Chapter 9
The Geospatial Web:
A Tool to Support the Empowerment of Citizens through E-Participation?

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ABSTRACT

This chapter introduces a spatial view to e-participation in urban governance which is based on the technological core of Geographical Information Systems (GIS) and their more recent transformation into service architectures. The chapter begins with the premise that the technological realms are available today in professional software packages and in open source software environments. It focuses on the utilization of GIS and various methodologies in participatory planning projects. The technical descriptions are limited to a degree that the reader can understand the applications envisaged. The chapter describes developments in the GIS domain which are summarized under the term 'Public Participation GIS' (PPGIS) since the 1990s. In 2005 however, the launch of Google Earth changed the situation significantly: such mapping platforms—including Microsoft Bing and others—brought mapping functionality to the computers of hundreds of millions of internet users and soon after, the term "volunteered geographic information" was created. It refers to the two-way communication possibilities using geospatial tools and to the participation of citizens in planning initiatives. The chapter highlights a few of such applications in urban planning and administration and discusses the situation in developing and emerging countries, while posing the question of whether or not such options may lead to an empowerment of citizens.

INTRODUCTION

Geospatial technologies were originally associated with the term Geographic Information Systems (GIS), which underlying principles were developed in the 1960s and 1970s. Today we can state that basically all concepts which are necessary to acquire, handle, analyse and display spatial data have matured and are available in professional software solutions. Second, it is estimated that nowadays more digital maps or map-like representations are produced within one day than printed maps were produced in the history of mankind. The wide use of GPS, virtual globes, smartphones

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as mapping devices and other web-mapping tools has rendered possible new approaches for disseminating information and collecting crowd-sourced spatial data (Volunteered Geographic Information). These rapidly evolving technologies have brought new perspectives for redefining participatory spatial planning, e-government and urban administration, with the aim to empower citizens and communities that so far have been excluded from decision making processes. In this chapter we analyse the role of geospatial web-tools and platforms for e-participation with a particular focus on geospatial participative procedures that are triggered to support urban planning and governance, especially in developing and emerging countries where shortcomings of democratic, collaborative and integrative local and regional planning are most obvious.

FROM PUBLIC PARTICIPATION GEOGRAPHIC INFORMATION SYSTEMS (PPGIS) TO THE "GEOSPATIAL WEB"

In this section we give a brief introduction to Geographic Information Systems (GIS) as they allow the collection, processing and disseminating of spatial data, which is crucial for spatial planning. We present Public Participation GIS (PPGIS) as an approach to include citizens and communities in spatial planning and public administration, and recap the most important methods of Spatial Decision Support Systems (SDSS). Then, we analyse how the advent of Web 2.0 technologies has provided us with an increasing number of web-tools that integrate crowd-sourced data and geo-web platforms. We critically analyse whether or not these new tools increase participation of individuals and communities in spatial planning and public administration, and if they boost the empowerment of citizens in general. Furthermore we have a closer look at controversially discussed issues such as usability, privacy and quality issues that are inherent to geospatial web technologies.

A BRIEF HISTORY OF GEOGRAPHIC INFORMATION SYSTEMS (GIS)

The idea of portraying different layers of data on a series of base maps, and relating things geographically, has been around much longer than computers (Goodchild et al., 1990). One of the earliest examples of an analysis of a real-world phenomenon with an explicit spatial focus is Dr. John Snow´s map showing locations of death by cholera in central London in September, 1854 (Wienand, 2007). He used the map to track the source of the cholera outbreak to a contaminated well – an early example of spatial analysis. Indeed, the origins of spatial analysis refer to mapping of spatial events and then overlaying the information in order to see where overlapping occurred. Before the widespread availability of computers, this effect was first achieved through a base paper map and then physically overlaying transparent printouts on top.

However, the foundations of GIS as we know them today were laid in the 1960s with the first primitive computers being available for scientists. In this 'era of innovation,' Roger Tomlinson, the 'Father of GIS,' initiated the Canadian Geographic Information System (CGIS) in order to facilitate use of land inventory data in federal, provincial and regional planning – the first fully operational GIS in the world was born (Longley et al., 2001).

The 1970s saw key innovations such as the first mapping software SYMAP, mainly driven by the Harvard Laboratory for Computer Graphics and Spatial Analysis (Lembo, 2005). Furthermore, the first Earth observation satellite – Landsat 1 – was launched in 1972, which brought completely new perspectives for generating spatial data, as well as insights into processes at the Earth's surface. The 1980s brought the commercialisation of GIS, which was now recognized by an increasing number of users in academia and public administration. ArcInfo from the US-based company ESRI was the first major commercial GIS software system (Longley et al., 2001). The launch of the Global Positioning System (GPS) by the USarmy also dates back to this era – GPS and other GNSS (Global Navigation Satellite Systems) are nowadays a major source of data for navigation, surveying, and mapping (Longley et al., 2001).

The 1990s mark the breakthrough of Geographic Information Systems with numerous new software applications, data models and formats. It was then when GIS were applied to a wide field of domains, where spatial data had to be processed in order to create information that allows us to better organize our lives (ESRI, 2008): (e-) government and public administration[1], land-use planning, business, (public) health, transport, utility management, natural resource management, and disaster risk reduction, just to name some examples. Already in 1997, Clarke (1997) stated that "the growth of GIS has been a phenomenon of amazing breadth and depth and will remain so for many years to come. Clearly, GIS will integrate its way into our everyday life to such an extent that it will soon be impossible to imagine how we functioned before" (p. 6).

THE PUBLIC PARTICIPATION GIS (PPGIS) DEVELOPMENTS

The origins of PPGIS (Public Participation GIS) date back to the 1990s and early 2000s. They can retrospectively be characterized as an amalgamation of pioneer applications accompanied with a scientific debate about the role of GIS as a facilitator for empowerment or marginalisation. In the following sub-sections we give a short introduction to the origins of PPGIS, and the academic discussion that gave birth to this critical approach of using GIS. Then we analyse how the rapid technological developments in GIS have brought the foundations for a 'second wave' of PPGIS, whereby the term is less and less used by the scientific community.

Public Participation Geographic Information Systems (PPGIS)

As there is no exactly defined set of methods and tools that are used by PPGIS practitioners, there is no common and unique definition of Public Participation Geographic Information Systems within academia. Originally, PPGIS were referred to as a variety of approaches to make GIS and other spatial decision-making tools available and accessible to all those with a stake in official decisions (Schroeder, 1996), linking community participation and geographical information in a diversity of social and environmental contexts, and thus involving citizens in decision making processes (Steinmann et al., 2004; Blaschke, 2004). According to McCall and Dunn (2012), the term Public Participation Geographic Information Systems refers to a "form of participatory spatial planning which makes use of maps and other geo-information output, especially using GIS" (p. 82). Sieber (2006) states that PPGIS pertain to the "use of GIS to broaden public involvement in policy-making as well as to the value of GIS to promote the goals for non-governmental organizations (NGOs), grassroot groups, and community-based organizations" (p. 491).

