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Searching for social justice in GIScience publications

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ABSTRACT

Maps are explicitly positioned within the realms of power, representation, and epistemology; this article sets out to explore how these ideas are manifest in the academic Geographic Information Science (GIScience) literature. We analyze 10 years of literature (2005–2014) from top tier GIScience journals specific to the geoweb and geographic crowdsourcing. We then broaden our search to include three additional journals outside the technical GIScience journals and contrast them to the initial findings. We use this comparison to discuss the apparent technical and social divide present within the literature. Our findings demonstrate little explicit engagement with topics of social justice, marginalization, and empowerment within our subset of almost 1200 GIScience papers. The social, environmental, and political nature of participation, mapmaking, and maps necessitates greater reflection on the creation, design, and implementation of the geoweb and geographic crowdsourcing. We argue that the merging of the technical and social has already occurred in practice, and for GIScience to remain relevant for contributors and users of crowdsourced maps, researchers and practitioners must heed two decades of calls for substantial and critical engagement with the geoweb and crowdsourcing as social, environmental, and political processes.

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Introduction

Throughout the 1990s, academic writing in the field of critical cartography aligned with the principles and intent of social justice, especially regarding theorizing and sharing empirical examples of the impact of mapping on marginalized communities and empowerment. This flowed from Brian Harley's paper, *Deconstructing the Map* (1989), which explicitly positioned maps within the realms of power, representation, and epistemology. Scholars such as Harris and Weiner (1998), Ghose (2001), Elwood (2002), Corbett and Keller (2005), and Stephens (2013) continued to write about marginalization and empowerment within the context of Geographic Information Technologies (GITs) in the following years. Alternative methods of mapping, such as participatory, community, counter, citizen, alternate, and most recently the participatory geoweb, have emerged. These developments have led some to claim that mapping has the potential to directly question and contest control and power, as well as transform relationships into ones that are more inclusive and community-based (Crampton and Krygier 2005; Harris and Hazen 2006; Lydon 2002). We are therefore interested to analyze the extent social justice exists within this subset of literature.

While the underlying principles laid out by Harley for the deconstruction of mapmaking remain influential and important (Krygier 2015; Rose-Redwood 2015), this article sets out to explore how these ideas are manifest in the academic Geographic Information Science (GIScience) literature related to the geospatial web (geoweb) and geographic crowdsourcing (from hereafter referred to simply as crowdsourcing) as a generic term, referring to the global network of services that connect geographic data, geotags (electronic geographic locations assigned to digital media), and other digital information (Scharl and Tochtermann 2009). In using "geoweb," we do not restrict our analyses of the literature by this term, rather, we have adopted it as an encompassing descriptor, enabling us to avoid providing long lists of related terms at each mention. Geographic crowdsourcing, as defined by Estellés-Arolas and González-Ladrón-de-Guevara (2012) refers to a participatory online activity where an individual, company, or organization proposes a voluntary task, of a geographic nature, to be undertaken by a crowd of variably skilled individuals. A range of motivations, purposes, and objectives influence why the geoweb and crowdsourcing are adopted (Johnson and Sieber 2012) and why people engage with issues through these media (Goodchild 2007).

We analyze 10 years of literature (2005–2014) appearing in top tier GIScience journals that publish material specific to the geoweb and crowdsourcing, and find little explicit engagement with topics of social justice, marginalization, and empowerment. We then broaden our literature search to include three more generalized Geography journals and contrast these results with our previous findings. Finally, we use this comparison to discuss the technical and social divide apparent within the literature. In conducting this assessment, we are not suggesting that a conspiracy of silence exists, nor that every GIScience article ought to include a discussion of social justice. Rather, for more than two decades, researchers have identified the need for social justice to be included in relation to the development and use of new technologies. This is well illustrated by the “GIS and Society” research priority identified by the National Center for Geographic Information and Analysis research consortium, and specifically the research undertaken in the Varenius project (Craig, Harris, and Weiner 1999). The methodology presented in this article is one means to assess the extent that top tier journals have, or have not, explored these ideas within GIScience studies.

Social justice

The term “social justice” was originally coined by a Jesuit thinker Luigi Taparelli in the midst of European social revolution in the mid-1800s, although it received little attention at the time (Behr 2003). Throughout the twentieth century, the idea of social justice would regularly reappear, for example, the term was connected explicitly with the establishment of the International Labour Organization in 1919, although here the usage of the term did not explicitly outline how social justice was to be achieved (ILO 2014; Rodgers et al. 2009). As a broad ideal, social justice seeks to imbue fairness and mutual obligation, fostering relationships built upon equality of opportunity that enhance and strengthen responsibility for one another (Rawls 1971). Social justice is most contested as to how, when, and to what extent these ideals are put into practice. An example of the challenging nature of implementing social justice is considering how, when, and for whom the redistribution of opportunities ought to occur.

