Counter-mapping data science

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Key Messages

- Counter-mapping offers a useful theoretical framework and practical methods for developing grassroots data science not focused on profit.
- Counter-mapping is inherently a situated combination of ideas and practices for developing and realizing alternative social relations and worlds.
- Counter-mapping requires careful sensitivity to each situation and associated power relations, especially by the map-maker(s) themselves.

Counter-mapping is a combination of critical ideas and practices for social change that offers a productive and promising approach for grassroots data science initiatives. Current information technologies collect, store, and analyze data with new degrees of size, speed, heterogeneity, and detail. While much work utilizing data science technologies is dedicated to generating profit or to national security, some data science projects explicitly attempt to facilitate new social relations, though with inconsistent results and consequences. This paper reviews counter-mapping's particular combination of theory and practice as a potential point of reference for such initiatives. Counter-mapping takes the tools of institutional map-making at government agencies and corporations and applies them in situated, bottom-up ways. Moreover, counter-mapping's multiple theoretical approaches and polyglot practices offer a variety of inspirations and avenues for future work in identifying and realizing alternative, ideally better, possibilities. This paper defines counter-mapping; outlines its multiple theorizations; briefly describes three relevant case studies, The Detroit Geographical Expedition and Institute, Mapping Police Violence, and the Counter-Cartographies Collective; and concludes with a few hard-learned considerations from counter-mapping that are directly pertinent for data-oriented projects focused on change.

Keywords: counter-mapping, critical cartography, critical data studies, big data, counter-data

Science de la contre-cartographie des données

La contre-cartographie est une combinaison d'idées critiques et de pratiques pour le changement social qui offre une approche productive et prometteuse pour les initiatives populaires de la science des données. Les technologies de l'information actuelles collectent, stockent et analysent les données avec de nouveaux standards de taille, de vitesse, d'hétérogénéité et de détail. Alors qu'une large part des applications des technologies de l'information sert à générer des profits ou à assurer la sécurité nationale, certains projets de la science des données tentent explicitement de faciliter de nouvelles relations sociales, malgré des conséquences et des résultats contradictoires. Cet article examine la combinaison particulière de la théorie et de la pratique de la contre-cartographie comme point de référence potentiel pour de telles initiatives. La contre-cartographie reprend les outils de la cartographie institutionnelle des organismes gouvernementaux

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et des sociétés d'État et les applique de manière engagée et en mode ascendant. De plus, les approches théoriques multiples et les pratiques polyglottes de la contre-cartographie offrent un éventail d'inspirations et de pistes pour un travail futur en identifiant et en réalisant des usages alternatifs, de préférence meilleurs. Cet article définit la contre-cartographie, expose en détail ses multiples théorisations; décrit brièvement trois études de cas pertinentes, Detroit Geographical Expedition and Institute, Mapping Police Violence et Counter-Cartographies Collective et conclut avec quelques considérations durement apprises de la contre-cartographie, lesquelles sont directement pertinentes pour les projets axés sur les données qui mettent l'accent sur le changement.

Mots clés : contre-cartographie, cartographie critique, études de données critiques, données massives, contre-données

We need radically inventive maps exactly like we need radical political movements: to go beyond received ideas and orders, in fact, to go beyond representation, to rediscover and share the space–creating potentials of a revolutionary imagination. Brian Holmes (2003)

Loveland Technologies launched in 2013 with *Why don't we own this?*, a web-based cadastral map of Detroit which highlights properties available for sale in the annual foreclosure auction. Detroit was hit hard by the subprime mortgage crisis, leading to tens of thousands of properties in foreclosure across the city.[1] Loveland soon added a toolbox, including a blexting app for reporting blighted buildings with a smartphone. By producing more data about the physical condition and tax foreclosure status of Detroit properties, and making information widely available to the general public, the company attempts to increase transparency and make it easier for Detroit residents facing foreclosure to stay in their homes.

Loveland's map is one of many recent data science tools to receive accolades for claiming to contribute to a broadly defined "social good" (Eltantawy and Wiest 2011; Crawford 2014). Yet simply producing more data, even open data, does not automatically produce beneficial results. Well-meaning data science can even perpetuate processes which exacerbate inequality and exploitation, often due to technologically led, generic top-down programs working through government agencies or for-profit corporations, even with volunteered or crowd-sourced data (Morozov 2014; Cardullo 2015). In Loveland's case, the terms of the Wayne County foreclosure auction undercut the company's claims. Those terms prohibit both owners from buying their own homes back at auction and non-profits from purchasing homes on behalf of current owners. New rules also exclude anyone with outstanding tax bills (Wayne County Treasurer 2016).