Whatever definition of PPGIS we may stick to: their applications in practice are diverse and widespread. In the planning domain, PPGIS emerged in the mid-1990s, when John Pickles published his edited book 'Ground Truth – The social implications of Geographic Information Systems' - in a time, when GIS was exclusively used by a small group of experts within geography and computer science (Ghose, 2007; Kienberger, 2010; Ramasubramanian, 2010). Inspired by Pickles' book, an academic discussion evolved, where scholars such as Obermayer (1998), Schuurman (2000), Carver (2001), Craig et al. (2002) and Elwood (2006) were criticizing that the use of GIS commonly does not address non-experts and their particular spatial perspectives, and therefore are likely to perpetuate existing power-relations and marginalize vulnerable stakeholders of decision making processes. They argued how to 'socialize' GIS in a new paradigm, known as 'Critical GIS' (Corbett & Keller, 2005; Sieber, 2006; Schuurman, 2006; Pavlovskaya, 2006; Kienberger, 2010). Critical GIS may be seen as an umbrella to encompass all research on the societal effects of GIS (e.g., geo-surveillance), the social processes that should or should not be modelled by GIS (e.g., gender movement in space), or the representation, ontology, and epistemology of GIS (Ahlqvist, 2000; Agarwal, 2005; Schuurman, 2006).

Despite this still ongoing discussion about theoretical foundations and practical implications of PPGIS, they have been applied now for over a decade by practitioners of various disciplines in urban planning and community revitalization, land-use and natural resource planning, conservation and environmental management, conflict management, and many more (McCall & Dunn, 2012) - with the common goal to empower individuals and communities that so far have been excluded from spatial decision making processes. Critical discussions on how PPGIS in general, and geo-web tools in specific, lead to empowerment and/or marginalisation of citizens is given in other sections of this chapter.

GOOGLE EARTH AND VIRTUAL GLOBES: THE RAPID DEVELOPMENT SINCE 2005

Technical Developments and Standards

The recent advent of freely available Virtual Globes such as Google Earth, Microsoft Bing Maps 3D and similar applications allow users to interact with and query overhead imagery and spatial data via a three-dimensional representation of the Earth (Butler, 2006). Virtual Globes make it relatively straightforward to build spatially enabled web applications. It is simple to overlay available data layers and to visualise them (Craglia et al., 2008). Anybody can explore the high resolution imagery provided and can superimpose additional layers such as street networks, place-names, hotel information or landmarks.

Keyhole was the first company to release such an Earth-viewer in 2001 and NASA´s World Wind followed in 2003, receiving recognition in what is a relatively small community of interest. In October 2004, Google acquired Keyhole Corporation and released Google Earth in June 2005. For non-expert users, Google is associated with the notion of having created an appealing 3D browser with a 'video game-like' feeling. It is widely used and implemented by a growing variety of vendors. In June 2006, Google claimed 100 million product activations worldwide and within a year (by September 2006), about 30,000 copies of their programming interface (API) were in use worldwide (McLeod, 2006; Craglia et al., 2008), leading to an unprecedented number of applications. With KML (Keyhole Markup Language), Google created a de facto standard.

Such a pseudo-standard is not new, as there are many examples (such as VHS, ESRI´s shapefile, Adobe PDF, and so forth) where a format became standard despite the fact that it was not technically superior to its competitors. For some years, there had been friction within the standardisation community, but in 2008 KML Version 2.2 was adopted as an OGC (Open Geospatial Consortium) implementation standard (OGC, 2010).

Booming Applications

The value of scientific data increases when we can link it to the information that a user already considers important: "scientists should take this opportunity to use GIS to present their scientific results in a way that users can easily tie to other data sources" (Butler, 2006, p. 776). Online mapping services have only existed since the late 1990s, and they are mainly associated with the questions ‘where is x?’ and ‘how do I get there?’ However, recently, online map services have become much more complex and interconnected. While 2D street maps were quickly adopted by average internet users, Virtual Globes are attracting additional attention through the use of a three-dimensional representation of the Earth. Interaction with digital information is becoming much less abstract: working directly with spatial views (Google and Microsoft currently leading the way) ties the ‘online domain’ directly into daily individual experiences and perceptions. New consumer demand will probably turn out to be a major driver in the development of future spatial data infrastructure services (Strobl, 2005; Kiehle et al., 2007).

Another aspect is creativity and imagination. Professional GIS has its strength in spatial analysis. It is also used for visualisation and for displaying different scenarios, but it is rarely used for “playing around.” By integrating tools to encourage creative imagination, we may be able to ask more innovative and socially relevant questions about the changing character of the earth´s surface, especially under conditions of global environmental change. A “massification” (Blaschke et al., 2012) and the wider use of GIS is bound to potentially lead to an increasing number of applications which may not always obey standard cartographic rules such as maps which give wrong associations due to flawed colour or symbol representations based on questionable data or presumptions.

Since GIS exists as a tight coupling of spatial data, analysis, and visualisation technology, such intelligent software may create incorrect conceptual models of each of these components (Glennon, 2006). But, we should question whether the number of inappropriate uses is significant when compared to the impact of the 500+ million unique downloads of Google Earth worldwide (according to Google Press Release, 2009), and the sharply increasing number of geo-services that are being offered online and via mobile services.

Two-Way Cartography

Maps evolved as the primary method for storing and communicating knowledge of the earth´s surface. They serve as repositories of both the raw data and the results of geographic inquiry, and mapmaking has always figured prominently in the skill set of geographers. Maps are thus indispensable tools in the geographers´ search for understanding how human and physical processes act and interact on the earth´s surface and the way the world works (Goodchild, 2004).

However, in these days Virtual Globes or other web-based mapping tools enable anyone with access to a computer and to the internet to make a map. They do not require cartographic skills what causes various challenges. For the most part, laypersons are predominantly not aware of the fact that the information they get on the screen – street maps, landmarks, 3D buildings – are models of the reality and contain various types of generalisation. As long as map-making – in a wider sense – was predominantly the domain of cartographers and GIS experts, it was in the hand of experts who were supposed to be aware of principles and limitations. Moreover, such experts presumably have skills to transform, emphasise, eliminate, summarise, exaggerate, and enlarge entities in geographic representations and to obey scaling rules (Kraak, 2003; Obermeyer, 2007). However, Virtual Globes allow any reasonably computer-literate person to make a map or other geographic representation regardless of his/her understanding of spatial concepts.

While the transition to digital mapping has taken only a few decades - with a period of time when both manual and digital techniques operated in parallel - there may be a much faster transition from the one-way communication of spatial data into a two-way, interactive geo-data publishing process. Cartography, Geography and Geoinformatics students today have to deal with Spatial Data Infrastructure (SDI) architectures, OGC standards, or the Sensor Web Enablement Initiative (SWE) in the quest for an interoperable display of real-time measurements. With the advent of Virtual Globes, the potential for making GIS functionality available to general users is dramatic: GIS as a term or abbreviation, respectively, may disappear. The range of GIS functionality – either explicit in GIS software or as services embedded in Virtual Globes – will expand.

