Revisiting Critical GIS: Reflections from Friday Harbor

Jim Thatcher, University of Washington - Tacoma, Division of Urban Studies

Luke Bergmann, University of Washington, Department of Geography

Britta Ricker, University of Washington - Tacoma, Division of Urban Studies

Reuben Rose-Redwood (Landscapes of Injustice Research Collective), University of Victoria, Department of Geography

David O'Sullivan, University of California, Berkeley, Department of Geography

Trevor J Barnes, University of British Columbia, Department of Geography

Luke R. Barnesmoore, University of British Columbia, Department of Geography

Laura Beltz Imaoka, University of California, Irvine, Program in Visual Studies

Ryan Burns, University of Washington, Department of Geography

Jonathan Cinnamon, University of Exeter, Department of Geography

Craig M. Dalton, Hofstra University, Department of Global Studies and Geography

Clinton Davis, Temple University, Department of Geography and Urban Studies

Stuart Dunn, King's College London, Department of Digital Humanities

Francis Harvey, Leibniz Institute for Regional Geography and University of Leipzig

Jin-Kyu Jung, University of Washington-Bothell, School of Interdisciplinary Arts & Sciences

Ellen Kersten, University of California, Berkeley, Department of Environmental Science, Policy, and Management

LaDona Knigge, California State University Chico, Department of Geography & Planning

Nick Lally, University of Wisconsin–Madison, Department of Geography

Wen Lin, Newcastle University, School of Geography, Politics and Sociology

Dillon Mahmoudi, Portland State University, Urban Studies and Planning

Michael Martin, Simon Fraser University, Department of Geography

Will Payne, University of California, Berkeley, Department of Geography

Amir Sheikh, University of Washington, Department of Urban Design and Planning

Taylor Shelton, Clark University, Graduate School of Geography

Eric Sheppard, UCLA, Department of Geography

Chris W. Strother, University of Georgia, Department of Geography

Alexander Tarr, University of California, Berkeley, Department of Geography

Matthew W. Wilson, University of Kentucky, Department of Geography

Jason C Young, University of Washington, Department of Geography

Revisiting Critical GIS: Reflections from Friday Harbor

1. Introduction

From late afternoon, October 17th, 2014, until early on the 20th, 30 researchers met at the University of Washington's Friday Harbor Laboratories to revisit the spirit of 'critical GIS' in approaching questions both emerging and enduring around the intersection of the spatial and the digital. The title of this 2014 meeting, 'Revisiting Critical GIS', was not itself unproblematic. But, as we explain below, the name suggests an ongoing opening, a repetition but with difference, and not a reification of any fixed field. Furthermore, in comparison to the alternatives we considered, 'Revisiting Critical GIS' seemed to provide for an unexpectedly rich set of juxtapositions of contemporary concerns—around and among data, technology, visuality, subjectivity, the digital, political economy, spatiality, social theory, and cultural critique. We hope many of you will join us in refracting key geographical concerns through the many prisms of critical GIS.

This meeting was held roughly two decades after the November 1993 meeting at Friday Harbor, which is widely seen as catalyzing the conversations leading to critical GIS.[1] Although several attendees were present at both Friday Harbor meetings, the majority of participants in 2014 were early-career scholars and students looking to the future as much as toward the past. In selecting participants from respondents to the open call, the organizing committee was clear about a desire to focus less on past accomplishments of individuals and more on compelling articulations of promising future directions for inquiry and critical intervention. Some participants were known to each other ahead of time, but many were not. Short prospectuses written by each participant for the group were circulated ahead of time. At the meetings, no papers were presented, nor were any keynotes delivered. Instead, working before and during the meeting, participants collaboratively organized a series of nine interactive sessions around themes they identified to be of greatest interest.

New allies, new concerns, and new paths were uncovered. In this brief report, we identify some of them. We begin with a number of 'stories so far', discussions of what brought this specific group of 30 students, scholars, and researchers together at Friday Harbor Labs in the intellectual space opened up by the original meeting. We then turn to the questions of what various 'hybrid' strategies, such as critical quantification and the digital humanities, may offer critical GIS. Despite some progress, particularly around geospatial data, a political economy of geospatial technologies remains largely undeveloped and pursuing this goal became one focus. These topics led directly into questions concerning how GIS functions in relation to issues of social justice and, perhaps most important, what might be the methods and praxis of a distinctively 'critical' GIS. We cannot document the full nuance and complexity of the discussions. Instead, we aim to communicate the intellectual inspiration the meeting delivered both within and (we hope) beyond its boundaries of time, place and community. We finish with an invitation to others to join us in revisiting critical GIS, not as a historical body of scholarship, but as living, diverse, dynamic endeavors necessary in the present and invested in transforming the future.

