptable, credible guarantees that their LSK will not be misused by agencies.

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