SPATIAL DECISION SUPPORT SYSTEMS

After describing the origins and recent technological developments within Geographic Information Systems, we now may have a look at Spatial Decision Support Systems (SDSS), as they embrace some major concepts of Public Participation GIS and their implementation in spatial planning and public administration.

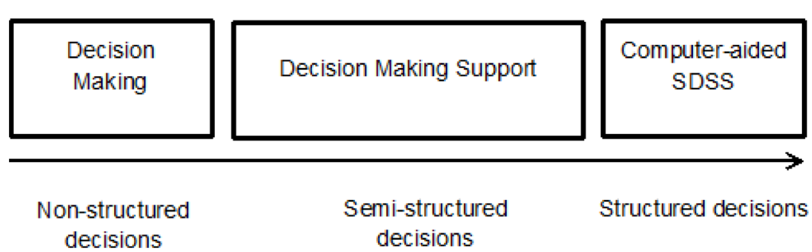
Decision Support Systems (DSS) in general, are specialized software products that are designed to solve non-structured problems, providing an easy-to-use user interface for experts and lay-persons. They are helping users to explore solutions by using data and models in order to generate a series of feasible alternatives for a problem by iteratively changing model parameters, and to examine the effects of these changes (Eastman et al., 1992). Whereas Decision Support Systems have been developed in operational research and management science to address business problems, Spatial Decision Support Systems (SDDS) can be viewed as their spatial analogues. They are explicitly designed to explore and structure complex spatial problems providing a framework for "integrating database management systems with analytical models, graphical display and tabular reporting capabilities, and the expert knowledge of decision makers" (Densham, 1991, p. 403; Sprague et. al., 1982). Similar to DSS, they usually consist of a database management system for spatial data, a model-based management system for analysis procedures and a user interface (Ascough et al., 2002).

SDSS help to structure decisions as described in Figure 1.

By structuring the decision making process, SDSS boost empowerment in two ways: first, the problem can be explored to increase the level of understanding and to refine the definition [of the problem]; and, second, the generation and evaluation of alternative solutions enables the decision maker to investigate the possible trade-offs between conflicting objectives and to identify unanticipated, and potentially undesirable, characteristics of solutions (Densham, 1991, p. 403).

When evaluating different scenarios by applying a decision rule to a set of alternatives in a SDSS, it is often distinguished between multi-criteria evaluation and multi-objective evaluation. The concept of multi-objective evaluation refers

Figure 1. Level of structure of problems and decisions within SDSS



to a decision process in which several objectives must be satisfied simultaneously. In the latter, the objectives of a decision making process may be complementary, so two or more objectives are met through this decision at the same time. Or these objectives may be conflicting and cannot be met at the same time (Eastman et al., 1992). As an example, we may look at the problem of allocating scarce land to different types of land use within a city. While recreation and the protection of public green spaces are generally seen as complementary objectives, recreation and the need for construction land are usually considered as conflicting objectives. Therefore, decision rules set by the stakeholders of a decision making process determine how to settle conflicting objectives. The concept of multi-criteria evaluation in turn, describes a decision making process in which several criteria (that are parameters for decisions that can be measured and evaluated) are evaluated in order to meet one specific objective, e.g. the protection of public green spaces for recreational purposes.

In a SDSS, this is commonly achieved in a weighted linear combination of criteria that have been previously represented in spatial data models and mapped in a GIS (Malczewski, 1999; Malczewski, 2000).

If we call PPGIS for being a framework to fully integrate all stakeholders of a problem in a spatial decision making process, we should not neglect the importance and potential of Spatial Decision Support Systems. Recently, several software packages have been developed that incorporate basic and advanced methods and techniques of SDSS. CommunityViz (http://www.orton.org/tools/communityviz) is a package of software tools that allows developing scenarios for land-use planning that enable the visualisation and interpretation of the impact of different planning scenarios in a participatory matter. IDRISI (http://www.clarklabs.org/) implements common decision making techniques in a comprehensive software package for raster analysis, just to name two common examples.

However, only a few applications have so far given access to SDSS for a broader public of non-experts (Carver, 2001; Rinner & Raubal, 2004; Li, 2006), neither are they yet implemented in geo-web solutions. Taking into consideration that the final rung of the e-participation ladder refers to online decision support systems, the integration of SDSS into geo-web applications is one of the major tasks for the future (cp. Figure 2). The advent of Web 2.0 technologies provides totally new opportunities to face this challenge. This is focused on in the next sub-sections of this chapter.

TOWARDS A NEW ERA OF PUBLIC PARTICIPATION GIS? VOLUNTEERED GEOGRAPHIC INFORMATION AND NEOGEOGRAPHY

The rapidly evolving area of geospatial data and tools, as well as recent developments in internet technologies ('Web GIS 2.0') and a subset of social networking and user-generated web content - that has been termed 'Volunteered Geographic Information' (VGI) - have disclosed so far unknown possibilities of the participation of citizens in planning initiatives and administration. The 'crowd' nowadays is able to rapidly collect data, identify problems and propose solutions for shortcomings related to their habitat on the web in a transparent way. In doing so, they increase the pressure on administrative bodies to involve citizens into a participatory planning processes and efficient governance at a local and regional scale. In this sub-section we discuss the origins of this development which were partially triggered by the development of virtual globes (e.g. Google Earth) and collaborative mapping initiatives such as http://www.openstreetmap.org.

It is important to note that geography is about understanding processes in space and time which create facts and footprints in our spatial reality. The advent of Volunteered Geographic Information (VGI) (Goodchild, 2007; 2008; Elwood, 2008) not only dramatically changes technology and its applications, but also raises a series of new basic questions for Geographic Information Science (Blaschke & Strobl, 2010). Geographic Information Science or 'GIScience' in short, increasingly deals with the effects of these changes from traditional one-way cartographic communication to a system of millions of volunteer contributors. This voluntarism certainly has the potential to relocate and redistribute productive activities from mapping agencies to networks of non-state volunteer actors. However, if we are about to design strategies and systems to maximise the advantages and minimise the risks associated with these changes, we must have a clear understanding of the people and technologies involved (Coleman, 2010).

Blaschke et al. (2012a) recently explored the role of the Geospatial Web – although they mostly refer to the term 'Virtual Globes.' They summarize recent developments from the history of Virtual Globes and the concept of a 'Digital Earth' envisioned by former US Vice-President Al Gore in a speech in 1998 (Goodchild, 2008; Elwood, 2008). The Geospatial Web, and particularly VGI, widen the user base dramatically but create some resulting challenges for GIScience and for society. Sui (2008) even speaks of a 'wikification of GIS,' Torrens (2008) speaks of 'Wifi-Geographies.' We may need to differentiate between these fast technical developments and the quest for understanding processes in space and time, which create facts and footprints in our spatial reality. These developments not only dramatically change the technology and its applications, but we may claim that first time in history we can derive a more 'complete' picture of the behaviour of persons and groups in space and time. Blaschke et al. (2012a) conclude that geospatial web-tools and platforms will completely change the traditional mapping/planning process which was in essence a one-way dissemination of authoritative information from mapping agencies and other authorities. Classic concepts of Geography may serve as a common denominator among and between various disciplines, acting as a facilitator for interdisciplinary research (Blaschke et al., 2012b). As a reaction to the growing demand for participatory solutions in planning and public administration, authorities such as mapping agencies, environmental protection agencies or other national or regional organisations have recently begun providing data to non-public initiatives such as OpenStreetMap, or making data generally available for participatory initiatives.