---

[1] We do not aspire here to write histories of critical GIS and negotiate its many diversities, which have been taken up elsewhere (e.g., Poiker 1995; Schuurmann 2000; Sheppard 2005; O'Sullivan 2006; Wilson 2009). Other points of entry into critical GIS and critical cartography literatures, *inter alia*, may be found: Pickles (1995, 2004); Harvey and Chrisman (1998); Curry (1998); Kwan (2002); Crampton and Krygier (2005); Harvey, Kwan and Pavlovskaya (2005); Goodchild (2006); Cope and Elwood (2009); and Rose-Redwood (2015).

2. Not only, but also: Our stories so far

While evoking the spirit of the earlier meeting, this event was a very different gathering with few of the 'class of 1993' present. Notwithstanding the contemporary ubiquity of digital maps, 'I want to be a GIS scholar when I grow up', remains a rare aspiration, rarer still when the qualifier 'critical' is added; and so we opened the meeting with a discussion of who the attendees were and what brought us to a research station on an island in the far northwest corner of the United States. While sharing personal 'genealogies' might encourage introspection, here it usefully highlighted the myriad paths that have laid the groundwork for critical approaches to GIS and spatial technology and highlighted new allies working in unexpected fields, such as digital humanities, and on different problems, like the attention economy.

At the meeting, while individuals' genealogies varied wildly, particularly in the technology of first encounter—be it FORTRAN, CartoCSS, ArcGIS or the darkroom—there was a strong sense that it was the *critical* in critical GIS that drew participants to this meeting. But, what *critical* means, how it might itself be critiqued, and what work it enables depends on the disciplinary background of individual scholars. For some, predominantly from earth science backgrounds, the groundwork for critical GIS is found in practitioners using this quantitative tool not only to inventory the natural world, but also to spatially document its qualitative features. Others spoke of mathematical models and economic analyses that led them to critical social theory while retaining a focus on the spatial organization of the world (Sheppard and Barnes 1990). Still others came to critical GIS through engagements with critical cartography, science and technology studies, a politics of reflexivity, and the digital humanities. While many of the participants had used GIS in their own research and teaching, and were thus interested in an internalist critique of GIS, others were not GIS professionals themselves but rather sought to draw upon insights from related fields (e.g., visual media studies) to critically examine geospatial techniques as contingent, reiterative practices that performatively enact geo-coded worlds.

Diversity of experience and intent defined this meeting in contrast to the 1993 gathering at Friday Harbor, which seems to have had much in common with 'peace talks' brokered between warring factions. Over a decade into the twenty-first century, critical GIS draws a field of practitioners bursting with questions, varied experiences, and profound concerns. As spatial technology and information becomes ever more present in daily life (Greenfield 2006), as new fields both claim and extend spatial inquiry and visualization in previously unheard of ways (Drucker 2009), and as the academy itself increasingly grapples with its role in a neoliberalized world (Wyly 2015), critical GIS remains a touchpoint for discussion of these and other issues, for building allies, and for a constant dialectical process of critique and renewal.

3. Two hybrid strategies, among others: critical quantifications and digital humanities

One session at the meeting examined two 'hybrid' scholarly strategies: critical quantification and digital humanities. The conveners of this session wished to explore whether these two approaches—one historically more associated with critical GIS practitioners and one just entering into conversation with them—offer productive paths cognizant of critiques of mainstream computation and positivist quantification. In these mindful transgressions of what are often seen as epistemological and ontological barriers between the qualitative and the quantitative, or between the social-theoretic and the

mathematical, are there lessons that critical GIS is well positioned to articulate? Under what conditions can critical hybridities emerge and become productive?

Critical quantification suggested a variety of stances and practices to those present; this became apparent in a series of break-out group exercises and conversations around what it might mean to 'quantify' particular objects or phenomena. Some questioned the value of distinguishing a specifically 'critical' quantification, given that scholars generally aspire to think critically. Nevertheless, many participants recognized the particular intellectual charge of efforts to re-appropriate and refashion mathematical, statistical, and computational practices using theoretical insights stemming from a serious engagement with the methodological, ontological, and political commitments of social and cultural theory that inform much critical geography. For example, qualitative methods are being increasingly integrated into GIS practice (Cope and Elwood 2009; Knigge and Cope 2009) and geographers have pursued a variety of 'mixed' method approaches including interweaving of narrative and simulational practices (Bergmann, Sheppard, and Plummer 2009; Millington, O'Sullivan and Perry 2012). At the same time, the qualitative-quantitative 'divide' discourse is a construct arising out of particular moments of debate, especially in the social sciences (Wyly 2009). Critical GIS already embraces the critique offered by 'qualitative GIS' as part of a broader proliferation of GIS practices in dialogue with different theoretical commitments. We need an engaged pluralism among GIS (and apparently 'non-GIS') approaches (Barnes and Sheppard 2010).

