ECOLOGIES OF DIGITAL MAPPING: OPEN SOURCE COMMUNITIES AND GRASSROOTS MAPS

BY

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DISSERTATION

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ABSTRACT

This dissertation explores the work and practices (both online and offline) of digital mapping communities in matters of disaster management, environmental justice, and grassroots activism. My interest in these communities stems from their drive to integrate considerations of the lifeworld, in the parlance of Jürgen Habermas, into systems of digital mapping to create and maintain actionable data archives. The project is a multi-method qualitative approach employing archaeological analysis, Critical Discourse Analysis (CDA), and participant observation to study three communities: Humanitarian OpenStreetMap Team (HOT), OpenStreetMap (OSM), and Public Lab.

While Habermas' work influences the slate of methods, Susan Leigh Star's conceptualization of ecologies and Michael Burawoy's extended case method equally inform it. The dissertation is comprised of eight chapters which explore the role of mapping in contemporary times and why it is worth studying; detail the theoretical and methodological purview at hand; analyze archived documents from the administrations of President Clinton and President George W. Bush on imagined public use of GPS; examine discursive commitments of grassroots mapping in its values, beliefs, and practices; delve into the work of each of the aforementioned communities through participant observation; and summarize responses to the project's research questions while specifying what one can gain from seeing maps as ecologies. Accordingly, I argue that mapping merits fuller explorations in terms of discourse and practice; human and nonhuman production; and different space-times in contribution. This is needed to complicate the increasingly "living" nature of maps; the development of the infrastructures, policies, and technologies underpinning nonexpert-produced maps; and inventive use of maps towards matters of the public sphere.

Envisioning digital mapping systems as complex ecologies in doing so more critically accounts for the challenges that ethical orientations toward technology, intellectual property policies, and structures of class, colonialism, and gender in relation to technology pose in nonexpert

production of maps. Work in communication and media research and Science and Technology Studies (STS) provides a critical foundation for such investigations. However, this dissertation also refines conceptualizations of mapping and technology in these areas to account for the current state of such formations.

ACKNOWLEDGEMENTS

While writing this dissertation, the downtown area of where I grew up flooded twice in two storms deemed as "once in a century" occurrences. Throughout the city's history, overrun from the nearby river has been a constant problem. But with the caliber of storms we now face as a result of human-produced climate change, it is now an annual fear. The aftermath of these storms has ignited public conversation on how to best plan around the ever-looming possibility of the unthinkable striking a third time sooner rather than later. While living and working on campus at Illinois as these conversations continue, I have found some solace in thinking through related issues in terms of waterway monitoring and mapping of areas afflicted by natural disasters within this dissertation, in ways I feel warrant noting here to bring that facet of this work to readers' attention. For a project honed on the role of the situated in mapping practices, this seems fitting.

I as always want to start by thanking my family, my friends, my teachers, and Maja Vlajnic, who transcends all of those categories. I am of course indebted to various figures in the Institute of Communications Research for their time and generosity. First and foremost, Professor Cameron McCarthy has been an exemplary mentor. The range of ideas I present in this dissertation simply would not have come together without his guidance, and I am a better scholar for having developed this dissertation alongside him.

Professor James Hay's New Media Theory course was the starting point for this project. I wrote and presented an early draft of Chapter 3 as a final project for the course, one that, upon submitting it to conferences, received positive feedback and encouragement toward a broader project on the issues it identifies. This inspired the chapter sequence for the dissertation. As such, I am deeply appreciative of Professor Hay's teaching in providing the first step for this project.

I have learned more working with Professor Anita Say Chan than I could summarize here. Professor Chan first discussed Public Lab's work with me when we first met in person based on my interests in digital mapping. That conversation has obviously carried over into this project. But in working with Professor Chan under the Mellon-funded Innovation in the Global Midwest research cluster the past few years and collaborating on course designs centered on media production, storytelling and community data based on that research, Professor Chan has entrusted me with a wide array of projects and provided me with invaluable teaching, research, and project management experience. Much of that research plays a role in the dissertation, from perspectives on second-order cybernetics and accessibility designs to cultures of computation writ large. The project is far stronger for these additions as well as for the local knowledge of the Champaign-Urbana area and its history that I gained through that research.

Last, but certainly not least, I want to thank Professor Kevin Hamilton for our formative conversations on this project and for his early stewardship of the Learning to See Systems INTERSECT program, for which I served as a graduate fellow during my first two years at Illinois. In the chapters that follow, I return consistently to scholarly traditions explored as part of the program. I am thankful for the framing my intellectual training as part of the program has provided.