Recent literature in GIScience has provided the beginning of a new era of scientific research on fundamental issues, raised by this new two-way information channel. This approach enables bi-directional communication between the government and citizens, rather than following the traditional top-down dissemination of information (we may even claim that McLuhans law of the media may need to be revisited from this point of view). Furthermore, we may diagnose the rise of 'day to day geography' (Bissel, 2009). Some scientists – predominantly with a Geography disciplinary background - use the term 'Neogeography' (e.g. Turner, 2007; Haklay et al., 2008,; Hudson-Smith et al., 2009). This contrasts classic GIS tools, targeted techniques and applications with areas of approachable, colloquial applications. Neogeography may also be seen as an umbrella for a diverse set of practices that (mostly) fall outside the professional geographic domain. Its popularity can be credited to the ability to communicate and share data through simple, freely available tools that can be learnt quickly and effectively without immersion in professional activities (Hudson-Smith et al., 2009).

In a more personal statement we may conclude that Neogeography tends towards the intuitive, expressive, personal, absurd, and/or artistic, but they may just be idiosyncratic applications of 'real' geographic techniques. We do not favour the use of this term but acknowledge its existence when scientifically discussing the two realms which can overlap as the same problems are presented to different sets of users: experts and non-experts. In a Web 2.0 environment, geographic content and applications can be deployed and used with minimal consideration or knowledge of the underlying and fundamental principles of geodesy, cartography, and/or geography.

GEOSPATIAL WEB APPLICATIONS AND TOOLS

As it was analysed, the advent of Web 2.0 and the availability of crowd-sourced information provided the ground for the development of new applications that integrate spatial web technologies and Volunteered Geographic Information in novel and powerful tools, which aim to improve citizen participation in spatial planning and public administration, referring to the concept of good governance as a common ground of political action (Fu & Sun, 2010).

In this sub-section we provide an overview of the currently implemented asset of the Geospatial Web, which is defined as "the use of the internet to deliver geographic information and maps" (Haklay et al., 2008; 2011). As applications are very rapidly developing, this overview will not be complete or exhaustive but should provide a good representation of 'typical' applications and widely used tools.

Carver et al. (2001), Rinner and Raubal (2004), and Li (2006) report about first initiatives in order to create Collaborative Decision Support Systems (CDSS), which allowed participatory planning and decision making using web-technologies. Since then, with citizens turning from consumers to 'prosumers' of (spatial) data (Fischer, 2009), and the every-day use of collaborative functionalities in social media such as Facebook, Twitter, Youtube or Flickr, a considerable number of participatory geospatial web-platforms have been introduced in spatial planning and public administration. From an e-participation point of state, what might interest us the most is that local and regional governments are increasingly resorting to geospatial web-platforms such as FixMyStreet (http://www.fixmystreet.com/), SeeClickFix (http://en.seeclickfix.com/) or ParcScan (www.parkscan.org), where citizens can inform them about problems (potholes, graffiti, broken streetlights, etc.) that rapid and appropriate actions can be taken. Since these actions are immediately reported to the public on the platform, governmental operations become more transparent and the citizens are able to more easily monitor their outcomes (Fu & Sun, 2010; Ramasubramanian, 2010).

Besides mapping tools, geospatial web-applications integrate blogs, video blogs, RSS-feeds, twitters, social network tools, discussion forums, widgets and other applications that allow users to create their own mash-ups, combing online data from multiple sources (Ashley et al., 2009). Increasingly, these applications are accessed by mobile devices.

Crowd-sourced planning applications such as the San Jose Wiki Planning Project[2] allow users to conduct surveys, add comments and post photos about issues relevant to planning initiatives and to get involved into urban planning (e.g., http://albany2030.org/ or http://www.vanalen.org/urbanvoids/). Web 2.0 tools are used within crisis management and emergency mapping such as Sahana (http://live.osgeo.org/en/overview/sahana_overview.html), transportation (http://openplans.org), public-health management (http://westnile.ca.gov/), public safety (www.firehistory.ok.ubc.ca) and in the environmental domain where citizen observers have contributed to developing a broad understanding of critical environmental issues during the 2010 Deepwater Horizon Gulf oil spill in the Gulf of Mexico (Bednarz & Kemp, 2011), just to name some examples. Geo-wikis (e.g., http://wikimapia.org/ and http://cyclopath.org/), GeoTweets (e.g., the ArcGIS Explorer Desktop Twitter), and mash-up competitions (e.g., http://www.appsfordemocracy.org/) complete this diverse picture of tools and platforms (Fu & Sun, 2010).

Most of these applications are led by non-governmental or community-based organizations such as OpenPlans (http://openplans.org), Place-Matters (http://www.placematters.org/), Urban-Buzz (www.urbanbuzz.org) or MySociety (http://www.mysociety.org/), and resort to open-software solutions. However, recently the software industry has started to act in this domain, which proves the growing importance of these applications. In 2012, for example, one of the biggest GIS-software vendors, ESRI, launched its Community Planning web application (http://localgovtemplates2.esri.com/communityplanning/), which provides communities with a collaborative design tool to develop land use plans interactively on the web (Smith, 2012).

INCREASING PARTICIPATION LEVELS: THEORY AND APPLICATIONS

A major question remains unanswered so far. Firstly, do the technological developments that have been described in this chapter, and especially the geospatial web, really boost participation? And secondly, how should existing applications be evaluated? Let us try to answer these questions in this sub-section.

Geographic Information Systems in general, offer many benefits to facilitate participation and communication between stakeholders of a decision making process. According to Ramasubramanian (2010), these include the ability to (a) identify and clarify spatial relationships, (b) speed up information processing time to answer formal criteria-based queries in real time, (c) improve communication with and among non-specialists, and (d) create what-if scenarios that help to evaluate different planning alternatives. Geospatial web applications in specific, amplify participatory opportunities through a set of new tools and applications, as we have already seen. For evaluating whether PPGIS applications in general facilitate participation in decision making processes, Steinmann et al. (2005) propose three overall evaluation criteria:

- Interactivity, implying that some action of the users generates a response either from another user or from the application itself.
- Visualisation, as it is a powerful method for representing spatial data.
- Usability, as PPGIS applications should be easily accessible and understandable by a broad audience.