Discourses of critical quantification, such as they are, have been closely associated with critical GIS, whether interacting within the same project or co-existing within the oeuvres of scholars (Sheppard 2005; Sheppard 2001; Schwanen and Kwan 2009; O'Sullivan 2006; Bergmann 2013). Such a description of the relationship between the digital humanities and critical GIS might be premature, although conversations at this meeting, which included scholars from the spatial humanities, suggest there is considerable potential for synergies (Bodenhamer, Corrigan, and Harris 2010). While examples retrospectively understood as digital humanities stretch back decades or even centuries, to the work of those such as Roberto Busa and Ada Lovelace, it is only in recent years that digital scholarship has become widespread in the humanities and recognized more broadly. Whereas the digital humanities are even less bounded in their remit than critical GIS, and also involve many researchers who see less relevance in the theoretical humanities for their work than most critical GIS scholars find in social-theoretic and critical geography, considerable intersections and opportunities for cross-fertilization exist. Of particular interest to critical GIS, the digital humanities have grappled directly with the contradictions between interpretative approaches to scholarship that characterize many humanistic ways of knowing, and analytical computing paradigms largely designed by engineers to serve the interests of capital accumulation and state power. Projects in 'speculative computing' have attempted to rework visualization, data, interfaces, and analysis for the theoretical commitments of humanistic scholarship (Drucker 2009, 2012; Burdick et al. 2012). In this, they share much in common with efforts in critical GIS to theoretically reconstruct geospatial practices (from software to concepts to applications) to be in greater sympathy with the commitments of social-theoretic and critical geography (Curry 1998; Kwan 2002; Sieber 2004; Sheppard 2005; Cope and Elwood 2009). Bringing critical GIS and the digital humanities into conversation around the efforts of both in 'speculative computing' holds great promise—not only for critical GIS, but also for the digital humanities, where critical geographical perspectives on absolute and relative spaces as well as on cartography have much to offer.

4. The political economy of GIS

Nearly a decade ago, O'Sullivan (2006) noted the incomplete and partial nature of studies charting the political economy of spatial technologies. While recent work has explored the political economy of new spatial and mapping technologies, situating them within a larger framework of neoliberalism (Leszczynski 2012) or as 'fixes' for capital as loci for speculative investment (Wilson 2012), a comprehensive political economy of spatial technologies remains a remote prospect. However, the meeting revealed several potential avenues for furthering such research along lines we designated as questions of scope, historical pathways, and expanding reach.

The title of this section points to a political economy of GIS, but the previous paragraph refers to 'spatial technologies' and 'new spatial and mapping technologies'. This slippage is not a mistake, but rather the crux of a debate that emerged at the Friday Harbor meeting: What exactly is the scope for critical GIS? Should we, as scholars, dedicate our inquiry towards a political economy of GIS, of spatial technologies more broadly, or of a separate set of questions entirely? What can an interrogation of GIS tell us about broader political economies? Accompanying each of these terms is a particular commingling of state, economy, society, and specific pathways of technological development. The answers to such questions feed into any political economy of GIS and into how its development shapes its future and the expanded role that spatial technologies now play in economy and society.

Against mythic accounts of the *sui generis* solutionisms (Morozov 2013) promised in new spatial technologies, a means of justifying their value in and of itself (Leszczynski 2014), critical GIS must situate these new technologies within the older traditions from which they emerged. This involves parsing the long histories behind where, when, and how specific geospatial technologies were produced. We must chart the paths that have shaped and continue to shape this technological form and its role in the world, paying attention to where, how, and when actors such as the state, and in particular, the military-industrial complex, have influenced the development of spatial technologies. We must continue the work begun by scholars like Clarke and Cloud (2000) that foregrounds the relationship between GIS and the military, but we must also push further. We must recognize the recursive relations between ideology and technology, discussing how any technological orientation both results from and shapes subsequent epistemological and ontological orientations to the world. Work by Barnes and Wilson (2014) and Dalton and Thatcher (2015) attends to this historical excavation, tying the present myth of 'big data' to earlier movements in social physics and geodemographics, respectively; however, these concerns extend well beyond 'big data.' A critical spatial history of GIS must also pay heed to other processes of governmentality that have implicated spatial rationalities and technologies in the reconfiguration of geographical spaces (Rose-Redwood 2012).