Critical scholarship on data science evaluates its role and effects in society. A growing thread of this critical work focuses on practices: how data science can be deployed in socially productive ways that don't focus on top-down policy or profit. However, the process of identifying an appropriate context, developing a data-oriented initiative, and realizing it in practice with the intended effect(s) is hard conceptual and material work. It requires a carefully situated approach, for generic technical solutions, no matter how large and transparent, are often, like Loveland, counter-productive.

In a time of technological change and great need for effective social movements, we propose that counter-mapping's situated framework and effective tactics constitute a useful approach for grassroots, data-oriented practices and initiatives of many kinds. Much like current critical data initiatives, counter-mapping springs from and reacts to a lineage of technologically facilitated, institutionalized, top-down knowledges. What counter-mapping does is use (geographic) data to unite critical ideas and radical practice to explore and realize more equitable alternative possibilities.

We demonstrate counter-mapping as an approach that combines critical ideas and practices and thus a potentially valuable touchstone for a wide variety of data science initiatives and social struggles. Here, we review the theory and a few case studies of counter-mapping, as well as several lessons we've learned in our own experiences with counter-mapping and data.

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[1] The 2014 Wayne County tax foreclosure auction featured 24,000 properties, about 7,000 of which were occupied. Approximately 17,000 sold at an average price of US$3,838 (Cwiek 2014).

Data science ascendant

Data science encompasses a variety of recent methods of data collection and analysis made possible by the combination of big data, volunteered and collected sources, algorithmic analysis, and ample venture capital in the IT industry. It is an increasingly influential analytical approach (Kitchin 2013; Schutt and O'Neil 2013), most often used to accumulate capital, including at Google, Facebook, Acxiom, and Palantir, or by governmental agencies such as at the National Security Agency. Echoing a tech industry trope, many that use data science describe their purposes as being for "social good" (Porway 2015) or "making the world a better place" (Mathews 2014). While some are successful, others display seriously problematic, inequitable, and even self-defeating tendencies, as with Loveland (Burns 2015; Cardullo 2015; Hoyng 2015). Such initiatives often involve an over-reliance on broad, technical solutions with insufficient engagement with the social, contextual issues of a particular place and time.

Critical scholarship problematizes data science initiatives in terms of political economy, epistemology, ontology, digital divides, and engagement with small data (boyd and Crawford 2012; Couldry and Powell 2014; Graham et al. 2014; Kitchin 2014; Thatcher 2014; Adams and Brückner 2015; Alvarez León 2016; Gieseking 2017), while others contextualize it in terms of previous forms of knowledge production (Barnes and Wilson 2014; Dalton and Thatcher 2015).

Building on these critiques, some seek not only to analyze and problematize but also to utilize data science sources and methods in unorthodox ways to help realize new social relations. Fortun et al. (2016), Gabrys (2016), Currie et al. (2016), and Brucato (2017) describe the use of data by data designers, citizens, and community members in environmental and police brutality initiatives. Singer (2016) and Gradecki and Curry (2017) directly employ data tools in their art to call out government and corporate surveillance to their audiences. Conceptualizing and realizing such initiatives, much less doing so in responsible ways, is not easy. Wilmott (2016) in particular develops a carefully situated, grounded approach to reveal resistances to and limitations of quantified data processes in individuals' everyday lives. Counter-mapping offers both theorists and practitioners a way to connect careful, situated approaches to data, such as Wilmott's, to the enacted practices of social organizing and change-making. It can combine critical thought and practice to draw on data science sources and methods (often developed by or for large corporations), yet does so in a situated, bottom-up manner to realize different ends.

What is counter-mapping?

Counter-mapping involves a wide set of cartographic ideas and practices, both digital and analog, undertaken by people in multiple contexts, making it difficult to pin down a comprehensive definition. Broadly speaking, it involves map-making practices by those outside or on the margins of large, powerful institutions such as corporations or governments. The modern history of most maps and GIS is one of government programs, such as extending territory, military conflicts, property cadastres, or administering resources. These programs tend to be top-down, with geographic experts analyzing data and cartographically informing stakeholders.