Although it is increasingly regarded as essential, public involvement in spatial decision making is not common in most countries of the world. Even in the industrialised countries it has a highly problematic history. Public scepticism about the activities and motivations of planning, design and engineering professionals remains high. Arnstein´s (1969) famous 'Ladder of Citizen Participation' is still a useful way of characterising levels of public involvement, ranging from the ideal of citizen control to creeping manipulation by officials and powerful interest.

When talking about different levels of public participation in decision making processes, we may refer to different rungs of a ladder. Arnstein (1969) used this analogy to describe the transfer of political power from traditional decision makers to citizens. This ladder was modified by Smyth (2001; found in Carver, 2003) to an 'e-participation ladder' that transfers the generic levels of participation described by Arnstein to the framework of e-participation. In Smyth's e-participation ladder, the bottom rung refers to a stage where participation entirely exists in a passive mode, and the public is informed about planning issues through data sheets and information bulletins that are delivered online. Climbing up the ladder, the level of participation and public empowerment increases, with the top rung representing full public control and responsibility for final decisions in (spatial) planning processes (Carver, 2003; Steinmann et al., 2005). The further up the ladder, the more interactive methods and tools of online-collaboration and decision making are incorporated, starting from simple online-information delivery, online discussion forums, and opinion surveys to fully adopted online decision support systems. As the level of interactivity increases, the communication between citizens and public administration transforms from being unidirectional at the bottom rung to being bidirectional on the upper rungs of the ladder (Steinmann et al., 2005). This means that information, ideas and feedback are openly and collaboratively shared between public administration and the citizens.

Figure 2 merges Arnstein's ladder of participation with Smyth's ladder of e-participation and amends those ladders with content related to Geospatial web-applications. For each rung of the participation ladder we tried to identify methods and tools of the Geospatial web that have already been applied to e-participation initiatives or might be in the future:

This metaphor of a ladder has been extensively used in literature (Carver, 2003; Blaschke, 2004; Schlossberg & Shuford, 2005; Steinmann, 2005; Baker et al., 2007; Kienberger, 2010). In a very similar approach, the International Association for Public Participation (IAP 2) links the goals of public participation with the increasing impact on decision-making in a matrix that ranges from information sharing, consultation, involvement, collaboration to empowerment (Ramasubramanian, 2010). Hennig and Vogler (2011) amended this matrix with web-tools that refer to each stage of the participation process (cp. Table 1).

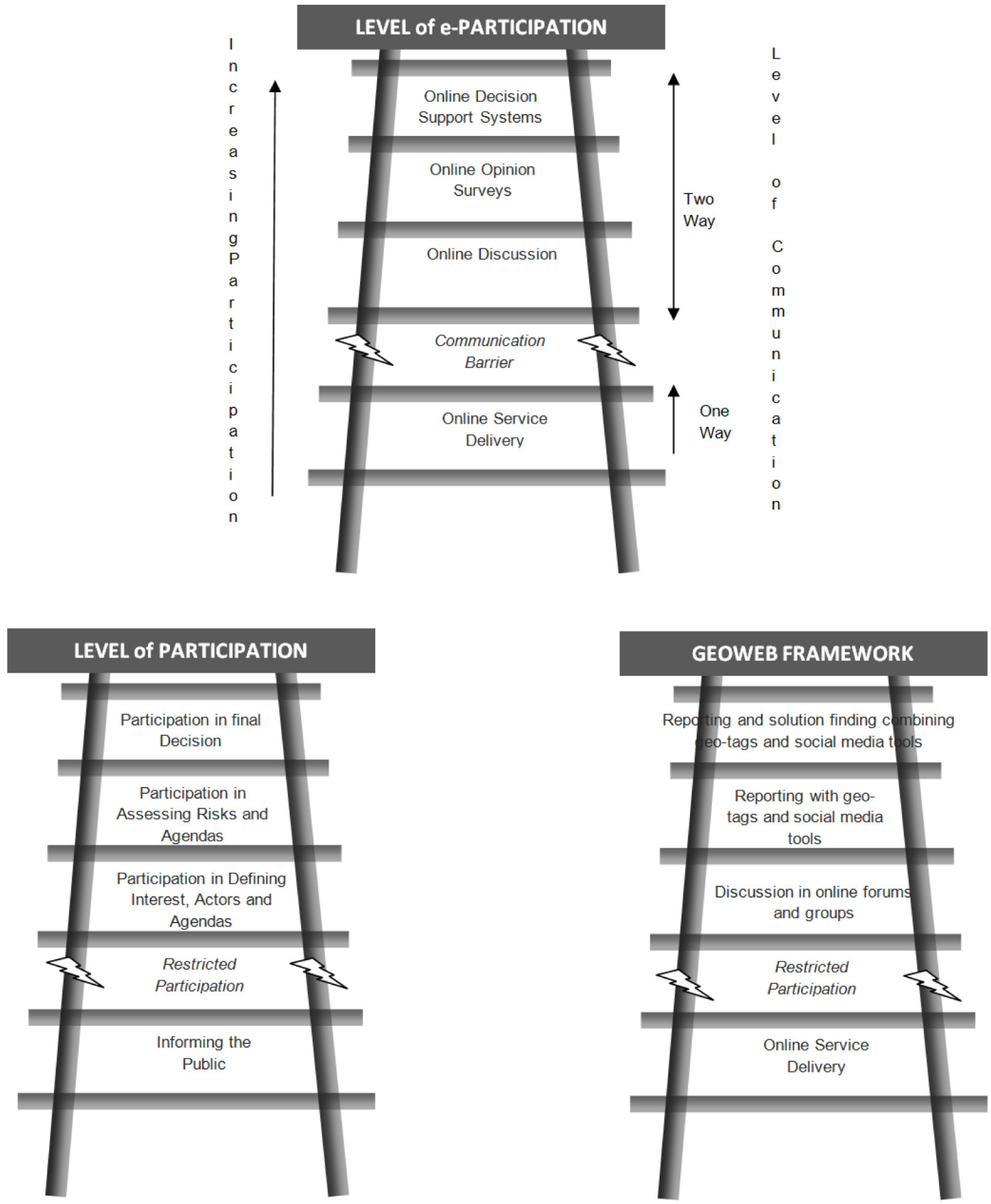
Steinmann et al. (2004), as well as Sieber (2006) carried out an extensive review of existing PPGIS applications in the mid-2000s. By then, still the majority of online PPGIS applications were limited to the stage/tool 'online discussion' and did not move further up the participation ladder towards fully involving citizens in decision making processes. Surprisingly or not, it seems that this has not changed despite the above mentioned technological advances within the last ten years. By the time of writing, the most sophisticated geospatial web-applications (e.g. FixMyStreet or SeeClickFix) referred to the second to last rung of the ladder where citizens typically report problems to the public administration. However, the highest level of participation – the complete integration of citizens into problem solving and decision making processes - has not been yet realized in any web-based software application. Referring to the matrix of Henning and Vogler (2011), empowerment of citizens is not yet fully realised in existing applications of the Geospatial web.