I additionally want to thank the editors and reviewers of the forthcoming *Macrotask Crowdsourcing: Engaging the Crowds to Address Complex Problems* collection. Their support and advice in applying my research toward the dissertation to insights and literature from HCI helped reinvigorate portions of many of the sections that follow. My contribution to the collection includes selections from this dissertation, most notably from the Introduction, Chapter 3, Chapter 5, Chapter 7, and the Conclusion. These chapters are in turn stronger for the encouragement I gained throughout the editing of the collection.

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CHAPTER 1

LIVING MAPS – A PREFACE

Have others tried their hand at crowd-sourcing map data as well? Absolutely. Waze and Google – or, just Google now – provide similar mechanisms to improve their maps, based mostly on OSM's innovations. With one big catch. It is very much their map. Not yours. (Just ask the developers who pay a lot of money to use it.)

OpenStreetMap is different. All of the quality data contributed is openly available – just like Wikipedia. So, anyone can download, experiment and play with it freely. It's not locked up beyond your reach.

- Steve Coast, founder of OpenStreetMap[1]

Early in my research for this project, I noted this quote from Steve Coast in a webinar slide presentation on humanitarian satellite efforts. The webinar featured Humanitarian OpenStreetMap (HOT) and leading open satellite imagery initiatives. In discussing the quote, a presenter described OpenStreetMap (OSM) as a "living thing," a product of a global network of hobbyists and humanitarian volunteers that adds data to the platform continuously. In contrast to Google Maps, which turns users into "sharecroppers" by using their location and data to strengthen Google's understanding of the user as a consumer while keeping users locked out of free use of its aerial imagery and spatial data, OSM is (as Coast echoes) an open alternative.[2] On such an open platform, use or modification of code, data, and community techniques is permissible, provided one attributes the platform and shares any improvements.[3]

This "living" dimension of OSM exemplifies how the digital state of maps now means maps evolve at a more rapid pace. They can combine a range of data to afford possibilities for more and different maps**.** These capacities warrant further scholarly understanding than the current literature available on mapping provides. *Ecologies of Digital Mapping* breaks ground in exploring maps as living – as agents of rapid transformation and dialogue in and of themselves whose ramifications merit

critical attention. It forces discussions of mapmaking out of the traditional domains of cartography, mimesis, and cultural geography and toward conversations embedded within mass communication, mediatization, and the aesthetics of the self.

A study of digital mapping matters for communication studies because digital mapping has become increasingly embroiled in interrogations of the ties between and points of potential within mass media and democracy, as the second section of this preface details. While work in critical media theory and studies of media, space and place provides compelling starting points for such a perspective, communication and media research has yet to stake a claim as this project does in offering a critical lens in both theory and methodology to the production of maps online, digital mapping imagery, and online mapping communities. This mode of production raises questions on conventional framings of communities and publics, divorcing them from typical notions of physical contiguity as a defining feature.

What can be gained from doing so is a fuller conceptual model of what maps communicate, how they communicate, and who or what communicates through them. As mapmaking accelerates within digital production and aggregates more of users' data ecologies, honing in such an understanding of what maps, amateur cartographers, environments, and everyday users of map-enabled applications perform within mapping is pressing. Hence, *Ecologies of Digital Mapping* not only seeks to bring mapping technologies and processes into communication and media studies, but more broadly rethinks the objects the field typically investigates and how it frames their evolution.

This preface lays the foundation for conversations that arise in later chapters by articulating what is significant about the role of mapping in contemporary society. It sets the thematic groundwork for the chapters that follow, whereas the Introduction (Chapter 2) details the bodies of theory, case studies (HOT, OSM, and Public Lab), methodologies and body chapters at hand. Within this preface, I convey three points. The first is that the caliber of study mapping warrants is

one studies of mass communication have long established in approaching other forms of media and communication. The second goes beyond this foundation to claim the digitization (or "living" nature) of mapping opens it to realms of critical thought that can refine our understanding of mapmaking as a process. The third is that, among these realms of thought, feminist understandings of science and technology, nature, and development policies emerge as particularly insightful. They underscore considerations of the dense and diffuse arrangements between the nonhuman and the mapper that research in mapping must better recognize moving forward. The latter two points contrast the longstanding academic vision of maps as immutable mobiles within Science and Technology Studies (STS) and critical cartography and as objects of authority (rather than partiality) within popular thought.

