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# Geographic information science: emerging research on the societal implications of the geospatial web

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**Abstract:** This review examines emerging research on the geoweb, particularly recent efforts to assess the social, political and disciplinary shifts associated with it. The rise of the geoweb is associated with shifts in the processes and power relations of spatial data creation and use, reconfigurations in previously bounded disciplinary knowledge sets, and shifts in the subjectivities and social relations that are produced through the geoweb's technologies, data, and practices. This early research on the societal implications of the geoweb is drawing productively upon conceptual frameworks from critical GIS, public participation GIS, and spatial data infrastructure research, but must also theorize beyond these existing bodies of work.

**Key words:** critical GIS, geospatial web, GIScience, neogeography, pervasive computing, social theory, volunteered geographic information.

## I Introduction

Under names like 'neogeography', 'volunteered geographic information', 'wiki-mapping', 'GIS 2.0', and others, innovations and new applications of online geospatial technologies and crowd-sourced spatial data continue their rapid expansion. These data and technologies are used in emergency response (Crutcher and Zook, 2009; Mills, 2008), public deliberation in spatial decision making (Rinner *et al.*, 2008), participatory planning (Seeger, 2009), and citizen science (Tulloch, 2008). Geographers and others continue to develop research agendas attending to both the technological and societal possibilities

and impacts of this 'geospatial web' (Scharl and Tochtermann, 2007). Last year's progress report (Elwood, 2009) examined changes in the content and character of digital spatial data that are emerging from the geospatial web ('the geoweb' as I refer to it here), reviewing GIScience research that is grappling with the representation, analysis, and administration of large volumes of heterogeneous data, particularly spatial data expressed in qualitative or natural language terms. Research on data interoperability and semantic heterogeneity continues to be at the forefront of these efforts, particularly strategies for interoperating between formal and

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informal geographic knowledge (Goodchild and Hill, 2008; Lees, 2009). GIScience researchers are taking on new challenges, blending conventional GIS softwares and techniques with tools from the geoweb (Moreno-Sanchez *et al.*, 2007; Yao and Liang, 2008), and adapting free mapping application programming interfaces (APIs) to facilitate spatial analysis and inclusion of feature attributes (Chow, 2008). New methods for studying the geoweb are emerging as well – note Zook and Graham's (2009) efforts to use the spatial distribution of information contributions to GoogleMaps as a means of understanding the social characteristics of contributors. Alongside these more technical and methodological engagements with the geoweb in GIScience research, increasing attention is being paid to social, political, and disciplinary shifts associated with it. This review focuses on these developments.

## II 'What's in a name?'

A notable characteristic of geographers' early writing about the geoweb has been negotiations over what to call this collection of technologies, methods, and social practices. These negotiations over naming are significant because of what they identify as central to this research agenda, and illuminating some of the social, political, and disciplinary shifts that we are trying to come to grips with in study of the geoweb.

Identifiers such as 'volunteered geographic information' (Goodchild, 2007) or 'collaboratively contributed geographic information' (Bishr and Mantelas, 2008), call our attention to changes in processes and relationships through which geographic information is produced. Names that reference GIS, such as 'GIS 2.0' (McHaffie, 2008), or a 'wikification' of GIS (Sui, 2008) highlight the ways in which the technologies and practices of the geoweb may be transforming discipline-specific understandings of what constitutes a GIS. These names suggest the Web 2.0 modes of interactivity, user-generated content,

the iterative mutability of wikis, and their implications for the processes and relationships of knowledge making. Terms like 'neo-geography' (Turner, 2006) or 'ubiquitous cartography' (Gartner *et al.*, 2007) suggest a remaking of the bounded knowledges and skill sets around which these disciplines have conventionally been conceived and hint at the increasing 'everywhereness' of spatial information in our daily lives.

These identifiers and the issues that resonate with them suggest several directions for research on the societal implications of the geoweb. They suggest that we must examine: changes in the processes and power relationships that characterize the social and political production of spatial data; the ways in which the rise of the geoweb is reconfiguring structures such as 'expert knowledge' or 'cartography' and the politics that may be advanced through these structures; and the subjectivities and social relations that are produced with and through the geoweb's technologies, data, and practices. The following section considers how emerging research on the geoweb is engaging with these issues, with attention to how it is drawing upon and extending societal studies of GIS and other information technologies.