Perhaps the most influential thinker to propose a response to this question, and develop a theory to support that process, is John Rawls. This American philosopher argues that part of the answer requires the balancing of individual freedom with social equity (Rawls 1971). Balance, at least theoretically, can be

achieved because all people assume an “original position” wherein they do not know where their place will be within society; this includes aspects of their class, status, assets, and abilities. Based upon this, Rawls believes that all people will opt for a distribution of these aspects in a way that treats all people fairly. Doing so, Rawls argues, will result in the establishment of appropriate principles to govern society. Foundational to Rawls’ theory, which focuses upon the structures of society, is the establishment and protection of rights and opportunities while ensuring a fair allocation of resources, opportunities, and benefits to the least advantaged members of society. Two core principles advocated by Rawls are that first, all people have the equal claim to basic liberties, and second, although inequality exists, social justice must strive for equality of opportunity or to assert the greatest benefit for the least advantaged members of society (Rawls 1971). Incorporating these discussions into the geoweb and crowdsourcing are beyond the scope of this work, however we draw upon some key themes that are prominent throughout social justice theorizing, namely empowerment and the reproduction of marginalization, as a starting point for our analyses of their role within the GIScience literature.

For decades, geography has been concerned with social justice. Geographers, such as Harvey (1973, 1996), Smith (1994), Mitchell (2003), Kesby (2007), and Rosenburg (2014) have all focused on social justice within their work. In recent years, increasing user interactivity of web-based technologies, often framed as Web 2.0, has led to and facilitated new opportunities and challenges for supporting social justice (Brabham 2008). Researchers, such as Jordan et al. (2011), Boulton (2010), Lingel and Bishop (2014), and Sui (2015), have continued to discuss social justice within the context of the geoweb and Web 2.0 technologies. It is thus a well-established area of research within the discipline of Geography.

However, while Web 2.0 technologies provide new means for governments, organizations, and the public to interact and engage with each other, they also pose new challenges in terms of unequal access and opportunity, as well as the potential to undermine the protection of individual rights, especially those related to anonymity and privacy. Despite these challenges, the emergence of new digital technologies offers enormous potential to strengthen social justice; government has a suite of new tools available to them to enhance transparency and accountability, and to seek greater public participation in decision-making processes. The geoweb and crowdsourcing platforms offer the technologies needed to engage the public in spatial issues and

decision-making, which in turn has the potential to both support and enhance the principles of social justice. However, as we discuss in the following sections, social justice is a complex issue that does not directly correlate with access to technology, as access to such platforms are equal themselves equally distributed. The “digital divide” and digital inequalities (the socio-technical impediments to equal access and use of technology, see Hargittai and Hsieh 2013; Wei 2012) are reproductions of societal inequalities more broadly. Groups who are marginalized by the digital divide and digital inequalities are the same groups that have been historically marginalized by other social, political, and economic practices (Saleh 2009).

Why social justice?

Maps, regardless of how they were made or by whom, influence lives, affect policy, and alter the way we understand and engage with the world around us. As Harley (1990) notes, “Cartography, we see, is never merely the drawing of maps: it is the making of worlds. Deconstructing the map is deconstructing of [*sic*] the society that produced it.” He explains further that this is not a simple generalization; but power is embedded in all maps:

Maps are never value-free images; except in the narrowest Euclidean sense they are not in themselves either true or false. Both in the selectivity of their content and in their signs and styles of representation maps are a way of conceiving, articulating, and structuring the human world which is biased towards, promoted by, and exerts influence upon particular sets of social relations. (Harley 1988, 277)

Within all maps are embedded power and social relations, and thus investigating social justice is crucial for mapmakers and map users. Even more egalitarian approaches to mapping such as participatory, or citizen led processes can create or entrench existing power and control mechanisms that exclude and marginalize some, as well as simultaneously include and empower others (Harris and Weiner 1998). Fox et al. (2006) demonstrate that individuals can both gain and lose as a result of mapping activities; Fox illustrates this using the example that increased rights over lands won through the use of participatory mapping processes may also become a loss of community control, ownership, and decision-making power. Marginalized people may not wish to participate in a mapping process wherein the medium in which they are represented expresses their domination and powerlessness, yet they feel obligated to participate because they have “little to gain and much to lose” (Rundstrom 1991, 8).

Rundstrom further argues that some approaches and technologies within community-based and participatory mapping disempower those involved (Rundstrom 1995). Like mapping processes of the past, participatory mapping processes are expressions of power and control, while the shifts of who creates maps and for what purposes can be positive, they can also contribute to and be causative agents of conflict (Corbett 2003; Pramono, Natalia, and Janting 2006) as well as further entrench marginalization (Harris and Weiner 1998). This article builds upon Harley’s work and seeks to analyze to what extent crowdsourced and participatory manifestations of maps are analyzed within the context of social justice.

Perhaps one of the most notable crowdsourced mapping initiatives is the Green Map System. This is a participatory digital mapmaking system that seeks to build, enhance, and create healthier, sustainable, and just communities by improving accessibility and knowledge about ecological, and civic resources (Open Green Map 2015). With mapmakers in more than 65 countries, hundreds of completed maps, and millions of visitors, the Green Map System demonstrates how a small-scale and community-focused crowdsourced mapping process can successfully alter the way in which information is accessed as well as the types of information that is available. However, the values, content, and context embedded within the mapmaking process and maps often align with the interests of a core group, while alienating many others (Parker 2006). While many online Green Maps have been created using diverse crowdsourced data with a range of people engaged in the mapmaking process, the Green Map System is largely powerless to address issues of cultural accessibility and knowledge barriers that influence the use and interpretation of the map and mapmaking processes. As Harley points out, “to discover these rules, we have to read between the lines of technical procedures or of the map’s topographic content” (Harley 1989, 5).