Nancy Peluso coined the term counter-mapping to describe grassroots map-making by an indigenous people in Indonesia (Peluso 1995). As with any form of mapping, it is shaped by its context, including social processes, power relations, and contextual knowledges. However, counter-mapping involves an additional twist. Harris and Hazen (2005, 115) helpfully define it as "any effort that fundamentally questions the assumptions or biases of cartographic conventions, that challenges predominant power effects of mapping, or that engages in mapping in ways that upset power relations." This is similar to, but not the same thing as participatory GIS (Elwood 2006). Counter-mapping appears as a response to the consequences of map-based bureaucratic practices and/or culturally derived cartographic conventions. However, by focusing on the "counter-" this singular definition doesn't highlight the creative, multitudinal central element of "mapping": counter-mapping mixes theory and practice to be *productive* and *generative*, a way to open, explore, and realize alternatives to the status quo.

Counter-mapping theory

Counter-mapping thought developed alongside critical cartography and critical GIS. Maps and GIS

technologies are not neutral arbiters of truth, nor containers of political meaning, but rather shape and facilitate the exercise of power in a society. Mapping practices, including the use of geographic data, can help produce not only geographic visions, but also associated subject positions, material processes, and social programs such as state-building and capital accumulation (Elwood 2006; Crampton 2010; Wood 2010). Counter-mapping initiatives can take many different forms in different cultural and political situations. At least three threads of thought conceptualize how that works: counter-mapping as a straightforward tactic for confronting asymmetrical power relations, as a kind of linguistic proposition, and as an intentionally creative, practiced social formation.

Peluso (1995), Harris and Hazen (2005), and others first developed a cohesive concept of counter-mapping to describe map-making programs with indigenous peoples and for conservation projects. This approach conceptualizes counter-mapping practice as a tactic for confronting unequal geographical power relations and achieving local political goals. It builds on critical cartography's arguments about the political functions of maps in modern history to understand cases of mapping for indigenous land claims and preserving or developing new indigenous geographical knowledges (Hirt 2012; Palmer 2012).

Wood (2010) refines this concept to emphasize how maps work as semiotic geographic propositions that attempt to establish agreement, or at least consent, in a reader. He focuses on how counter-mapping contests modern, capital-C Cartography, its origins, and its continuing legacy as a tool of state power. If Cartography, with its scientific epistemology, standards, and cultural conventions, tends to facilitate governmental programs, how is it categorically blind to alternative mapping practices and cultures? How could other kinds of mapping be productive? Wood's approach offers two strong points. First, it emphasizes the evaluation of cartographic rhetoric in map design. Second, it historically situates mapping and counter-mapping in relation to one another. For Wood, the development of modern Cartography's epistemology and political purposes are intimately tied to the rise of modern state governments, and counter-mapping is a reaction to those developments. For example, he cites the Dadists, Surrealists, and recent map artists who complicate singularly scientific and statist forms of mapping by intentionally twisting cartographic cultural expectations.

A key limitation of this approach is an emphasis on rhetorics of governmental power and reactions to it. Today, maps facilitate not only governmental programs, but also neoliberal actions of corporations, such as Google, ESRI, and Palantir. Given those developments, other counter-mappers attempt to directly theorize how counter-maps work discursively, in recursive processes for particular purposes.

Cobarrubias and Pickles (2008) describe counter-mapping by activist collectives to produce space differently, contesting public spaces and opening new possibilities of citizenship. Those movements employ an explicitly Deleuzian approach that differentiates "tracing," re-presenting and re-producing current conditions and knowledges, from "mapping," truly innovative practices that open new possibilities, relations, spaces, and subjects (Deleuze and Guattari 1987, 12). Rather than a logic of either/or, such as conventional Cartography versus its discontents, this is a practice of proliferation and dissemination, of "and … and … and …" (Deleuze and Guattari 1987, 25), that forges new maps and their worlds (Pickles 2004). With this approach, counter-mapping breaks from representational attempts to plot current conditions. The purpose is to map in new ways, producing new worlds of social and material relationships. What alternatives, overlooked or ignored in top-down initiatives, could stakeholders discover and make real through mapping practice?