A political economy of GIS should be cognizant of the slippage between traditional GIS and spatial information more broadly. Leaving behind the desktops of state workers, academic researchers, and private sector analysts, the tools of GIS—of spatial information, visualization, and analysis—have become prime sites of speculative investment (Wilson 2012) and a core means by which individuals navigate and understand the world around them (Sui 2008, Elwood, Goodchild, and Sui 2012, Leszcynski and Wilson 2013, Thatcher 2013). Just as the move from mainframe to desktops in GIS raised concerns over a 'hidden technocracy' (Obermeyer 1995), similar concerns must be raised concerning the advent of 'big' spatial information and analysis. A political economy of GIS should be forward looking, examining not only the historical paths that led to the present moment (see, for example, McHaffie 2002), but also those paths opened and foreclosed toward possible futures (Sheppard 1995). Our purview must remain attentive to the specific functions of traditional GIS within society, but participants at Friday Harbor stressed that, as engaged scholars, we must also not lose sight of the widening import of 'big' spatial

information. From the vantage point of 2015, this includes growing economies of surveillance, consumer location-based services, data speculation, and other economies of control (Dalton and Thatcher 2014).

5. Social justice and GIS

Another major focus at Friday Harbor was the contradictory role that GIS has played in addressing questions of social justice (Warren 2004). On the one hand, critics have questioned the complicity of geospatial technologies, and mapping more generally, in supporting the interests of corporate and governmental power, not to mention the military applications of GIS and its role as part of the broader apparatus of geosurveillance (Smith 1992; Pickles 1995, 2004; Crampton 2008). On the other hand, there is a growing body of literature that draws upon GIS techniques to document systematic patterns of spatial inequity, particularly in terms of the disproportionate risk that socially marginalized groups face with respect to environmental hazards, such as exposure to air pollution and toxic waste (Margai 2001; Buzzelli et al. 2003; Higgs and Langford 2009; Raddatz and Mennis 2013). In recent years, there have also been efforts to use GIS mapping to illustrate how discriminatory policies have resulted in the exclusion of low-income and racialized communities from public services and municipal infrastructure (Burtman, 2009). In some cases, such uses of GIS have been instrumental in legal decisions resulting in millions of dollars in damages for affected residents (e.g., *Kennedy v. City of Zanesville*; see Parnell 2008; Monger 2010). The strategy of using GIS mapping and spatial analysis as part of the toolkit for legal defense shows some promise in challenging social and environmental injustices via law and due process. However, some participants questioned whether social and environmental justice is reducible to 'justice' as conceived by juridical systems alone, particularly in the context of settler societies where the colonial state has been one of the primary agents of oppression and the dispossession of indigenous lands.

It was particularly apparent from our discussions of how GIS has been used to reinforce or challenge social injustices that these are complex issues demanding serious theoretical and empirical consideration as *questions to be posed*, rather than presuming at the outset that the answers are self-evident. For instance, such questions might include: Within the context of critical GIS, how should we conceptualize the notion of 'justice,' in procedural, distributional, or other terms? Are we drawing on 'passive' or 'active' conceptions of equality (May 2008) as we theorize the role of GIS in exposing and challenging social and environmental injustices? Has the analysis of some spatial inequities been privileged over others in the critical GIS literature, and to what extent does the availability of particular types of data influence which injustices are addressed? How can marginalized populations be digitally empowered in the contemporary geoweb era? Ultimately, what does it mean to *do* critical GIS in the world engaging different publics? What tools and theories are most relevant to our work and with what epistemological entanglements do they come?

Additionally, what mechanisms of inclusion and exclusion are at work in the GIS community itself? This last question was of particular interest to the group as we discussed the need for a broadening not simply in the objects of study, but in the practitioners themselves. Despite attempts to make the meeting as inclusive and diverse as possible, where we succeeded with career stages, disciplinary backgrounds, and geographic locations, we were less successful with categories like gender and race. Moving forward, a core focus of our group is being more proactively inclusive, especially given the centrality of feminist interventions in constituting critical GIS (Kwan 2002; Cope and Elwood 2009; Leszczynski and Elwood 2014; Schuurman 2000). One approach involves a continual questioning of 'Who is missing? How would their presence alter not only our own conversations, but also the social roles of critical GIS?'