## III The geoweb in society

From work on automated cartography, geographies of the information society, and GIS and society, to more recent work on geographies of cyberspace, critical GIS, pervasive computing, cybergeographies, and spatial data handling, there is a large and diverse body of geographical scholarship that has examined the ways in which information technologies are embedded in changing social, political, and economic geographies. As I illustrate below, emerging propositions about the societal impacts of the geoweb draw on key concepts from this diverse body of work. They are also filling key gaps where these prior theorizations are not sufficient for conceptualizing the social and political construction of the geoweb, its knowledge

politics, or the subjectivities and social relations in which it is implicated.

### *1 The social and political construction of spatial data and technologies*

For well over a decade, public participation GIS (PPGIS), critical GIS, and spatial data infrastructure (SDI) research has examined the structures, relationships, and institutions through which spatial data and technologies are produced and used, with an eye toward understanding the inclusions and exclusions that may result in social process, data structures, or ways of knowing (Schuurman, 1999; Craig *et al.*, 2002; Williamson *et al.*, 2003). Researchers have detailed inequalities in access to spatial data and technologies, involvement in their production and use, and participation in decisions in which they are used and noted that these exclusions tend to reinforce existing inequalities along lines of gender, race, class, and other axes of difference (Elwood, 2002; Weiner and Harris, 2003; Kyem, 2004). This work has shown how spatial data administration and sharing practices are shaped by structures such as copyright and privacy laws (Onsrud, 2000), legislated relationships between tiers of government (Nedovic-Budic *et al.*, 2004; Craig, 2005; Harvey and Tulloch, 2006); metadata or data standards (Schuurman, 2006); and a host of social contracts, such as cultural expectations of privacy, local political traditions, or relationships between citizen and state (Craglia and Masser, 2003; de Man, 2003; Elwood and Leitner, 2003; Onsrud *et al.*, 2005; Georgiadou *et al.*, 2005).

Early claims about the societal implications of the geoweb circulate around similar questions of inclusion, exclusion, and knowledge claims. Yet it is also clear that the processes and relationships governing the social and political production of the geoweb diverge in several ways from these earlier discussions. Goodchild (2007) argues that the geoweb represents a paradigmatic shift from a model in which national governments were the lead actors in producing carefully 'curated' spatial

data sets, to a newer multivocal model in which citizens, states, and private entities are all involved in producing 'patchwork' data sets that bring together curated and volunteered information (Guptill, 2007; Grossner *et al.*, 2008). This transformation requires a reworking, for example, of PPGIS accounts that script citizens and grassroots groups as petitioning government officials for data. Elwood (2008a) illustrates how these citizens and grassroots groups may also be generating spatial data that is in demand by government officials, altering the roles of petitioner and provider. Similarly, Budhathoki *et al.* (2008) note that the geoweb problematizes relationships that supposedly undergird SDIs as a model of spatial data management, arguing that it is increasingly difficult to differentiate data 'producers' and 'users' in an environment where many participants function in both capacities. Taylor and Caquard (2006) and Dormann *et al.* (2006) make similar claims about the impact of collaborative online mapping tools, noting that cartography's notion of a 'map user' no longer implies a discrete singular consumer of cartographic communication.

Societal studies of GIS have paid considerable attention to the role of private-sector actors, such as software companies, geodemographic marketing firms, and data vendors, in shaping the political economies of GIS and spatial databases as well as their functionalities (Obermeyer, 1995; Goss, 1995; Curry, 1998). Private-sector actors are present in different ways in the geoweb with scholars drawing different conclusions about their dominance and means of control. Many online mapping and data tools of the geoweb are not provided through a fee-for-service model, for example, but rather are provided for the end-user for free, paid for by advertisements streamed to this user's interface. Zook and Graham (2007a; 2007b) note that this model introduces an additional private-sector actor – advertisers – and that the structure and functioning of these tools is influenced by the imperatives of selling

advertisements and by end-user needs. Others contend that the role of private-sector actors is being transformed by the strong presence of free and open source software (FOSS) tools and the activism of open source champions – creating a pushback against private-sector efforts to shore up the model of proprietary software and applications (Haklay *et al.*, 2008; Crampton, 2009).