Exclusion and marginalization can be intentional acts, used as a means to achieve particular objectives; exclusion and marginalization can also be an unconscious act or an outcome of systematic exclusion and marginalization. The latter – unconscious or systematic exclusion and marginalization – is commonly the result of considering maps and mapmaking as technical, scientific, and objective processes that are often considered value neutral. In other words, the framing of maps and mapmaking is such that the processes and outcomes are not viewed as altering power, control, and relationships, but are viewed as an expression of reality free from bias. Because of this perceived

neutrality, the geoweb and crowdsourcing can recreate and entrench power relations, facilitate the positions of the elite, create conflict, and reinforce the methodology, worldview, and approach that the processes were designed to counter (Pramono, Natalia, and Janting 2006). In addition, structural, technical, organizational, and economic barriers prevent access to data, which act as (in)formal control mechanisms (Sieber 2007). “The entire process of GIS production,” Bunch writes, “from software development to data creation, analysis, visualization and interpretation of GIS output is characterized by political, economic and social motivations” (2001, 71). Beyond the technical, actors within these processes are often driven by their own motivations, which can result in increased conflict, resource privatization, and loss of common property – a shift that might also be a reflection of embedded knowledge within maps (Wright, Duncan, and Lach 2009).

The geoweb and crowdsourcing support new forms of participatory mapmaking with potential to involve and engage new audiences in creative and visual ways that challenge injustice, marginalization, and exclusion. Marginalized and disadvantaged individuals and groups within society can utilize maps to strengthen their voice, enhance knowledge about available services and resources, and support advocacy. However, for the participatory geoweb and crowdsourcing initiatives to achieve these aims, they must first engage with the barriers that have existed, and continue to exist, in creating, accessing, and using maps. Yet, this potential has not been realized, and in more cases than not, the expectations of social justice are unmet. Crowdsourced and participatory maps in some instances have even been abused, coopted as tools for the elite whose power was being challenged in the first place (Bryan and Wood 2015). GIScience covers a broader set of research interests than simply addressing technical issues, a fact that was highlighted throughout the National Center for Geographic Information and Analysis programs during the late 1990s. From that time there have been continued calls for GIS to better engage with the social, environmental, and political

contexts in which the technical is manifest (Corbett and Keller 2005; Elwood 2010; Fox et al. 2008; Harris and Weiner 1998). As the findings below demonstrate, there has been some progress in the inclusion of terms related to social justice in GIScience publications from 2005 to 2014 (thus reflecting the significance of these issues in the field), however the overall situation appears not to have significantly changed over the period covered in the study, one of the reasons for this is a continuing lack of evidence related to the effectiveness and impact of participatory mapping (Brown and Kytta 2014). Elwood (2010) envisions a comprehensive GIScience research in which “information technologies are embedded in changing social, political, and economic geographies” which in turn directly address key societal knowledge gaps. Yet, this discourse appears to remain at the margins, and the findings of this research below highlight that the GIScience agenda envisioned by Elwood is almost entirely absent in top tier GIScience journals.

Methods

In order to analyze the extent to which social justice is included, identified, or expressed in the context of the geospatial web and geographic crowdsourcing literature, we analyzed top tier journals in the field of GIScience. The ranking of these journals was identified in a Delphi study conducted by Caron et al. (2008), listed in Table 1. We compiled and analyzed a decade of publications from 2005 to 2014. Although arbitrary, 2005 marked a significant turning point for the development of the geoweb and the potential for geographic crowdsourcing: OpenStreetMaps was launched for the United Kingdom in 2004 and Google Maps was launched in 2005. These two examples are (and remain) two of the most commonly used and referred to examples of the geoweb and both support a large number of projects that facilitate the crowdsourcing of spatial digital content. The year 2005, therefore, acts as a marker year that represents the move towards a more democratic, interactive, and user-focused approach to

Table 1. Journals and keywords (alphabetical).

Journals	Keywords (included with one or more matches)
(1) <i>International Journal of Geographic Information Science</i>	API, Bing Maps, bottom-up GIS, citizen cartography, citizen science, community information systems, community mapping, counter mapping, crowdsourcing, cyber cartography, digital globes, digital mapping, Geolive, geospatial web, geoweb, Google Earth, Google Maps, grassroots GIS, internet map servers, internet mapping, internet-based mapping, online mapping, open data, open street maps, participatory 3D mapping, participatory GIS, participatory mapping, PGIS, PPGIS, VGI, web mapping
(2) <i>International Journal of Remote Sensing</i>	
(3) <i>Photogrammetric Engineering & Remote Sensing</i>	
(4) <i>Computers and Geosciences</i>	
(5) <i>Geomatica</i>	
(6) <i>Transactions in GIS</i>	
(7) <i>Geoinformatica</i>	
(8) <i>Cartography and Geographic Information Sciences</i>	
(9) <i>Environment and Planning B</i>	
(10) <i>IEEE Transactions on Geoscience and Remote Sensing</i>	

web-based mapping, and more specifically the geoweb's, accessibility and use.