By posing such questions, we seek to broaden the scope of what a 'social justice and GIS' research agenda might entail by reconsidering how critical engagements with political theories of justice and equality can enrich our critiques *of* GIS as a political technology as well as how GIS itself can more productively be employed as a means of intervening *within* struggles for social justice.

6. Questioning every click: what's so critical about critical GIS?

For many of the attendees (and, we suspect, many readers), a contradiction often emerges between our interests in social justice, political economy, and critical quantification, on the one hand, and the expectations of our students and professions, on the other. While this is problematic in many academic fields, critical GIS sits uncomfortably between the Science-Technology-Engineering-Mathematics (STEM) fields and the social sciences and humanities, thereby heightening the instrumentalist-liberal educational tension. The resulting pedagogical pressures manifest as students demand clear, precise pathways akin to 'button pushing' in order to arrive at expected results, and in parallel, for their training to lead, linearly, to a paid position. This instrumentalization of teaching is plainly an over-generalization, as each student approaches GIS with their own expectations; however, it was a repeated theme in discussions. The salience of such concerns seems destined to increase as the spatial technology and information job sector continues to shift rapidly, with roles moving between cartographer and developer, designer and programmer, worker and consumer. In this context, how can we bring the *critical* of critical GIS into the classroom? What is the praxis of critical GIS today? How does one take critical quantification and apply it to a study in the real world—either in the classroom or as a research project?

At Friday Harbor, one suggestion that arose from our discussions was the importance of 'questioning every click,' of moving beyond the focus of traditional GIS education on the practices of clicking, towards engaging with how human-computer interactions are interconnected with diverse meaning-making practices in society. Some approaches may seem obvious, such as attempting to understand the user's intended purpose or asking why a given tool or method was chosen, but others require deeper theorization and empirical research. For example, a key component of understanding broader processes of quantification rests in the design and choice of the algorithm used, and in the database structure invoked in the processes of representation and analysis (Kitchin and Dodge 2011; Kitchin 2014). The interfaces of a given tool, of GIS *as system,* mediate both the experience of the end-user and the resulting product (Manovich 2013). To understand not only the operation of geospatial technologies but their political economy also will require an understanding of the decisions made by the firms and individuals who create them. This is as true for open-source tools created by and for researchers as it is for large software packages structured by the pursuit of profit. This suggests the need not only to question every click, but also to question what happens before, between and after every click.

7. Future directions

In this report, we have attempted to convey the diversity of perspectives and opinions that surfaced at the Friday Harbor meeting in 2014. Nevertheless, this diversity was of a particular kind, including only those interested in identifying with 'critical GIS', however transient the agreement or divergent our interpretations. While that label has its uses, on the evidence of this meeting it seems to exclude not only 'mainstream GIS' *but also* perhaps discourages active engagement with questions around geospatial

technologies, their impacts, political economy and social implications by geographers and other social scientists more widely.

Whereas the original Friday Harbor meeting in 1993 has been portrayed as an important moment of *detente* in a previously uncomfortable relationship between 'GISers' and more skeptical human geographers (Schuurman 2000), it would be impossible to put such a spin on the 2014 meeting. With few exceptions *both* mainstream GIS (or should that be GIScience?) *and* important strands in contemporary human geography were notable by their *absence* from this meeting. This is a concern. First, it suggests that GIScience is now beyond the reach of skeptical questioning, even as, only a few years ago (ten years on from Pickles's [1995] *Ground Truth*), Mike Goodchild suggested that 'GIScience would never again be quite the comfortable retreat for the technically minded that it had been in the past' (2006, 687). If that claim was true then, it seems less so now, as monolithic desktop GIS mutates into a much more varied array of spatial technologies well beyond geography's purview, and as what was once 'academic GIS' has become 'GIScience'. Second, it highlights what appears to be a neglect by critical human geographers more widely to seriously interrogate geospatial technologies and their implications following up on significant works from the 1990s (yet, see Sheppard, 2005; Rose-Redwood, 2006, 2012; Wilson 2011, 2015). It is too simplistic to suggest that the existence of critical GIS as a distinctive (if tiny) subfield has had a deadening effect on a wider engagement of these issues in the geographical mainstream, nevertheless we looked forward at the meeting to the prospect of working with others from across the geographical spectrum and in disciplines beyond.

Consequently, how the (eternally?) nascent community around 'critical GIS' can more constructively engage *not only* mainstream GIScience *but also* critical human geography to put the concerns raised at meetings like these on those wider agendas, was one of the most recurrent theme in conversations. Even allowing for a solipsistic, self-important sense of urgency, the need for wider consideration of the concerns central to this meeting seems clear.