The Counter-Cartographies Collective (3Cs)[2] combines the Deleuzian approach with the ideas, ethics, and practices of Colectivo Situaciones, a collective that attempts to break down social research's subject-object divide to co-produce knowledge for mutual understanding and social change (Colectivo Situaciones 2002; Dalton and Mason-Deese 2012). In practice, this means working from a particular social and cultural standpoint in constant discussion with (or as) stakeholders, building a relationship of mutual respect. Through this approach, 3Cs counter-mapping focuses on the contextual production of new possible worlds. In doing so, the purpose is not to formulate and install yet another top-down map, but to continue to explore and create alternatives.

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[2] Both authors are founding members.

Gerlach (2010, 166) questions the oppositional or confrontational subtext implicit in some counter-mapping accounts, arguing that mapping is "a little more complex, a little messier, and a little more micro-political," than a presupposed binary "David and Goliath" story. The full importance of mapping, including counter-mapping, is that it, and through it, the world, is constantly becoming through people's performative mapping practices (Kitchin and Dodge 2007; Gerlach 2014). Effective counter-mapping emerges from specific social situations in an explicitly, intentionally political (and sometimes oppositional) manner. For counter-mapping practitioners, navigating the micro- and macro-power relations at work in mapping initiatives requires care, a conscious reflexive awareness of those relationships, and close collaboration such as the relations of mutual learning described by Colectivo Situaciones (2002). Furthermore, as we discuss later in this piece, sometimes the best map is no map at all.

Counter-mapping practice

Practice is an inherent part of counter-mapping; incorporating critical ideas not as an agenda, but as part of a continuing, recursive process. As a project develops, it may involve sharing geographic knowledge amongst participants, conceptualizing what to map, gathering and analyzing data, map design, dissemination, and use. Often these play out in iterative cycles, with new knowledges and participants entering the conversation as a project takes shape. Three case studies of counter-mapping—the Detroit Geographical Expedition and Institute, Mapping Police Violence, and the Counter-Cartographies Collective—provide useful examples of counter-mapping practices in action.

The Detroit Geographical Expedition and Institute

Despite its relatively short lifespan, the Detroit Geographical Expedition and Institute (DGEI), jointly led by Gwendolyn Warren and Bill Bunge, remains an inspiration for counter-mappers. The DGEI, which operated in predominately black inner-city Detroit from 1967 until 1972, was comprised of an education arm led by Warren, and a research arm led by Bunge. The DGEI was an

explicit attempt to use the quantitative and qualitative tools of academic geography to improve the quality of life in black neighbourhoods (Bunge 2011). Warren (1971, 10) states "... we thought about it, all those funny little things geographers do. Out of all the stuff they were saying to us, we wondered how we could take a little bit out of all that 'bull' and make it useful." While the DGEI's work has been described extensively elsewhere (Merrifield 1995; Peake and Sheppard 2014), accounts of its work can fall into white savior narratives, highlighting the work of Bunge, a white man, while downplaying the role of Warren and other black community members, even as the DGEI's own writings are explicit in their attempts to subvert these racial dynamics.

Several aspects of the project are particularly relevant for counter-mapping and data science today. DGEI members focused on their own neighbourhoods in Detroit, with each investigation looking at the city from its social margins. For example, several investigations problematized traditional conceptions of economic development by mapping the system of urban value extraction to show how lower-income neighbourhoods are made poor: tracking the amount of wealth leaving "slum" neighbourhoods by calculating the average revenue per store and comparing that to the stores' pay rates and percentage of local employees. Other investigations examined the material conditions of children living in the city. Distressingly, they found everything from a lack of playgrounds to issues of basic survival amidst traffic-heavy streets (Bunge 2011).

In producing compelling maps and writing, the DGEI participants were thoughtful about their own situated, locally responsive process. Warren (1971, 13–14) notes that anyone could have gathered the data and made the same maps, "and even though you may come up with the same answers as Black students would, your book would go to the library ... but we [the Black community] may never know about it." Their work highlights the importance of understanding counter-mapping as a situated and productive process, linking discourses, people, and communities together.