Alongside these discussions of the geoweb's capacity to open geographic technologies and cartographic capabilities to a lay public, social studies of the geoweb are also attentive to its implications for the so-called 'digital divide', with the first efforts to study the digital divides of the geoweb now emerging. Studies of the spatial distribution of geographic information posted by GoogleMaps users show similar patterns of inequality at both global and local scales: an overrepresentation of information from and about higher-income places, as well as popular tourist destinations (Crutcher and Zook, 2009; Zook and Graham, 2009). These discussions and others (Elwood, 2008b; Tulloch, 2008) suggest that the geoweb reinscribes digital divides along existing lines, disadvantaging the poor, racial and ethnic minorities, rural residents, residents of the Global South, and so on. That said, I would argue that the geoweb almost certainly introduces new mechanisms of exclusion as, for instance, in the advantage afforded to those who have the coding skills to *create* their own 'mash ups' with open APIs, compared to those who can only view or contribute to such resources.

## 2 The 'knowledge politics' of spatial information and technologies

A further consideration in efforts to understand the societal implications of the geoweb lies in the range of possible 'knowledge politics' that it may be used to advance. By knowledge politics, I mean the ways in which individuals and institutions leverage digital spatial data and spatial technologies in negotiating social, political, and economic

processes, often doing so in ways that rely upon the differential influence and authority that is granted to particular forms of knowledge or representations. The work of critical GIS scholars and others has shown how quantitative data and representations are advantaged by the pervasive numeracy of many state institutions and policy regimes, how cartographic rationalities lead to maps being afforded greater influence or 'truth power', or how technicist rationalities privilege claims advanced through the use of digital technologies (McLafferty, 2002; McCann, 2008; Ward, 2009). These politics are enacted through the efforts of actors to cast themselves and their claims as accurate, influential, or 'expert' (Elwood, 2006).

The geoweb may require us to rethink these propositions. First, it is clear in early accounts of the geoweb that structures such as cartographic or technicist rationalities do not operate in the same ways, because the geoweb affords access for a wide range of actors to the representations and practices that activate these politics – maps, map-making tools, digital spatial data, and so on. Literature is replete with accounts of the opening of cartography, GIS, and digital data production associated with the geoweb (Taylor and Caquard, 2006; Goodchild, 2007; Kitchin and Dodge, 2007; Sui, 2008; Crampton, 2009). Prior accounts of knowledge politics advanced in critical GIS rest upon the notion of a stable 'inside' and 'outside'. That is, these explanations tell us that actors seek greater influence by casting themselves as 'inside' a particular expert community or validated/privileged skill set. The changes associated with the geoweb alter these boundaries and demarcations and, by extension, the range of knowledge politics that may be possible through these data, applications, and representations.

Further, the geoweb is likely to enable entirely new knowledge politics. Much of the early discussion of the societal significance of the geoweb focuses on its capacity to assemble data sets of unprecedented size and

granularity (Goodchild, 2007; Gupta, 2007; Haklay *et al.*, 2008). If six million citizens are reporting geographic information, why not 'Map the whole world' as Wikimapia's slogan suggests? We are already seeing signs that the massiveness and granularity of one's data set is poised to become a central basis upon which claims to expertise and insight can be built. Witness, for example, the faith being placed by scholars, media, and business on 'crowdsourcing' and the 'wisdom of the masses' (Dean, 2008), underlain by an assumption that more is better. There is as yet little theorization of the sociopolitical significance of this growing emphasis on the massiveness of information sets; Joronen (2008) is a helpful starting point. Drawing on Heidegger's proposition that modern technologies produce the world as something to be ordered, Joronen theorizes the Web as an example of a technology whose power is derived in part through accumulating, ordering, and storing multitudes of entities. Such a conception has much to offer our efforts to understand the new knowledge politics emerging through the geoweb.

### 3 Subjectivities and social relations

Another consistent thread in geographers' work on the societal implications of information technologies has been theorizations of how geospatial technologies and data constitute bodies, identities, and social relations, often with an emphasis on how this may produce relations of surveillance, governmentality, or hegemony. Critical GIS and critical cartography scholars have shown how 'spatial projects' such as addressing systems, choropleth mapping, or cartographic demarcation of tribal land claims serve to constitute citizens, enumerate their identifying characteristics, and designate places to which they have access through territorial claims that confer or deny particular rights and benefits (Curry, 1998; Crampton, 2004; Pickles, 2004; Chmara-Huff, 2006; Rose-Redwood, 2006). Research on pervasive computing suggests that wireless and mobile

technologies are altering the social and spatial scales of our engagement with computing and with one another, enabling new forms of social engagement and altering privacy, surveillance, and the mechanisms through which they are fostered (Dave, 2007; Dodge and Kitchin, 2007; Dourish and Bell, 2007; McCullough, 2007; Paay *et al.*, 2007).