Given the scale of that challenge, it was exciting that the overwhelming mood of the meeting was one of optimism that a coherent intellectual program can be built, drawing on diverse experiences, extending developments in the digital humanities, to develop a political economy of geospatial, that sheds light on the social implications of these technologies, and promotes different methods and praxis.

That optimism is founded on the most important—albeit intangible—outcome of the meeting, which was a strong sense of the emergence of a *community of interest* focused on the intersection of the geographical, the technological and the digital. Perhaps we might regard critical GIS as less of a field and fixed basis for identity and more of a multitude of intellectual banners, lacking fixed essence, raised through calls that repeat with difference, ever rediscovered and reclaimed. We are continually revisiting critical GIS. Join us.

References

Barnes, Trevor J., and Eric Sheppard. 2010. "'Nothing Includes Everything': Towards Engaged Pluralism in Anglophone Economic Geography." *Progress in Human Geography* 34(2): 193–214.

Barnes, Trevor J., and Matthew W. Wilson. 2014. "Big Data, Social Physics, and Spatial Analysis: The Early Years." *Big Data & Society* 1(1): 1-14. doi:10.1177/2053951714535365.

Bergmann, Luke R. 2013. "Bound by Chains of Carbon: Ecological-Economic Geographies of Globalization." *Annals of the Association of American Geographers* 103 (6): 1348–70. doi:10.1080/00045608.2013.779547.

Bergmann, Luke R, Eric Sheppard, and Paul S. Plummer. 2009. "Capitalism beyond Harmonious Equilibrium: Mathematics as If Human Agency Mattered." *Environment and Planning A* 41(2): 265-283.

Bodenhamer, David J., John Corrigan, and Trevor M. Harris, eds. 2010. *The Spatial Humanities: GIS and the Future of Humanities Scholarship*, Bloomington, IN: Indiana University Press.

Burdick, Anne, Johanna Drucker, Peter Lunenfeld, Todd Presner, and Jeffrey Schnapp. 2012. *Digital_Humanities.* Cambridge, MA: MIT Press.

Burtman, Bob. 2009. "The Revolution Will Be Mapped." *Pacific Standard*, 28 December, <http://www.psmag.com/navigation/books-and-culture/the-revolution-will-be-mapped-7130>.

Buzzelli, Michael, Michael Jerrett, Richard Burnett, and Norm Finklestein. 2003. "Spatiotemporal Perspectives on Air Pollution and Environmental Justice in Hamilton, Canada, 1985-1996." *Annals of the Association of American Geographers* 93(3): 557-573.

Clarke Keith C., and John G. Cloud. 2000. "On the Origins of Analytical Cartography." *Cartography and Geographic Information Science*. 2000 Jan;27(3):195–204.

Cope, Meghan S., and Sarah Elwood, eds. 2009. *Qualitative GIS: A Mixed Methods Approach*. Thousand Oaks, CA: Sage Publications Ltd.

Crampton, Jeremy W. 2008. "The Role of Geosurveillance and Security in the Politics of Fear." In *Geospatial Technologies and Homeland Security: Research Frontiers and Future Challenges* edited by Daniel Sui, 283-300. Dordrecht, Netherlands: Springer.

Crampton, Jeremy W., and John Krygier. 2005. "An Introduction to Critical Cartography." *ACME: An International E-Journal for Critical Geographies* 4(1): 11-33.

Curry, Michael R. 1998. *Digital Places: Living with Geographic Information Technologies*. London: Routledge.

Dalton, Craig M. and Jim Thatcher. 2015. "Inflated Granularity: Spatial 'Big Data' and Geodemographics." Available at SSRN: http://ssrn.com/abstract=2544638 or http://dx.doi.org/10.2139/ssrn.2544638

Dalton, Craig M. and Jim Thatcher. 2014. "What Does a Critical Data Studies Look Like, and Why Do We Care? Seven Points for a Critical Approach to 'Big Data'." Available at: http://societyandspace.com/material/commentaries/craig-dalton-and-jim-thatcher-what-does-a-critical-data-studies-look-like-and-why-do-we-care-seven-points-for-a-critical-approach-to-big-data/ (accessed 27 April 2015).

Drucker, Johanna. 2012. "Humanistic Theory and Digital Scholarship." In *Debates in the Digital Humanities*, edited by Matthew K. Gold, 85-95. Minneapolis: University of Minnesota Press.