Ecologies of Digital Mapping explores the work and practices (both online and offline) of digital mapping communities in matters ranging from disaster management, environmental justice, and grassroots activism more broadly. What is at stake theoretically and methodologically is a fuller explanation of ecologies within communication and media research than what historical perspective in the field currently reflect. The specific intervention here lies in bringing nonexpert mapping campaigns – born often out of disillusion with prevailing mapping platforms, licensing practices, and government response to the most urgent issues of our time – into the fold of mass communication studies and critical media production. The aim in doing so is to bring the insights of critical cartography to map production – not just at the level of theory, but, crucially, at the level of practice. Such a focus serves as a critique of the transformational framing the platforms that host these campaigns advance and a call to accept the "messiness" of our current digital mapping environment for its productive entanglements.

That call is in large part a refusal to take such framings and their appeal to a civic-minded and working-class ethic at face value. This refusal is not a matter of cynicism – in fact, quite the

contrary. Just as mapping requires intense work (pivotally including but not limited to representation), so too does realizing such framings. This investigation can thus speak to how to seek this realization in ways that can better safeguard against haphazard project treatments.

This preface, in particular, highlights the ramifications of recombination within digital mapping and the need to complicate the "living" nature of digital mapping through Critical/Cultural Studies and STS. Digital maps are living in nature, but also *represent* living processes. The lack of regard for maps at the level of representation in this project is not one of myopia, but a tactical decision to bound the project in a more impactful manner. For such analyses, readers have ample options at their disposal**.** Instead, I focus on distinguishing digital mapping as a matter of translating data into a geospatial visualization, which crucially involves a great deal of work outside the matter of representation. Digital mapping computes difference while also – like more traditional maps – seeking to bring environments at a distance to those who have never resided in or visited such areas.

What it means to undertake a study of mapping within such relatively "new" circumstances in digitalization is that diagnoses of these circumstances present an opportunity for scholars to revisit ideas about mapping that long predate the digital so as to think more critically about consistencies and transformations of the form within its digitalization. The preface thus addresses the following questions: what is a map? Why is mapping worth studying? Why is mapping increasingly a matter of communication and media, not just one of cartographic disciplines, institutions, or expertise? How do maps circulate within structures of difference? What can maps reveal about the modern condition and the role technologies play within it?

These are all questions that a perspective accounting for work in critical media studies and STS is well-positioned to address. In these explorations, I contend maps can make arguments, condition and manage behavior, generate spatialities, and decolonize space in ways that counter their typical strategic uses. They make sense of myriad forces that bear on the human and the nonhuman,

and make new ways of understanding them possible. Recognizing the spatialities, identities, materialities, and agencies maps include or render possible opens the study of maps beyond matters of optimization or representation. These agencies include the imprint of employed media forms within the production of the map. I use the work of Gilles Deleuze specifically to argue maps aggregate diverse agencies and institutions, create the possibility of further maps, and merit study for their decolonizing potential in political and scholarly interventions on the construction of space. This is despite the problematic formations maps have historically supported and are currently supporting, which I explore in this preface as the monstrous capacities of mapping.

What is a Map?

In terms of representation, maps pin meanings to a location. They can link objects, statistics, and populations together on a common plane.[4] Maps, however, do more than simply represent. They lie within Bruno Latour's discussion of seat belts, doors, speed bumps, and keys as part of "the missing masses," material agencies that cement meticulously defined yet underrecognized schemes of action intended in technological and spatial designs. To borrow Latour's terms, the map *prescribes* one's location in a space and *delegates* via compasses, lines, and symbols for landmarks and landscape features. These elements simplify navigation, indicating which way is North, where to walk or drive, and what places one might seek in a given area. Such information conditions users' behaviors.[5]

Yet maps must also be seen more in a more rhizomatic sense. Deleuze describes the rhizome as a collection of nodes with endless possibilities of connection, being disconnected and reconnected constantly to forge new significations. He refers to the rhizome itself as a map; it is ceaselessly between being, with no start or end. This flux, as opposed to authority, constitutes what Deleuze means by territorialization and reterritorialization.[6] The ability of users to edit maps and

decode aerial imagery collaboratively or to remix different data and archives into geospatial representations on open mapping platforms certainly speaks to a growth of different maps, cultures of expertise, and worldviews in dialogue with each other, rather than a single authoritative map.