Mapping Police Violence

A current example counter-mapping in a racial justice struggle is the Mapping Police Violence

project (Mapping Police Violence 2017), founded in the wake of the police killing of Michael Brown in Ferguson, Missouri. The project maintains a comprehensive spreadsheet of people killed by law enforcement in the United States (US) since 2013, along with an interactive time-lapse web map of police killings and detailed statistical reports. Their map plots police killings at a compressed timescale, each second on the map corresponding to several days. Deaths appear cumulatively, with each new one flashing onto the map surrounded by a halo. Clicking on a point on the map opens a pop-up with details.

The project is part of a network of related initiatives that arose in response to the predominating cartographic viewpoint of the US federal government and most local police departments. Official governmental maps and datasets focus nearly exclusively on property crime, violent crime, and reported drug crime as geographic phenomena, marking particular neighbourhoods and demographics as inherently crime-ridden. Law enforcement maps tend to ignore the social inequities, costs, and violence of policing and incarceration in black communities in the US. Even raw data about police violence can be hard to come by. US federal law mandates data collection and reporting on people killed in police custody, but the reporting provisions are not enforced (Gross and Schatz 2014). Mapping Police Violence carefully collects data, manages the dataset, and makes maps which advance a distinct counter-mapping viewpoint: that police killings of black people are not separate, individual circumstances, but a broad phenomenon which can be tracked and must be stopped through policy solutions and policing reform.

The Counter-Cartographies Collective

In contrast to policy solutions, 3Cs focuses on the affective responses and everyday experiences around multiple issues including labour conditions on university campuses, migration, and gentrification. 3Cs' work is strongly influenced by feminist re-interpretations of the situationist *dérive* (drift). The refined technique gathers data about relationships of care, work, and solidarity (Precarias a la Deriva 2003). 3Cs' 2012 map project, *Counter\mapping Queen Mary University*, a collaboration with the Counter\mapping Queen Mary Collective, examines the role of borders and neoliberal management in

the United Kingdom on the campus of Queen Mary University (QMU) (Counter\mapping Queen Mary Collective 2012).

The two collectives convened a drift through QMU's campus as part of an open workshop on counter-mapping. Each participant was given a card with a question asking them to observe something over the course of a collective walk through campus. Examples included "Where do you see surveillance?," "Where is work happening?," or "What would navigating this space in a wheelchair be like?" Participants recorded their observations on maps, and more importantly, generated a conversation as they collectively encountered the campus. The end result is a colour poster map across multiple scales, and a board game on the reverse. Just as with the DGEI, the practice of data gathering was vital for generating conversation and building connections amongst participants.

Considerations from counter-mapping

Counter-mapping involves both ideas—such as those of Peluso (1995), Harris and Hazen (2005), Wood (2010), and Cobarrubias and Pickles (2008)— and practices, including the DGEI, Mapping Police Violence, and 3Cs. As such, counter-mapping offers useful, hard-learned lessons to those who use data for social change. This final section touches on several points that come out of our direct experiences in 3Cs projects and other counter-mappings. It is not a list of requirements, but a series of important considerations for anyone embarking on a critical or counter- data science or mapping initiative.

Practice situated analysis

The history of mapping and data is replete with examples of outside experts, even well-meaning ones, coming into a context, redefining it in their terms, and doing analyses for their own ends. In contrast, effective counter-mapping is typically a collaborative effort. It implies a greater deal of social engagement by map-makers, even experienced ones. People are not the objects of research, rather, they are the best situated to map the issues and forms of oppression at work in their situation (Haraway 1991). Naturally, there are multiple roles in a mapping or data analysis project, but this

ethics tends to focus on collaborative work from one's own situation, such as your own university or neighbourhood. Even if the initiative isn't local, such as 3Cs' at QMU, it is best initiated from a stated desire by a community and an intimate collaboration with community members to build an environment, not of research subjects and objects, but of mutual learning and respect. In data science, such situated work and relationships could offer powerful participatory, equitable analyses and outcomes.

When to map and when not to map

Not all contexts are best addressed with mapping or data analysis. A local, community-supported agriculture program may find mapping or data analysis redundant, a waste of time and resources. Some maps and analyses can actually make conditions worse due to co-optation. In one well-documented case, an indigenous mapping initiative in Central America actually perpetuated neocolonial processes and capital accumulation, overseen by the US Department of Defense (Bryan and Wood 2015). When it does map, 3Cs tries to map the structures of oppression, rather than potentially surveil those impacted by oppression. Understanding when to map and when not to map requires expertise beyond cartography; a familiarity and sensitivity to the range of political processes, institutions, and subject positions in a context; and an understanding of how a range of possible interventions, including but not limited to mapping or data science, might impact that context.