From the 10 top tier journals, we first identified articles relating to the geoweb and crowdsourcing by searching for 31 keywords (see Table 1). The keywords were complementary, matches to any of the terms resulted in inclusion to our dataset. While some terms, such as "geoweb" are used less in the literature, we also include broader terms, such as "web mapping," "digital mapping," and "internet mapping." All of the results of these terms were compiled together to create a dataset of relevant articles to analyze. This resulted in a total of 1190 articles matching our search terms from a total of 14,013 published throughout this period. The matching articles were included in this total if any one of the keywords was mentioned within the text. If multiple keywords appear in the article it is still only counted one time (see Figure 1). For example, in Elwood and Leszczynski (2013) article, *New Spatial Media, New Knowledge Politics*, 13 of the keywords appear, yet the article is counted as just one of the 1190 articles. In order to collect articles relating the geoweb and crowdsourcing, we used the online search features provided by the publisher when available. Using this subset of 1190 matching articles, we then searched for the social justice keywords of: social justice, empowerment, marginalization, social change, environmental justice, spatial justice, social impact, and positive change. We then analyzed how the content of the paper identified and expressed the principles of social justice. This qualitative analysis was conducted using NVivo.

The above methodology was used for 7 of the 10 selected journals. Three journals required a modified approach. First, the journal *Photogrammetric Engineering & Remote Sensing (PE&RS)* went through several format revisions for the online catalog during

this time period. Between 2010 and 2014, the catalog was published by issue, not by article, so we needed to separate individual articles from each issue before we could apply the search and analysis. However, a limited number of complete articles were also unavailable for full download without a paid subscription (and our university library is not a subscriber). In these few cases, we used the first page of the article which included all of its metadata, keywords, abstract, and the first page of the manuscript. In addition, no search feature was available on the PE&RS website, so we downloaded every article published between 2005 and 2014, imported them into NVivo™ and used its search feature to find articles matching our search terms. Second, the journal of the Institute of Electrical and Electronic Engineers: *Transactions on Geoscience and Remote Sensing (IEEE)* was analyzed using the native metadata search feature made available by the online journal catalog. Because IEEE (at the time of this research) did not have a function to search single journals and a standard search would contain results from the suite of different IEEE journals. Third, due to limitations of searchable features and access, the journal *Geomatica* was excluded from the study, although it is included in Caron et al.'s list of the top 10 journals. We have also excluded book reviews and other non-academic article materials from the analyses.

In order to determine how this result compared with a wider cross section of Geography-related publications, we conducted a second assessment of the literature using top tier journals from the broader discipline. These journals included the *Annals of the Association of American Geographers*, *Progress in Human Geography*, and *Transactions of the Institute of British Geographers*. These were purposely selected top tier geography journals focusing upon the human dimension of study in the field.

We are cognizant that a comprehensive assessment of the potential exclusion of social justice from top tier journals would require a review of all articles that were also rejected in the editorial or peer-review process. However, this material is unavailable through public sources. Furthermore, our objective is to evaluate trends in what has been published, as opposed to literature that was not. In addition, we recognize that most of the mapping work, particularly that relates to social justice, occurs outside of academic literature. Even within the academic realm, many inclined to the principles of social justice have opted not to publish in the pay-walled, subscription-based journals that often comprise the top tier. Similarly, there are collections of more practice-based, gray literature related to mapping, such as that hosted by Integrated Approaches to

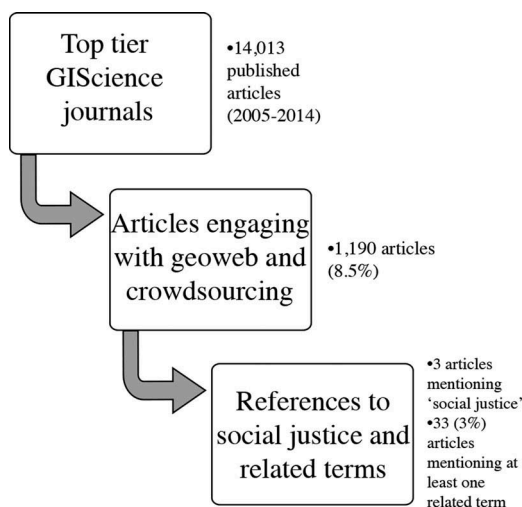


Figure 1. Location and analyses process flow.

Participatory Development (iapad.org). In recognizing the limitations of the approach taken, we utilize this methodology to analyze a particular subset of that literature, and do not offer generalizations that ought to be applied beyond the bounds of its specific evaluation. Future research is needed to answer other, important questions that relate to alternative and open access journals, gray literature and other GIScience priority areas, which will contextualize these findings.

Findings

In our analysis, there was significant variation in the keyword matches between each journal (see Table 2). The *IEEE Transactions on Geoscience and Remote Sensing* had the lowest keyword matches and the lowest percentage of matching published articles during the time period. *Transactions in GIS* had the highest percentage of matches while *Computers and Geosciences* had the largest number of matching articles. From all the journals, a total of 1190 articles matched one or more of the geoweb and crowdsourcing keywords, which comprised 8.5% of all the articles published by all the journals during this period (total: 14,013). Within the subset of 1190 articles, we found only three references to “social justice.” The first reference was made by Zhang and Fung (2013) in *Environment and Planning B*. The article referred to social justice advocacy in the abstract, the term was not actually used in the body of the article. The other two were both references to “social and environmental justice.” One being a list of researchers, Helga Leitner, Eric Sheppard, and Roderick Squires, who have contributed to GIScience through social and environmental justice (McMaster, Edsall, and Manson 2011). The other was a reference to how India’s Coastal

Area Mapping Project used Web 2.0 technologies to share and create online spaces to support participation in the stewardship of coastal regions, and thus enable social and environmental justice (Gajbe, Shankar, and Rodriguez 2014). None of these references to social justice played an important role in the research, nor did not they offer theoretical or empirical findings related to the term. Most significantly, social justice is hypothesized as a possible outcome, or side effect, of the Coastal Area Mapping Project but was not a direct focus of that research.