In addressing issues of subjectivities and social relations *vis-à-vis* the geoweb, some scholars take the position that the geoweb is a new medium for reinscription of existing forms of domination. Obermeyer (2007) calls into question the notion that digital information circulating on the geoweb is 'volunteered', arguing that these technosystems extend existing structures that take personal information from individuals without their knowledge, often for use by powerful corporate or governmental actors. Williams (2007) makes a similar suggestion, noting that the pervasive use of locating technologies such as GPS-enabled cell phones or digital card readers mean that our bodies and everyday activities leave 'digital traces' that may be monitored. The forms of surveillance and dangers of domination that they examine are familiar, but they also call to our attention that the geoweb may circulate our personal information in ways that are not immediately apparent or alter our ability to control this flow of information about ourselves.

Other scholars emphasize new dimensions of the subjectivities and social relations that are emergent with and through the geoweb, calling to our attention changing relationships between bodies and spaces and technologies. For Schuurman (2004: 1338), 'The 21st century cyborg is shaped not by electronics ... but data'. Describing a web-based triathlon training log into which individuals enter copious data about their vital signs, training goals, and so on, she notes that individual subjects are produced through these data-borgs and disciplined into them. The data become the way they know their bodies and their athletic performance. Wilson (2009) notes that participating



in such data and technosystems inscribes individuals into particular languages and metrics. He characterizes this subject as a 'geocoded citizen' whose way of knowing the world and articulating its characteristics is structured through the use of mobile technologies and spatial data schemata. Dodge and Kitchin (2007) argue that the pervasiveness of digital data records and their availability online creates newly permanent and constantly accessible digital selves. While human memory degrades over time, they argue, the pervasive digital traces of our lives constitute us as permanently 'retrievable' selves, often years after the fact.<sup>1</sup> They argue that this encourages a carefully monitoring and controlling of our digital selves – an internalized 'surveillance' (Mann *et al.*, 2003).

While none of the above papers explicitly names the geoweb as the focus of their inquiry, all three examine phenomena associated with it, including user-generated online content, the archiving of massive volumes of detailed individual data, and the use of geo-enabled handheld devices to generate spatial data. As such, the theorizations they offer hold particular promise for efforts to understand the embodiments and subjectivities emerging from the geoweb as individuals use it to disseminate information about their experiences, observations, and even in bodily responses to particular places (Nold, 2004; Proppen, 2005).

#### IV Conclusion

While we are only beginning to examine precisely how this is occurring, and to whose advantage and whose disadvantage, the geoweb is clearly altering the sociopolitical construction of spatial data, the knowledge politics associated with geographic information technologies and our embodied and social relations to these technologies and data. In this period of flux, the transformations and new technologies associated with the geoweb underscore Sheppard's (2006)

call to consider very carefully what constitutes a 'geographic information system', and by extension, how we define the substantive foci of GIScience. While much of the work I have reviewed here emerges from GIScience, much also draws broadly from human geography, information sciences, science and technologies studies, and social theory. The diversity of digital artifacts, forms of data, and social and political practices that comprise the geoweb will require disciplinary and theoretical ecumenicalism. Just as the geoweb itself is characterized by all sorts of unexpected collisions, combinations, and openings, the same must be true of our efforts to understand them.

While this review foregrounds the work of critical GIS and critical cartography scholars, I am inspired by Kingbury and Jones' (2009) call to think beyond the existing frameworks of these traditions. They argue that, in these literatures, the societal impacts of geographic information technologies have largely been viewed through dialectics of utopia and dystopia, of hope and fear, articulated around concepts such as order, control, surveillance, rationality, and (supposed) transparency. A much fuller range of geotechnological practices demands our attention, they contend, including the capacity for producing the unexpected through new collisions of representation and knowledge. Drawing on Benjamin, they emphasize that the transformative potential of technologies lies in their indeterminacy, and emerges through use outside the paradigm in which they originate, or are conventionally understood to belong. The critical question remains how different constituencies, variously more and less powerful, will take up this indeterminacy and what they will create with it.

#### Note

1. Consider for example, the much publicized difficulty of removing one's information from social networking sites (Aspen, 2008), or determining the birthdates of gymnasts competing in the Beijing Olympics.

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