PRESSING ISSUES: USABILITY, PRIVACY AND DATA QUALITY

The technological developments described in this chapter, particularly the development of Virtual Globes and the geospatial web, trigger a lot of research questions in regard to data quality, privacy and usability, and how this can be asserted and verified. In this sub-section, we discuss some of these questions before we turn towards final evaluation of the geospatial web within the domain of Public Participation GIS.

Let us first discuss the issue of usability and whether or not those people that are intended to be the main beneficiaries of PPGIS can access and fully use the geospatial web. Unlike in GIS

Figure 2. Geo-web e-participation ladder, modified after Carver (2003), Smyth (2001) and Steinmann et al. (2005)



(Taylor, 1991; Pickles, 1995; Schuurman, 2000) there is basically no debate about the acceptance or rejection of Virtual Globes and the Geospatial web as a method or technology. Rather, the issue revolves around a series of open questions about how such technology will be understood relative to the practices of geography, how Virtual Globes will specifically influence representations of space, society, environment, and economy at the expense of other representations. The concept of

Table 1. Spectrum and techniques of public participation (Hennig & Vogler, 2011; adapted from IAP 2, 2007; Kingston, 2002; Milovanovic, 2003)

	One-way Communication	Two-way Communication			
	Inform	**Consult**	**Involve**	**Collaborate**	**Empower**
Objectives	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
Techniques	• Fact Sheets • Open houses	• Public comment • Surveys • Public meetings	• Workshops • Deliberative polling	• Citizen advisory com-mittees • Consensus-building • Participatory decision-making	• Citizens juries • Ballots • Dele-gated decision
Web-tools	• Web Sites	• On-line polls	• On-line discussion	• On-line services, forms and documents in electronic form	• On-line decision making support systems

the 'digital divide' has been extensively discussed in literature (Castells, 1996; Compaine, 2001; Elwood, 2006; Ghose, 2007; Haklay, 2012), raising the question if the selective access to ICT perpetuates exclusive social structures and hence leads to even greater exclusion of marginalized communities from participation.

Haklay (2008), states two criteria that should help PPGIS practitioners to evaluate the usability of geoweb applications: The first criterion refers to whether or not users have access to internet, discovering a strong correlation between those users who are socially excluded from decision making and those who are digitally excluded. The second criterion is related to a 'secondary digital divide' in the context of WebGIS. This 'digital skills divide' focuses on the question if the users have the skills and the knowledge required to operate geoweb tools and to handle tasks such as switching layers on and off, zooming, panning and clicking the map in order to retrieve further information about a map object, even more complex queries of information or simply understanding the concept of scale and generalization (Steinmann et al., 2004; Haklay, 2008). Furthermore, the issue of map literacy which is defined as the "ability of the user to relate items and places on a map to the corresponding items in the real world" (Haklay, 2008, p. 6), may be considered as a limiting factor for efficiently using the Geospatial web (Haklay, 2008; Bednarz & Kemp, 2010; Gryl & Jekel, 2012). Taking into consideration the ever increasing availability of ICT-tools and internet all over the world, the challenge how to improve the spatial literacy of citizens will be in the focus of future discussions in this area.

The next important research topic refers to privacy issues. It is widely agreed that the protection of privacy and personal data is of high importance. Geographic data becomes 'personal data,' when it is related to an identified or identifiable natural person (Nouwt, 2008). When information about locations of people is provided we call this 'location data' or 'location information' which is commercially used in 'location based services.' Interestingly, for all applications studied in the context of this chapter we assume that the information is volunteered. If also the location as such – a coordinate or a street address – is provided, participatory Geospatial web applications are heavily concerned with this privacy issue. Nouwt distinguishes a) location data in a more narrow sense, which in general provides information about where a person or a thing is, b) 'traffic data,' which can provide information about where a person or a thing has been, and c) 'movement data' which provides information about the route a person or a thing has taken, or about the duration of a movement. Torrens (2010) even believes that developments in the precision of positioning systems and potency of contextual analysis could potentially erode locational privacy for individuals in their workplaces, homes, and recreation space. Frequently, users of Web 2.0 tools do not realize that they concede their privacy or intellectual property rights of information to online service providers when uploading content on, for example, social networks (Ashley et al., 2009). Not surprisingly geoweb-platforms such as 'RottenNeigbour' (where users have been encouraged to expose 'bad' neighbours like sex offenders, see: http://en.wikipedia.org/wiki/Rottenneighbor.com), or MyBikeLane (where citizens can report traffic violations like illegally parked cars on bike lanes; see: http://www.mybikelane.com/) have been controversially discussed in public and even raised serious legal concerns.

The third pressing issue when talking about the Geospatial web, refers to the quality of Volunteered Geographic Information. There is a legitimate concern amongst professional GIS-practitioners regarding certainty, accuracy and quality of spatial data collected by laypersons, which Crampton (2010) termed the '*GIS-wars*' of the 2000s (Fischer, 2012). Goodchild (2008) argues that cartographic products elaborated by highly qualified cartographers in traditional mapping agencies guarantee certain standards and specifications, whereas these quality standards are not necessarily inherent to crowd-sourced spatial data, so that VGI is sometimes termed "asserted geographic information, in that its content is asserted by its creator without citation, reference, or other authority"(Goodchild, 2008, p. 220). Furthermore, VGI datasets tend to reflect the characteristics of specific online-communities of interest and do not represent the qualities of a random sample population (Fischer, 2012). Nevertheless we should not ignore the huge potential of Volunteered Geographic Information in terms of participation and empowerment of citizens, bearing in mind that VGI might not necessarily be a representative source of information or of outstanding quality.

GEOSPATIAL WEB IN DEVELOPING COUNTRIES

This section of the chapter examines the relevance of the geospatial component to the empowerment of citizens in developing countries, where shortcomings of democratic, collaborative, transparent, cross institutional and integrative local and regional planning are most obvious. In such countries it is most difficult to challenge the dominating power structures and unbalanced top-down approaches in planning and administration.

People before Technology: Characteristics of the Use of the Geospatial Web in Developing Countries

In many developing countries[3], there is a lack of health- and security-services provided by governments, transparent information policy about infrastructure projects, extraction and conservation of environmental resources, land tenure and land use management. Traditional spatial planning has been discredited as it is accounted for advocating inefficient, ineffective and even illegal projects and inadequate service provision resulting in a lack of legitimacy in the eyes of the citizens (Rakodi, 2001). The overwhelming part of society generally has little or no access to information, and political networks are likely to be excluded from non-transparent planning processes, public expenditures are often not located where they are needed most urgently or are not properly controlled by society (Resl, 2006). As a consequence, conflicts between stakeholders in local and regional planning occur, mainly in following areas: (a) territorial management and public services, (b) security, (c) public and individual transport and (d) public (eco-) health management. As in developing countries, the population in cities has grown rapidly over the last decades; problems related to spatial planning have increased especially in these urban areas and need to be addressed by an administration that uses new and innovative concepts and tools for participation (Steinberg, 2005; Fay & Morrison, 2006; Freire, 2006; Irazábal, 2009; Rodgers et al., 2011).