Although the specific term “social justice” was almost entirely absent in the literature, the other related keywords appeared more often, although still infrequently (Table 3). For “marginalization,” nine articles (0.8%) of the 1190 made reference to the term. However, only one was made in-text and the remainder were bibliographic references. For “empowerment,” 36 articles (3.0%) included the term, of which 21 were in-text and the others appeared only in the bibliography. For the other terms: “social change” had four matches (0.3%) with 2 being in-text, “environmental justice” had 11 matches (0.9%) with 6 being in-text, “spatial justice” had 2 matches (0.2%) with none being in-text, “social impact” had 4 matches (0.3%) with 2 being in-text, and “positive change” had 5 matches (0.4%) with 1 being in-text (excluding references to mathematical calculations). Together there were 33 references to these related terms within the text of the articles.

For the majority of these terms, it is noteworthy that a significant amount of matches were limited to bibliographies (38 of 71; 54%). This indicates that researchers are aware of literature that engages with concepts related to social justice, such as the work of Harris and Weiner (1998), Ghose (2001), and Elwood

Table 2. Overview of total published journals, total keyword matches, and percentages by journal.

Journal	Total number of articles published 2005–2014	Percent of total articles by journal (14,013)	Total number of articles matching geoweb and crowdsourcing terms	Percent of geoweb and crowdsourcing keyword match per journal	Percent of total geoweb and crowdsourcing keyword matches (1190)	Number of articles with in-text references to social justice keywords
<i>International Journal of Geographic Information Science</i>	877	6.3%	184	21.0%	15.4%	7
<i>International Journal of Remote Sensing</i>	4699	33.5%	193	4.1%	16.2%	1
<i>Photogrammetric Engineering & Remote Sensing</i>	783	5.6%	62	7.9%	5.2%	1
<i>Computers and Geosciences</i>	1977	14.1%	285	14.4%	23.9%	1
<i>Transactions in GIS</i>	503	3.6%	230	45.7%	19.3%	7
<i>Geoinformatica</i>	232	1.7%	66	28.4%	5.5%	0
<i>Cartography and Geographic Information Science</i>	303	2.2%	117	38.6%	9.8%	8
<i>Environment and Planning B</i>	649	4.6%	34	5.2%	2.8%	1
<i>IEEE Transactions on Geoscience and Remote Sensing</i>	3990	28.5%	19	0.5%	1.6%	0
Total	14,013	100%	1190		100%	26

Table 3. Number of articles referencing social justice terms over time from top tier GIScience journals.

Keyword	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Social justice							1		1	1	3
Marginalization							1				1
Empowerment		3	2	1	2	2	2	5		4	21
Social change				1			1				2
Environmental justice		1			1	1	1		1	1	6
Spatial justice											0
Social impact								1		1	2
Positive change										1	1
Total	0	4	2	2	3	3	6	6	2	8	36

(2006b), but researchers are not directly engaging with the concept themselves. This is important because it indicates that technically inclined researchers are reading and referring to geoweb and crowdsourcing literature that grapples with the social justice issues. During the 2005 to 2014 period, the volume of published GIScience literature expanded greatly. There was more than a 50% increase of the overall number of articles published by combined set of journals, a trend reflected in GIScience journals generally (Biljecki 2016). However, this increase in the body of published articles does not align with a concomitant increase in references to keywords relating to social justice. For example, the results show that no matches occurred in 2005. This is best explained by the newness of the technologies and the delays for these terms to be published in the academic literature (Biljecki 2016). While this provides an explanation for “Google Earth” and “Google Maps,” it does not fully explain other terms, such as “citizen science” and “participatory mapping.”

In addition, using NVivo, we qualitatively analyzed the in-text use of the “social justice” keywords, while excluding those found only as bibliographic references or those found in-text but were not true references (for example an in-text reference to a title of another work). We looked for positive, critical, and negative connotations associated with the terms. If the article considered the geoweb and crowdsourcing as a way to decrease marginalization or encourage empowerment, it was considered a positive connotation. If the article discussed complex issues regarding the geoweb and crowdsourcing that revealed both positive and negative aspects, it was considered critical. If the article considered the geoweb and crowdsourcing as negatively impacting marginalization or empowerment, it was considered a negative connotation. Overall, we found 26 articles that contained in-text references to our “social justice” keywords (Table 2).