Realize that you're telling a story

Despite the claims of some early big data proponents (e.g., Anderson 2008), data cannot speak for itself. In maps, Wood (2010) makes clear the degree to which a map's design—including the legend, grid, frame, colour, abstract lines, and statements of locational accuracy—bolsters the map's appearance as expert, objective fact even as that design subtly crafts a propositional narrative by choosing, excluding, and organizing data. Effective mapping recognizes that every map is both data and narrative; counter-mapping involves reflexive analysis of the way data itself is constructed from a perspective. Striving for complete objectivity is neither an attainable nor a desirable goal.

Rather than working towards the singular goal of transmitting geographic truth through a graphical narrative, the purposes of counter-mapping are contextual. A map might be doing the "best" job of communicating a particular point of view from a particular situation. What that point of view is, what the situation is, and what "best" means all have to be considered strategically and contextually, both in terms of the data and the social situation. This does not mean that anything goes in counter-mapping. Rather, by moving away from a single standard of institutionally defined objectivity, the ethics of counter-mapping practice become much more important. Performing counter-mapping or similar data science requires both rigorous attention to the validity of data and analyses as well as a sensitivity to the limitations and biases, whether error, statistical bias, or cultural assumptions, involved.

Think beyond the digital

Counter-mapping involves thoughtful use of both digital and social technologies, oftentimes drawing on innovations in techniques for social interaction, research, and decision making developed by social movements. Examples include the new practices of democracy developed in Spain's 15M movement and the Occupy movement in the US. 3Cs' drifting draws on research techniques developed by Precarias a la Deriva in their organizing practice. Non-digital technologies can also draw from the realm more traditionally considered as high-tech. For example, *Feathers of Hope*, a network of indigenous youth in Canada, creates a pen-and-paper Facebook analog on a physical wall with hand-drawn user profiles as a way to build relationships amongst participants in workshops or forums.

The process is productive

Some counter-mapping makes use of every stage of an initiative, not just the results, to facilitate forms of change by encouraging additional participation, collective analysis, and reflection. For example, in order to make a map of the many forms of labour at UNC-Chapel Hill, 3Cs once set up a research station in a well-travelled place on campus with posters asking passers-by "What is your work, today and everyday?" We asked participants to map what they knew about work on campus, whether they defined

themselves as workers, and what work meant to them. These actions turned data gathering into a way of spreading those questions across campus. The full importance or impact of a mapping or data science initiative is not limited to outcomes; there are opportunities in *how* a project is done to realize change.

Conclusions

Counter-mapping, as a bottom-up union of critical theory and practice, offers a different approach to those looking for more effective and equitable ways to do data science. Wood's (2010) linguistic approach to maps and their data, 3C's situated mapping knowledges, and the Map Police Violence project show the importance of a critical approach. The participatory nature of indigenous mapping and the DGEI show the conceptual and practical importance of participation not only in data collection, but also in analysis. Finally, our counter-mapping experiences point to important considerations in doing critical, data-rich analytical work for social change. Counter-mapping's model—critical scholarship joined with situated, reflexive practice—offers a promising avenue for a critically aware data science dedicated to creating new worlds.

References

Adams, J., and H. Brückner. 2015. Wikipedia, sociology, and the promise and pitfalls of Big Data. *Big Data and Society* 2(2). https://doi.org/10.1177/2053951715614332.

Alvarez León, L. F. 2016. Property regimes and the commodification of geographic information: An examination of Google Street View. *Big Data and Society* 3(2). https://doi.org/10.1177/2053951716637885.

Anderson, C. 2008. The end of theory. *Wired* 16(7). https://www.wired.com/2008/06/pb-theory/.

Barnes, T. J., and M. W. Wilson. 2014. Big data, social physics, and spatial analysis: The early years. *Big Data & Society* 1(1). https://doi.org/10.1177/2053951714535365.

boyd, D., and K. Crawford. 2012. Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon. *Information, Communication & Society* 15(5): 662–679.

Brucato, B. 2017. Big data and the new transparency: Measuring and representing police killings. *Big Data and Society* 4(1). https://doi.org/10.1177/2053951717696332.