In the context of applying GIS in developing countries, there have been recent calls to rename Public Participation GIS (PPGIS) to Participatory GIS (PGIS) (Sieber, 2006; McCall & Dunn, 2012). While in industrialized countries of the 'Global North,' the access to spatial data and to sophisticated technologies is relatively easy, and decision making is embedded in more or less stable governance, the conditions of participatory work with GIS in developing countries are different. There, according to Kienberger (2010), PGIS is seen as "the crossing of participatory progressive development and GIScience, integrating low and high tech spatial management application […] that should facilitate empowerment, possessing own spatial information, communication among stakeholders and as a learning process" (p. 77). Practical PGIS applications derive from community mapping and Participatory Rural Appraisal (PRA). This is a participatory map-making process which "gathers information about a community's lands and makes it visible to outsiders by using the language of cartography" (Corbert & Keller, 2005, p. 92). Nowadays, many PGIS projects in the 'Global South' are related to the conservation and environmental domain, and especially to managing conflict over access to land and natural resources by promoting needs and rights of indigenous populations and local communities (Chapin et al., 2005; McCall & Dunn, 2012). However, PGIS applications in urban environments are rare.

The discussion of how to introduce (geo-) web 2.0 tools into the development domain basically started in September 2007, when the first international conference on 'Participatory Web 2.0 for Development' was organized by the United Nations Food and Agriculture Organization (FAO). Since then, the term 'Web2forDev' has become more and more common amongst PGIS-practitioners (for further information, please see the literature recommendations at the end of this chapter). The probably most well-known example of a Geospatial web-application in developing countries at the time of writing is Ushahidi (http://ushahidi.com/ - *Swahili for 'testimony' or 'witness'*). This is a platform that allows users to collect and upload geo-referenced information about incidents of public interest. It was created during Kenya's presidential elections in 2007 in order to provide Kenyan citizen journalists with a tool to report and map incidences of violence and peace efforts via the web and mobile phones.

The concept of digital divide that was described in the last sub-section especially refers to developing countries. However, the expanding provision of telecommunications infrastructure is helping to reduce costs and to improve access to the internet even in the 'Global South.' Furthermore, the increasing availability of mobile phones as a preferred tool for accessing and sharing information in many developing countries helps to address and overcome the digital divide (Martin & Corbett, 2011). However, especially in these countries the secondary digital divide, which refers to the skill of handling and processing spatial information (see previous sub-section), remains one of the main obstacles for using the Geospatial Web in a PGIS framework. Ashley et al. (2009) emphasise that "GIS-practitioners should not become sidetracked by a technology-driven hype, where excitement about the tools drive their usage, rather than what people can do with them" (p. 13). Furthermore, they criticise that many donor-funded projects supply equipment and tools without building community outreach services in order to build local capacity, content and acceptance. It is obvious and critically important to amend technology-driven PGIS initiatives with capacity building activities that allow users to fully access, understand, and use these tools (Sieber, 2006; Ghose, 2007; Ashely et al., 2009; McCall & Dunn, 2012). Furthermore, especially in developing countries, geoweb-tools have to resort to the social and cultural realities of the addressed citizens and communities. They have to take into consideration contextual factors such as the translation of materials into local languages (Garside, 2009), and provide a culturally and socially sensitive tool interface, data structure, data content and output design (Resl, 2006).

An evenly important factor is the organisational setting in which geoweb-tools are applied in developing countries. As GIS in general is an expert's tool, many small NGOs and community organisations are unable to use them as they cannot afford software licences and the cost of professional training (Weiner et al., 1995; Craig & Elwood, 1998; Elwood, 2006). However, the recent adoption of open source software in geoweb-tools is opening new opportunities for capacity building and outreach initiatives (Martin & Corbett, 2011). In this regard, scholars such as Resl (2006) suggest a network approach of interlinked communities, helping them to improve facilities, knowledge and capacities regarding system maintenance and management, and thus lowering undesired dependencies from other actors.

Aiming for Empowerment

Empowering marginalized communities and citizens is one of the main aims of applying the Geospatial web in developing countries. However, 'empowerment' is a widely and often casually used term. Frequently, it is referred to as both a process and an outcome of a critical reflective practice (Corbett & Keller, 2005). Carver (2001; according to Arnstein, 1969) defines empowerment "as the process by which stakeholders identify and shape their lives and the society in which they live through access to knowledge, political processes and financial, social and natural resources" (p. 62). Very interesting in the context of development countries is the definition of empowerment by Ramasubramanian (2010). She relates empowerment to the development of critical consciousness based on the theology of liberation of the Brazilian priest Paulo Freire (1970) that aims to overcome the exclusion of large parts of Latin American societies from political power since the Portuguese and Spanish colonisation of the continent. In her definition, critical consciousness "balances active engagement within a problem-solving process with a reflective analysis of the process itself and the resulting outcomes" (Ramasubramanian, 2010, p. 35). Hence, critical consciousness and thus empowerment amongst participants is achieved if,

1. The social, intellectual, and political capacity of the participants has improved.
2. The participants become more articulate and effective advocates for their own and the community's interests.
3. The Participants are more aware of the intricacies of urban governance and are better equipped to participate within these systems.
4. There is increased community cohesion.
5. There is willingness to participate, because there is increased trust in participatory processes and their outcomes (Ramasubramanian, 2010, p. 44).

We may record that the overarching goal of every P(P)GIS activity is empowerment, as P(P) GIS "can be empowering to disadvantaged groups by enabling them to use the language and tools of decision makers and so influence events that affect their lives and local geography" (Corbett

& Keller, 2005, p. 91). GIS in general and the Geospatial web in specific, are crucial for the construction of meanings of the physical environment, and allow what social geographers call the 'appropriation of space.' This refers to being empowered to challenge given meanings of space in order to achieve individual or collective aims (Gryl & Jekel, 2012). Hence, the production (and use) of spatial information through the Geospatial web allows 'actualizing citizens' for competing absolute representations of space as the Geospatial web is an instrument for hypothesis generation, democratic negotiation, and public participation in processes in a spatial domain. 'Actualizing citizens,' as opposed to 'dutiful citizens,' act through loose networks using social digital media and the Geospatial web for communication and interaction. They use digital narratives, which change their "relationships to civic knowledge and its components of authority, credibility, production-consumption, and sharing of information" (Gryl & Jekel, 2012, p. 8; according to Bennett et al., 2009, p. 108).

However, critics remain, especially when dealing with applying technology like the Geospatial web to the process of empowerment, as they introduce their own ambiguities with respect to access, equity, and digital representation of spatial knowledge (Elwood, 2006; Gryl & Jekel, 2012). Empowerment also implies the ownership and the legitimisation of the use of local knowledge with its conceptualization of space and spatial values that is generated within a participatory process. The – simplified - question 'who is the owner of the map' (Haklay, 2008), is a central element of legitimacy and empowerment and implies all stages of holding the data sources, data processing and the final information products themselves (McCall & Dunn, 2012). This is especially true for developing countries where local knowledge is of particularly high value for communities that are likely to be excluded from information networks and decision making processes.