“Marginalization” only appeared in Berry et al.’s paper *Web-Based Approaches to Enhance Public Participation in Wind Farm Planning* (2011) as an in-

text reference related to how the visualization capabilities of the participatory geoweb could support public participation of a more diverse group of users, and thus reduce marginalization. For empowerment, we analyzed 23 articles that included the term in-text. Two were excluded from the analysis because they were titles of other works and were not significant in any way. Fifteen were found to be positive, and six critical. Of the 15 found to be positive, all references referred to how GITs could contribute to empowerment in some manner, albeit largely in passing. Several authors discussed how particular GI technologies could help empower citizens (Béjar et al. 2012; Caldeweyher, Zhang, and Pham 2006). Others quoted fundamental principles of participatory mapping as a way to empower citizens (Brown and Pullar 2012) or how knowledge production through PPGIS can empower citizens (Sieber 2007). Several researchers noted how GITs have transformed emergency response through VGI (Camponovo and Friendschuh 2014; Shekhar et al. 2012) or how VGI can help keep geographic datasets updated and contemporary (Harvey 2012). Some looked at different models, strategies, or factors that could encourage citizen and community empowerment (Aditya 2010; Atzmanstorfer et al. 2014; Aggett and McColl 2006; Edsall 2007; Blaschke and Merschdorf 2014; Bodurow et al. 2009; Eisner et al. 2012). The final made reference to how changes in future GITs could allow for a two-way information flow that could aid in citizen empowerment through increased decision-making capabilities (Berry et al. 2011). Of the six critical references to empowerment, five were discussions of the complexity of empowerment and GIS technologies. They noted how there are both positive and negative impacts of mapping technology and how this complexity needs to be explored further (Hall et al. 2010; Caquard and Dormann 2008; Kessler 2011; Elwood 2006a; Swobodzinski and Jankowski 2014). The sixth critical reference focused on the role that critical feminist geographic analysis can play in empowerment in GIS (Gilbert and Masucci 2006).

The keyword, “social change,” resulted in two in-text references both of which were positive, one by Sui and Goodchild (2011) and the other by Caquard and Dormann (2008). Sui and Goodchild explored how Web 2.0 technologies have created social change through location-based services that bridge between the “cyberspace” and the real place. Caquard and Dormann discuss how humor serves as an agent for social change by allowing critical perspectives, which would otherwise be unacceptable, enabling people to conceptualize issues in different ways. “Environmental justice” had six positive, in-text references. One used environmental justice as an example of a project that could use codes, or labels that are assigned to qualitative data artifacts (Jung and Elwood 2010). Another, mentioned environmental justice in a quote about a geography workshop in 1996 (Pickles 2006). Third, an article discussed how data collected from earth observation has been used to support environmental justice by protesting industrial development (Harris 2013). Fourth, aerial photography that is focused on identification and classification of vehicles can provide important data to environmental justice studies (Holt et al. 2009). As previously discussed, environmental justice was also found in two references to “social and environmental justice” by McMaster, Edsall, and Manson (2011) and Gajbe, Shankar, and Rodriguez (2014). “Spatial justice” contained no in-text references and therefore was not analyzed. “Social impact” resulted in two positive, in-text references. The first being about how the potential for social impact results from the utility of PPGIS systems (Brown and Pullar 2012). The second stated that social impact assessments are required before new gaming machine licenses in Australia can be acquired and discussed how to best go about such assessments (Markham, Doran, and Young 2014). Finally, “positive change” had one positive, in-text reference which asserted that appreciative inquiry “is a methodology and philosophy for positive change” because it is based on the premise that every community is gifted with certain things that can lead to community improvement (Hodza 2014, 272).

These findings highlight that researchers publishing in these top tier journals about the geoweb and crowdsourcing are rarely writing about issues of social justice. In addition, they are not framing their work to address social justice related issues and outcomes. The concerns of power, control, representation, and epistemology raised by Harley in the late 1980s are crucial issues for participatory mapping and new mapping technologies, as has been demonstrated by researchers since then (Corbett and Keller 2005; Elwood 2002; Fox et al. 2006; Ghose 2001; Harris and Weiner 1998;

Pramono, Natalia, and Janting 2006; Stephens 2013), yet these concerns have received little attention within the top tier journals. As outlined at the outset, it is not necessary that social justice be integrated into each and every GIScience article, it is however problematic that, despite research highlighting its importance, it remains almost entirely absent in the top tier GIScience journals.

Our findings reflect the deeper division outlined by Openshaw: “the ‘soft’ pseudoscience of the social sciences” and “the ‘hard’ spatial science of which GIS is part” (1991, 621). Taylor and Overton (1991) suggest that viewing geography, and GIS, as a collection of techniques is problematic. Doing so neglects the “social relations that exist in the complex mechanisms whereby it has been decided by someone in some economic, social and political context” will collect, contribute, share, or ignore geographic information (Taylor and Overton 1991, 1088). While some authors have challenges this divide, developed avenues to traverse it, and worked within it (e.g. Chrisman 2005; Harvey and Chrisman 2004), the findings of this research demonstrate that the literature continues to reflect this divide. That is not to suggest that critical thought has been absent. In 2006, within the first year of the literature collection period for this study, Poore and Chrisman argued: “By not focusing more attention on social and organizational issues, GIScience risks missing an opportunity to include the potentially excluded” (2006, 519) and that “fundamental rethinking in the design of GISystems, placing emphasis on the crucial practices by which people interact” is required (2006, 516). Yet, the “hard” and “soft” geographies continue to operate in distinct spheres. In the following section, we analyze a broader selection of generalist top tier geography journals, using the same methodology outlined above, and find that 15% of the articles engaging with the geoweb and crowdsourcing mention “social justice,” in contrast to just three of 14,013 (0.02%) from the top tier GIScience journals. The geoweb and crowdsourcing platforms increasingly act as a medium through which contentious social justice-related debates are already occurring (e.g. Pramono, Natalia, and Janting 2006). These questions are being navigated and contested in practice, but are insufficiently reflected in the literature (Brown and Kyttä 2014).