Bryan, J., and D. Wood. 2015. *Weaponizing maps: Indigenous peoples and counterinsurgency in the Americas*. New York, NY: Guilford Press.

Bunge, W. 2011. *Fitzgerald: Geography of a revolution*, 2nd edition. Athens, GA: University of Georgia Press.

Burns, R. 2015. Rethinking big data in digital humanitarianism: Practices, epistemologies, and social relations. *GeoJournal* 80(4): 477–490.

Cardullo, P. 2015. 'Hacking multitude' and Big Data: Some insights from the Turkish 'digital coup'. *Big Data & Society* 2(1). https://doi.org/10.1177/2053951715580599.

Cobarrubias, S., and J. Pickles. 2008. Spacing movements. In *The spatial turn*, ed. B. Warf and S. Arias. New York, NY: Routledge, 36–58.

Colectivo Situaciones. 2002. *Hipótesis 891: Más Allá de los Piquetes*. Buenos Aires: Ediciones Mano en Mano.

Couldry, N., and A. Powell. 2014. Big Data from the bottom up. *Big Data and Society* 1(2). https://doi.org/10.1177/2053951714539277.

Counter\mapping Queen Mary Collective. 2012. Countermapping the university. *Lateral* 1(1). http://csalateral.org/issue1/.

Crampton, J. 2010 *Mapping: A critical introduction to GIS and cartography*. New York, NY: Blackwell.

Crawford, S. 2014. Detroit and big data take on blight. *Bloomberg View*. August 22. https://www.bloomberg.com/view/articles/2014-08-22/detroit-and-big-data-take-on-blight.

Currie, M., B. S. Paris, I. Pasquetto, and J. Pierre. 2016. The conundrum of police officer-involved homicides: Counter-data in Los Angeles County. *Big Data and Society* 3(2):1–14.

Cwiek, S. 2014. The 2014 Wayne County tax auction is over. *Michigan Radio WUOM*, October 29. http://michiganradio.org/post/2014-wayne-county-tax-auction-over-key-details-slow-emerge#stream/0.

Dalton, C., and L. Mason-Deese. 2012. Counter (mapping) actions: Mapping as militant research. *ACME: An International E-Journal for Critical Geographies* 11(3): 439–466.

Dalton, C. M., and J. Thatcher. 2015. Inflated granularity: Spatial "Big Data" and geodemographics. *Big Data & Society* 2(2). https://doi.org/10.1177/2053951715601144.

Deleuze, G., and F. Guattari. 1987. *A Thousand Plateaus, Capitalism and Schizophrenia*. Translated by Brian Massumi. Minneapolis, MN: The University of Minnesota Press.

Eltantawy, N., and J. Wiest. 2011. Social media in the Egyptian revolution: Reconsidering resource mobilization theory. *International Journal of Communication* 5. http://ijoc.org/index.php/ijoc/article/view/1242/597.

Elwood, S. 2006. Critical issues in participatory GIS: Deconstructions, reconstructions, and new research directions. *Transactions in GIS* 10(5): 693–708.

Fortun, K., L. Poirier, A. Morgan, B. Costelloe-Kuehn, and M. Fortun. 2016. Pushback: Critical data designers and pollution politics. *Big Data and Society* 3(2): 1–14.

Gabrys, J. 2016. Practicing, materializing and contesting environmental data. *Big Data and Society* 3(2): 1–7.

Gerlach, J. 2010. Vernacular mapping, and the ethics of what comes next. *Cartographica: The International Journal for Geographic Information and Geovisualization* 45(3): 165–168.

———. 2014. Lines, contours, and legends: Coordinates for vernacular mapping. *Progress in Human Geography* 38(1): 22–39.

Gieseking, J. J. 2017. Size matters to lesbians too: Queer feminist interventions into the scale of big data. *The Professional Geographer*. http://www.tandfonline.com/doi/full/10.1080/00330124.2017.1326084.

Gradecki J., and D. Curry. 2017. Crowd-sourced intelligence agency: Prototyping counterveillance. *Big Data and Society* 4(1). https://doi.org/10.1177/2053951717693259.

Graham, M., B. Hogan, R. K. Straumann, and A. Medhat. 2014. Uneven geographies of user-generated information: Patterns of increasing informational poverty. *Annals of the Association of American Geographers* 104(4): 746–764.