WHAT NEXT? FUTURE TRENDS AND DEVELOPMENTS

This chapter so far has tried to give an overview about the history, concepts and applications of the Geospatial web in the broader context of participation and empowerment. Still we are going to discuss trends and future developments that already become apparent in this last sub-section.

For a long time, collaborative mapping initiatives dominated real-world PPGIS applications (Sieber, 2006). As already mentioned in this chapter, recently available Web 2.0-techonolgies and their diffusion within society opened up new vistas for participatory planning initiatives. In this respect, Hennig et al. (2011) created the term 'social geo-communication,' referring to the participation of the public in planning processes supported by Web 2.0 platforms that allow the sharing and processing of information directly to and between the affected citizens and communities. However, the implementation of the concept of 'social geo-communication' in participatory spatial planning and public administration would demand one single web-platform that fully integrates web-mapping tools and social media in a user-friendly environment, and therefore constituting a social network for citizens and their initiatives in order to let them participate in local and regional development in an organized and structured way.

Analyzing existing geoweb-platforms that have been presented we may state that these platforms do not integrate proper tools for discussion and problem solving based on community interaction to their geo-tagging based observation and reporting frameworks. Therefore, an increasing number of scholars (Ramasubramanian, 2010;

Evans-Cowley, 2010; Fu & Sun, 2010) ask for the amplification of these platforms by adding additional functionalities which allow citizens to engage in building communities, programming activities, and in finding sound solutions rather than reporting their complaints to central (planning) offices. The availability of such spatially enabled, citizen driven and expert supported information and planning platforms would mean to finally climb the upper rung of the ladder of e-participation, what so far has not been achieved by any application. This would probably constitute a new paradigm for citizen participation in spatial planning. In an analogy to Web 2.0 we may suggest the term PPGIS 2.0 for this.

Beyond new technological developments like the ubiquitous access to the Geospatial web via smartphones or the concept of augmented reality which is about to be integrated into recent applications (Fischer, 2012), it is even more important to understand the consequences of using these tools for society, including legal issues, ethics, democracy, and equity. A respective body of knowledge specific to the geographic domain is just developing (Hudson-Smith et al., 2009). Research needs to clarify whether or not the Geospatial web can be used in order to support society to independently explore patterns from spatially 'mappable factors.' Society may then be able to utilise information about the location of phenomena and any relations between them.

However, this would presume that citizens are able to "access, read, interpret, and critically reflect of spatial information, to communicate with the aid of maps and other spatial representations, and to express location-specific opinions using geomedia" (Gryl & Jekel, 2012, p. 4). This is what Strobl (2008) refers to as a 'Spatial Citizen' that is considered as being a "growing tool for positive and productive engagement with improving and managing society" (Bednarz & Kemp, 2011, p. 19). This 'Spatial Citizen' has appropriated the spatial domain of social life and has the "knowledge, skills, competencies, and abilities to be able to access and make sense of (geo-) information, in order to participate in democratic processes and make decisions, taking into account the situations and circumstances he encounters on a daily basis" (Gryl & Jekel, 2012, p. 8).

In the end, GIS and the Geospatial web should represent the many and convince the few that development aimed at real common wealth is a worthwhile strategy towards sustainability (Resl, 2006), and therefore help to empower citizens and communities in the quest for a better planned (urban) living environment.

CONCLUSION

In this chapter we discussed the most important concepts and tools in the domain of Geographic Information Systems (GIS) that are used to empower citizens, in order to call for their own concepts of habitat, livelihood, living conditions, infrastructure, and the access to and use of resources in the future. We have seen that regardless of the long tradition of GIS, the participatory aspect of applying GIS-tools in spatial planning and decision making is a fairly recent paradigm. However, the advent and ubiquity of Web 2.0 technologies, the availability of Virtual Globes and the increasing amount of spatial data collected by laypersons (Volunteered Geographic Information - VGI) provide so far unknown opportunities for citizen participation in the renegotiation of representations of space, especially regarding issues in urban governance. In this chapter we showed that the Geospatial web is an efficient tool in the quest for empowering citizens and altering the level of participation in decision making. This is especially true for developing countries, where the need for good governance and transparent planning is particularly high, as the overwhelming part of these countries' societies has been excluded from participation since the era of colonisation.

The increasing availability of geoweb technologies leads to new opportunities for decision-makers and ordinary citizens in order to collaborate and share information in dynamic and time-critical decision-making environments in urban planning and administration. Current projects and applications especially aim at achieving the complete integration of social media platforms and geospatial web-tools for planning initiatives and (self-) governance that are evolving at the grassroots level. Further research has to be done also regarding the societal implications of geospatial web technologies referring to usability issues, privacy and ethical implications as well as to the quality and accuracy of data that is collected in the 'crowd.' Despite an ever increasing number of Geospatial web applications that are available for citizens, communities and public administration, we may state that we are just at the beginning of a development that may completely redefine the issue of citizen participation in public administration and spatial planning in the future.

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KEY TERMS AND DEFINITIONS

Empowerment: A process that aims at facilitating the access to knowledge, political and financial power as well as social and natural resources to individuals and groups that have so far been excluded from decision making processes.

Geographic Information Systems (GIS): A Geographic Information System (GIS) integrates hardware, software and (spatial) data to assist in the acquisition, handling, analysis and display of geographically referenced information.

Geospatial Web: Web-applications and data infrastructures that help users find, access, and sometimes manipulate data of interest on the web dynamically and therefore provide a two-way gateway for geographic information and maps to a wide range of users.

Public Participation GIS (PPGIS): Geographic Information Systems that are applied to participatory spatial planning processes with a specific focus on non-governmental or grassroot organizations, and community-based organizations as user groups.

Spatial Decision Support Systems (SDSS): Computer-aided systems that are designed to explore and structure complex spatial problems for a more transparent and efficient decision making process.

Virtual Globes: Web-based applications that allow users to interact with and query overhead imagery and spatial data via a three-dimensional representation of the Earth.

Volunteered Geographic Information (VGI): Spatial Data collected by laypersons provided to the public for free.

ENDNOTES

1 According to Ellul et al. (2008), 75% of all information in local government is geographically referenced with 45 of the 122 national British e-government priorities requiring GIS (p. 2).

2 http://www.govtech.com/e-government/San-Jose-Califs-Wikiplanning-Project-on.html; retrieved on March 1st, 2012.

3 Using the term 'developing countries' may be considered in these days as a strong generalization as it embraces complex societies. These societies may include power elites that have easy access to information and technology and are technologically sophisticated. On the contrary, there are groups of marginalized people in industrialized countries such as the United States. One can argue that at an individual level the needs of people in poor countries may be surprisingly similar to those of industrialized countries. A major difference is typically the governance and the potential to change this situation quickly – if political consensus is achieved. The authors try to avoid a political debate here and try to describe the technological developments and resulting options here in a neutral way although we are aware that there will never be a completely 'innocent' technology.