Drucker, Johanna. 2009. *SpecLab: Digital Aesthetics and Projects in Speculative Computing*. Chicago: University of Chicago Press.

Elwood, Sarah, Michael F. Goodchild, and Daniel Z. Sui. 2012. "Researching Volunteered Geographic Information: Spatial Data, Geographic Research, and New Social Practice." *Annals of the Association of American Geographers* 102(3): 571-590. doi:10.1080/00045608.2011.595657.

Goodchild, Michael F. 2006. "GIScience Ten Years After Ground Truth." *Transactions in GIS* 10(5): 687-692.

Greenfield, Adam. 2006. *Everyware: The Dawning Age of Ubiquitous Computing*. Berkeley, CA: New Riders Publishing.

Harvey, Francis and Chrisman, Nicholas R. 1998. "Boundary Objects and the Social Construction of GIS Technology." *Environment and Planning A*, 30(9): 1683-1694.

Harvey, Francis, Mei-Po Kwan, and Marianna Pavlovskaya. 2005. "Introduction: Critical GIS." *Cartographica* 40(4): 1-3.

Higgs, Gary and Mitch Langford. 2009. "GIScience, Environmental Justice, and Estimating Populations at Risk: The Case of Landfills in Wales." *Applied Geography* 29(1): 63-76.

Kitchin, Rob. 2014. *The Data Revolution*. Thousand Oaks, CA: SAGE Publications Ltd.

Kitchin, Rob, and Martin Dodge. 2011. *Code/space: Software and Everyday Life*. Cambridge, MA: MIT Press.

Knigge, Ladona. and Meghan S. Cope. 2009. "Grounded Visualization and Scale: A Recursive Analysis of Community Spaces." In *Qualitative GIS: a mixed methods approach*, edited by. Meghan Cope and Sarah Elwood, 92-114. Thousand Oaks, CA: Sage Publications Ltd.

Kwan, Mei-Po. 2002. "Feminist Visualization: Re-Envisioning GIS as a Method in Feminist Geographic Research." *Annals of the Association of American Geographers* 92(4): 645-661.

Leszczynski, Agnieszka. 2014. "On the Neo in Neogeography." *Annals of the Association of American Geographers* 104(1): 60-79. doi:10.1080/00045608.2013.846159.

Leszczynski, Agnieszka. 2012. "Situating the Geoweb in Political Economy." *Progress in Human Geography* 36(1): 72-89. doi:10.1177/0309132511411231.

Leszczynski, Agnieszka, and Sarah Elwood. 2014. "Feminist Geographies of New Spatial Media." *The Canadian Geographer* 59(1): 12-28.

Leszczynski, Agnieszka, and Matthew W. Wilson. 2013. "Guest Editorial: Theorizing the Geoweb." *GeoJournal* 78(6): 915-919. doi:10.1007/s10708-013-9489-7.

Manovich, Lev. 2013. *Software Takes Command*. New York: Bloomsbury Academic.

Margai, Florence Lansana. 2001. "Health Risks and Environmental Inequity: A Geographical Analysis of Accidental Releases of Hazardous Materials." *The Professional Geographer* 53(3): 422-434.

May, Todd. 2008. *The Political Philosophy of Jacques Rancière: Creating Equality*. University Park, PA: Pennsylvania State University Press.

McHaffie, Patrick. 2002. "Towards the Automated Map Factory: Early Automation at the U.S. Geological Survey." *Cartography and Geographic Information Science* 29(3): 193-206.

Millington, James D. A., David O'Sullivan, and George L. W. Perry. 2012. "Model Histories: Narrative Explanation in Generative Simulation Modelling." *Geoforum* 43(6): 1025-1034. doi:10.1016/j.geoforum.2012.06.017.

Monger, Jon. 2010. "Thirsting for Equal Protection: The Legal Implications of Municipal Water Access in Kennedy v. City of Zanesville and the Need for Federal Oversight of Governments Practicing Unlawful Race Discrimination." *Catholic University Law Review* 59(2): 587-616.

Morozov, Evgeny. 2013. *To Save Everything, Click Here: The Folly of Technological Solutionism.* New York: Public Affairs.

Obermeyer, Nancy J. 1995. "The Hidden GIS Technocracy." *Cartography and Geographic Information Systems* 22(1): 78-83.

O'Sullivan, David. 2006. "Geographical Information Science: Critical GIS." *Progress in Human Geography* 30(6): 783-791.