Gross, A., and B. Schatz. 2014. Congress is finally to make local law enforcement report how many people they kill. *Mother Jones*, December 17. http://www.motherjones.com/politics/2014/12/death-custody-reporting-act-police-shootings-ferguson-garner/.

Haraway, D. 1991. *Simians, cyborgs, and women: The reinvention of women*. New York, NY: Routledge.

Harris, L., and H. Hazen. 2005. The power of maps: (Counter) mapping for conservation. *ACME An International E–Journal for Critical Geographies* 4(1): 99–130.

Hirt, I. 2012. Mapping dreams/dreaming maps. *Cartographica* 47(2): 105–120.

Holmes, B. 2003. *Imaginary maps, global solidarities*. Rotterdam, Holland: Piet Zwart Institute, Willem de Kooning Academy. http://www.automatist.org/photo/Pictures/pzi%202002-2006/2003-04-brian_holmes/Piet%20Zwart%20Institute%20-%20Imaginary%20Maps,%20Global%20Solidarities.html.

Hoyng, R. 2015. From infrastructural breakdown to data vandalism: Repoliticizing the Smart City? *Television & New Media* 17(5): 397–415.

Kitchin, R. 2013. Big data and human geography: Opportunities, challenges and risks. *Dialogues in Human Geography* 3(3): 262–267.

——. 2014. *The data revolution: Big data, open data, data infrastructures and their consequences*. Los Angeles, CA: SAGE.

Kitchin, R., and M. Dodge. 2007. Rethinking maps. *Progress in Human Geography*. 31(3): 331–344.

Mapping Police Violence. 2017. *Mapping Police Violence*. May 13, 2017. https://mappingpoliceviolence.org/

Mathews, M. 2014. Making the world a better place with big data. *Plexxi*, October 22. http://www.plexxi.com/2014/10/making-world-better-place-big-data/.

Merrifield, A. 1995. Situated knowledge through exploration: Reflections on Bunge's 'Geographical Expeditions'. *Antipode* 27(1): 49–70.

Morozov, E. 2014. *To save everything, click here: The folly of technological solutionism*. New York, NY: Public Affairs.

Palmer, M. 2012. Theorizing indigital geographic information networks. *Cartographica* 47(2): 80–91.

Peake, L., and E. Sheppard. 2014. The emergence of radical/critical geography within North America. *ACME: An International E–Journal for Critical Geographies* 13(2): 305–327.

Peluso, N. L. 1995. Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. *Antipode* 27(4): 383–406.

Pickles, J. 2004. *A history of spaces: Cartographic reason, mapping, and the geo–coded world*. New York, NY: Routledge.

Porway, J. 2015. Five principles for applying data science for social good. *Data Culture,* October 1. https://www.oreilly.com/ideas/five-principles-for-applying-data-science-for-social-good.

Precarias a la Deriva. 2003. *First stutterings of 'Precarias a la Deriva'*. Caring Labor Archive. https://caringlabor.wordpress.com/2010/12/14/precarias-a-la-deriva-first-stutterings-of-precarias-a-la-deriva/.

Schutt, R., and C. O'Neil. 2013. *Doing data science: Straight talk from the frontline*. Sevastopol, CA: O'Reilly Media.

Singer, B. 2016. A chronology of tactics: Art tackles Big Data and the environment. *Big Data and Society* 3(2): 1–9.

Thatcher, J. 2014. Big data, big questions | Living on fumes: Digital footprints, data fumes, and the limitations of spatial big data. *International Journal of Communication* 8. http://ijoc.org/index.php/ijoc/article/view/2174.

Warren, G. 1971. About work in Detroit. *The Detroit Geographical Expedition and Institute Field Notes III*. Pp. 10–16 http://freeuniversitynyc.org/files/2012/09/Detroit-Geographical-Expedition-and-Institute-1971.pdf

Wayne County Treasurer (Office of). 2016. *Terms and conditions of sale.* https://www.waynecountytreasurermi.com/BiddingRules.aspx.

Wilmott, C. 2016. Small moments in Spatial Big Data: Calculability, authority and interoperability in everyday mobile mapping. *Big Data and Society* 3(2). https://doi.org/10.1177/2053951716661364.

Wood, D. 2010 *Rethinking the power of maps*. New York, NY: Guilford Press.