In concluding this component of the research findings, we feel it is appropriate to reflect on the limitations of the methods employed. In analyzing the outputs, the keyword analysis approach used excluded some important works. For example, Cartography and Geographic Information Science was included in the top 10 and some relevant works were not captured. Numerous articles and authors have engaged with the

societal side of GIScience (e.g. Bradley and Clarke 2011; Crampton et al. 2013; Kounadi et al. 2013; Li, Goodchild, and Xu 2013; Liu and Palen 2010; Mukherjee and Ghose 2009). While they engage with relevant content, it is also noteworthy that none of these engaged with issues of justice in a direct way. Had we focused on articles that engaged with broader societal issues, such as “power,” the results would have been different, and included many of these excluded papers. Yet, this also would have diluted the findings. We could not have known the extent, or lack thereof, that social justice is explicit. The findings demonstrate that top tier GIScience journals remain on the periphery, touching on the margins of social justice but not addressing it directly.

Contextualizing the findings

While we did not anticipate a large number of matches for the term “social justice,” the findings from the top tier GIScience journals were unexpectedly low. Using the same methodology described above, we analyzed articles from these three additional journals from 2005 to 2014. We then collected a subset of 128 articles (from a combined total of 1652 published articles) that matched our 31 geoweb and crowdsourcing keywords. The result of the initial GIScience journal search resulted in 8.5% of articles matching these keywords, while these additional three journals had a match rate of 7.7%. However, when analyzed against the social justice keywords we found a much higher rate of reference (see Table 4): “social justice” had 19 results (14.8%), with 11 being in text; “marginalization” had 24 results (18.8%), with 17 being in text; “empowerment” had 31 results (24.2%), with 20 being in text; “social change” had 19 results (14.8%), with 11 being in text; “environmental justice” had 13 results (10.2%), with 11 being in text; “spatial justice” had 4 results (3%), with 1 being in text; “social impact” had 1 result (0.8%), with none being in text; and “positive change” had 2 results (1.6%), with 2 being in text.

Discussion

Harley deconstructed the map as we knew it in the pre-digital era, while Harris and Weiner (1998), Ghose (2001), Elwood (2002), Corbett and Keller (2005), and Stephens (2013) have transitioned and expanded those critical perspectives into a more contemporary realm. However, in the last 10 years, in which the geoweb and spatial crowdsourcing emerged as technologies that nonspecialists increasingly use, these findings demonstrate that the literature in top tier journals has largely relegated issues of social justice to side notes and bibliographic references. The concern, as voiced by Pramono, Natalia, and Janting, about a “preoccupation on technical matters in mapping... [is that it] leads to the situation where map is an end not a means for social transformation” (2006, 12). We suggest that when the majority of publications in top tier GIScience journals (over 95%, if the bibliographic references are generously included) focus on technical issues and do not address social justice we must pose the question: what happens when the map is (re)rendered technical? The concerns raised by Harley, and those who followed in his footsteps, are absent in top tier GIScience literature. The results of this study show that the most important GIScience journals have not, even in a minor way, engaged with maps, and map creation, of which the geoweb is a fast growing field, as social, economic, and political products.

In 2005, Crampton and Krygier wrote that “cartography has been slipping from the control of the powerful elites that have exercised dominance over it for several hundred years” (2005, 12). Having established the platforms that enable participation in the mapping process, such as through the geoweb and crowdsourcing, articles in the top tier GIScience journals now neglect to reflect upon what, why, when, who, and how these maps affect users and nonusers alike. For example, the information that creates a particular map may be crowdsourced, however, certain people will be empowered by that process and product and may disproportionately participate in its creation, while others remain marginalized and excluded. Maps have

Table 4. Articles with in-text references to social justice terms over time for socially focused geography journals.

Keyword	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Social justice		2	2	1			2	2		2	11
Empowerment		4	3	2	2	1		4	2	2	20
Marginalization		3	3			1		1	3	6	17
Social change		2			1	2		1	1	4	11
Environmental justice		1	2		1	1	2	2		2	11
Spatial justice						1					1
Social impact											0
Positive change		1								1	2
Total	0	13	10	3	4	6	4	10	6	17	73

been, and continue to be, used as a means of representing the world as understood by the mappers. They express a particular political and socio-cultural context and are often viewed as expressions of scientific, geographic fact. This process is both an expression and entrenchment of power, while those absent are rendered disenfranchised – again.