Parnell, Allan. 2008. "Maps Used in Support of the Plaintiff's Argument in Kennedy et al. v. City of Zanesville, et al." Race Equity Project, Legal Services of Northern California, <http://equity.lsnc.net/2008/08/maps-used-in-support-of-the-plaintiff's-arguement-in-kennedy-et-al-v-city-of-zanesville-et-al/> (access date April 18, 2015).

Pickles, John. 2004. *A History of Spaces: Cartographic Reason, Mapping and the Geo-coded World*. London: Routledge.

Pickles, John, ed. 1995. *Ground Truth: The Social Implications of Geographic Information Systems.* New York: The Guilford Press.

Poiker, Tom. 1995. "Preface to Special Issue." *Cartography and Geographic Information Systems* 22(1): 3-4.

Raddatz, Liv and Jeremy L. Mennis. 2013. "Environmental Justice in Hamburg, Germany." *The Professional Geographer* 65(3): 495-511.

Rose-Redwood, Reuben. 2015. "Introduction: The Limits to Deconstructing the Map." *Cartographica: The International Journal for Geographic Information and Geovisualization* 50 (1): 1-8.

Rose-Redwood, Reuben. 2012. "With Numbers in Place: Security, Territory, and the Production of Calculable Space." *Annals of the Association of American Geographers* 102(2): 295-319.

Rose-Redwood, Reuben. 2006. "Governmentality, Geography, and the Geo-coded World." *Progress in Human Geography* 30(4): 469-486.

Schuurman, Nadine. 2000. "Trouble in the Heartland: GIS and its Critics in the 1990s." *Progress in Human Geography* 24(4): 569-590.

Schwanen, Tim., and Mei-Po Kwan. 2009. "'Doing' Critical Geographies with Numbers." *The Professional Geographer* 61(4): 459-464.

Sheppard, Eric. 2005. "Knowledge Production through Critical GIS: Genealogy and Prospects." *Cartographica* 40(4): 5-21.

Sheppard, Eric. 2001. "Quantitative Geography: Representations, Practices, and Possibilities." *Environment and Planning D: Society and Space* 19(5): 535-554. doi:10.1068/d307.

Sheppard, Eric. 1995. "GIS and Society: Towards a Research Agenda." *Cartography and Geographic Information Systems* 22(1): 5-16.

Sheppard, Eric, and Trevor J. Barnes. 1990. *The Capitalist Space Economy: Geographical Analysis after Ricardo, Marx and Sraffa*. London: Unwin Hyman.

Sieber, Renee E. 2004. "Rewiring for a GIS/2." *Cartographica* 39(1): 25-39. doi:10.3138/T6U8-171M-452W-516R.

Smith, Neil. 1992. "History and Philosophy of Geography: Real Wars, Theory Wars." *Progress in Human Geography* 16(2): 257-271.

Sui, Daniel Z. 2008. "The Wikification of GIS and Its Consequences: Or Angelina Jolie's New Tattoo and the Future of GIS." *Computers, Environment and Urban Systems* 32 (1): 1-5. doi:10.1016/j.compenvurbsys.2007.12.001.

Thatcher, Jim. 2013. "Avoiding the Ghetto through Hope and Fear: An Analysis of Immanent Technology Using Ideal Types." *GeoJournal* 78(6): 967-980. doi:10.1007/s10708-013-9491-0.

Warren, Stacy. 2004. "The Utopian Potential of GIS." *Cartographica* 39(1): 5-16. doi:10.3138/JW0L-3577-0J40-V3Q4.

Wilson, Matthew W. 2015. "New Lines? Enacting a Social History of GIS." *The Canadian Geographer / Le Géographe Canadien* 59(1): 29-34. doi:10.1111/cag.12118.

Wilson, Matthew W. 2012. "Location-Based Services, Conspicuous Mobility, and the Location-Aware Future." *Geoforum* 43(6): 1266-1275. doi:10.1016/j.geoforum.2012.03.014.

Wilson, Matthew W. 2011. "'Training the Eye': Formation of the Geocoding Subject." Social & Cultural Geography 12(4): 357-376.

Wilson, Matthew W. 2009. "Towards a Genealogy of Qualitative GIS." In *Qualitative GIS: A Mixed Methods Approach*, edited by Meghan Cope and Sarah Elwood, 156–70. Thousand Oaks, CA: Sage.

Wyly, Elvin. 2015. "Where is an Author?" *City* 19(1): 5-43. doi:10.1080/13604813.2014.962897.

Wyly, Elvin. 2009. "Strategic Positivism." *The Professional Geographer* 61(3): 310-22. doi:10.1080/00330120902931952.