As maps are expressions of power, control, epistemology, representation, and values, new forms of mapping ought to also be considered and deconstructed in Harleyian fashion. While we recognize some important work has been done in this area for the geoweb (e.g. Brown and Reed 2012; Elwood 2010; Elwood and Leszczynski 2011; Fox et al. 2008; Sui, Elwood, and Goodchild 2012; Wright, Duncan, and Lach 2009), too little is occurring in the top tier GIScience journals. The trend of rendering the geoweb and crowdsourcing technical is, in our opinion, a worrisome one. This is a trend whereby maps and mapmaking are considered neutral, or at least uncritically presented, resulting in these objects and processes being viewed as reflecting reality, rather than a creation of a particular reality. The geoweb and crowdsourcing may have shifted power, control, epistemology, representation, and values, however, that shift is not egalitarian. Because of the impact maps and mapmaking have on individuals and society, GIScience researchers might be better served in recognizing who contributes and creates, and who does not; who benefits, and who does not; how people are empowered or marginalized; when maps are created and why they have been created at that particular time and place; and what or whose objectives are being served with the creation and promotion of the geoweb and crowdsourcing. This is not to suggest that technically inclined journals, and technically focused researchers, should shift their attention entirely towards concerns of social justice. Rather, it is the continuation of a call made by researchers throughout the last three decades, that there needs to be greater recognition that maps and mapmaking processes have consequences. The tools GIScience researchers design, refine, and advance are used to empower, and to marginalize.

The experience of GIScience in the late 1990s and early 2000s, particularly within the NCGIA programs, demonstrated that one of the successful ways to overcome the divide between “hard” and “soft” research was collaboration between researchers with different foci. Interdisciplinary research projects could be one viable mechanism that would facilitate the reemergence of this form of discourse. The Geothink project, a 5-year partnership research grant funded by the Social Sciences and Humanities Research Council of Canada is one example of how funding bodies can support the emergence of

collaborative research and bridge the divide. Geography may be in a unique position for collaborative efforts of this nature, as its disciplinary membership embraces both “quantitative” and “qualitative” research. Collaborations with social work and indigenous studies have already demonstrated the potential collaborative efforts can have (Corbett 2012; Parker 2006; Peluso 1995; Stocks 2003). Innovative and creative approaches that break the traditional academic mold have been used as a mechanism to support researchers and students to think beyond the specifics (e.g. Ghose 2001).

Conclusion

When this research project was in its conceptual phase, we did not anticipate the results of our keyword search from the literature. We anticipated that a small percentage of articles would reference social justice, with a larger, but still a relatively limited amount addressing related terms. We also assumed that there would be an increasing trend over time in these references, as the number of publications, researchers, and research projects increasingly conduct research related to the geoweb and crowdsourcing (which by their very nature tend to include a human/social focus). The finding that only three papers of our subset of almost 1200 papers referenced social justice in minor ways was unexpected. This result increased our concerns that the GIScience literature examining the geoweb and crowdsourcing is insufficiently engaging with social justice. Rendering the geoweb and crowdsourcing as solely technical processes in the top tier journals fails to encapsulate their uses, purposes, and impact on individuals and communities. We do not claim that editors, peer reviewers, and journals are systematically excluding submissions related to social justice, rather, we put forward this analysis so that academics, editors, and peer reviewers take note of these trends and recognize the need for greater critical analyses regarding issues of social justice within and alongside the technical components of maps and mapmaking. In raising this concern, we do not believe that a quota of articles ought to exist, nor do we believe that there is a proportion of articles that would appropriately cover this aspect of GIScience. Instead, we provide an analysis of the literature to provoke debate about the role of social justice in GIScience literature and explore reasons why, despite its long-time recognized need for integration, continues to appear, at best, on the margins.

The contrast between the top tier GIScience journals and purposely selected socially focused geography journals reveal a divide in literature, one in which geographers have recognized but insufficiently

addressed for decades. The fact that top tier GIScience journals are highly technical highlights the technical-social or “hard” and “soft” divide in the literature. It also indicates which of these spheres is prioritized and viewed with more importance by GIScience academics. For GIScience, and specifically in the realm of participatory mapping and crowdsourcing, the implementation, utilization, and impact of the development of the field has direct effects for individuals and communities, and therefore requires more reflection within the field of study, and more importantly, some thoughtful change in practice. Those journals and academics focusing upon the technical components of mapping tend to influence the design, creation, and functionality of digital maps and crowdsourced platforms, while those focusing upon issues of social justice examine the impacts, theoretical or practical, of these systems. While some technically inclined academics are aware of issues of social justice, demonstrated in bibliographic references, the lack of their integration of these issues into their publications in an apparently meaningful way demonstrates that these issues are insufficiently or superficially considered. The result is socially inclined academics insufficiently engaging with the details of the technical processes of mapping while the more technically inclined academics insufficiently engage with the social processes involved.

We have arrived at a point when the geoweb is an almost universally accepted and utilized GIT, and one increasingly used to collect, visualize, and communicate information concerning social issues (Elwood 2010). Our applications have to be conceptualized, developed, implemented, and analyzed as existing within social, environmental, and political contexts. GIScience researchers might be best served by viewing the geoweb and crowdsourcing as they are, not as isolated technical concerns, even where and when individual technical challenges exist. Limiting our focus to specific technical questions does not render the social, environmental, and political components of the map within which it exists technical. The challenge for GIScience, and we believe an essential element for remaining relevant for VGI contributors and geoweb users, is to more substantially and critically engage with the geoweb and crowdsourcing as media through which people participate and engage in discussions and sharing experiences related to social justice.

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