This resonates with Deleuze's fashioning of the map as generative and emergent. Since spaces are always in processes of realization – multiplicative and transformative, rather than being realized – maps, for Deleuze, emerge as artifacts of superimposition after superimposition rather than embodying any "real" space or having any originating state.[7] In their rhizomatic capacities, maps can compel subjects to reimagine spaces toward liberation. From toxic tourism to queer, feminist and indigenous reimagining of space, maps can confront structures of power in ways the primarily religious and state historical uses of maps did not.[8] Various scholarly projects have likewise used mapping to examine detriments of capitalism and imperialism – systems cartography has notoriously abetted.[9] Maps thus engage in politics as subjective encounters with what spaces mean. One cannot separate space and maps from politics, even though some in the membership of online communities facilitating mapping work do, nor presume the politics of such communities without tracing subjectivities and assemblages they foster.[10]

Maps are thus not self-evident. A sphere cannot be represented as a flat surface perfectly. All mapping projections embellish certain elements and compromise on others. Cartographic groups have long recognized these tradeoffs.[11] Various mapping projections exist, but almost all Western educated subjects learn from the Mercator projection. Many criticize it as a Eurocentric worldview affording more landmass to areas within the Global North than areas within the Global South. The effect is becoming more widely acknowledged outside of cartographic circles. Institutions like Boston Public Schools are switching to other projections like the Peters projection accordingly.[12]

This unravels the popular myth that mapping is now an accurate and complete endeavor with its digitization. Mapping is not just scientific, but performative and artistic. Fittingly, there was

little distinction during the Renaissance between landscape painting and mapping. Both involved similar techniques of viewing and representing space, with both even "often done by the same people."[13] In turn, recent examples in feminist cartography of depicting largely imagined spaces include Valerie S. Goodwin's *City Grid IV* and Emily Garfield's *Growing Fields (Cityscape #100)*.[14]

The Deleuzian trace more appropriately speaks to the false pursuit of the accurate and the complete. To trace is to commit the structural and to cede the constructed and "standing" order of a space. The rhizomatic thinks more experimentally, rather than in terms of ontological stability. It highlights emergent properties from the interactions that result from unconventional approaches to capturing or navigating space. The conventional approach to space via tracing in our current times is that of routing via Google Maps, or of using aerial imagery to fix a space and its dynamics as a means of knowing, rather than appreciating its constant becoming. To map in our current times is to experiment with more uncertain means, to entangle oneself with natural elements, everyday methods, and technological infrastructures to support community-minded initiatives. It disrupts the typical hierarchical order, at both institutional and spatial levels.[15] The chapters that follow examine the online communities at hand for how their output can be both trace-based and rhizomatic.

Communication scholarship can attend to maps' rhizomatic significance. While better known for distinguishing transmission and ritual views of communication, James Carey's "A Critical Approach to Communication" frames the map as producing different realities out of the same spaces that one must constantly negotiate. As a metaphor for the symbolic dimensions of communication in the essay, maps allow for different performances of space and thus the possibility of creating new spatial models. It is not merely a matter of representation, but the production of space.[16] Likewise, as critical/cultural work recognizes, distinct cultures and subjectivities experience space in radically different ways that necessitate mapping being rhizomatic and incomplete. These different spatialities in large part justify the need to study maps, as does the nature of the broader

information ecosystems maps now operate within.

Why is Studying Maps Important?

An xkcd comic strip entitled "Most-Used Word in Each State Based on Something Something Search Data" exemplifies what one often thinks of as a map. It is an image of an area (in this case, specifically, the United States) with borders, different distinguishing colors to demarcate different regions, and text to label each state. Reading the text in English from left to right and top-down – a presentation presuming the reader is Western educated – the map reads, "You can make these maps say whatever you want by adjusting the methodology. Half the time you're just amplifying random noise because the underlying data doesn't vary that much from one state to another. But whatever. Nobody checks this stuff. Just pick whatever normalization lets you make fun of Florida." The last word is imposed over Florida as the comic's punchline.[17] The map as a mode of manipulation – what the comic ultimately speaks to in the skewed presentation of search data within "clickbait" maps – mandates critical literacy in how maps disseminate data.

The ways digital mapping representations aggregate and present data, especially now with users' consent into different apps and online services, make digital mapping worth studying in a multidisciplinary framework. What merits consideration in a study of maps fits squarely within the promise and dangers of mass media from the advent of the printing press on. With the capability to publish and distribute more information to further reaches of the public, one might celebrate how mass media could bolster a more educated, literate citizenry in the issues that affect them. This extended reach and ease of publishing, however, could also lead to easier manipulation by propaganda. The work of the Frankfurt School**,** dissecting ramifications of mass media and culture

leading up to and following WWII, encapsulates this fear. These conversations on media must be applied more overtly to the context of digital mapping within transnational information capitalism.

Evgeny Morozov further complicates associations between technology and democracy within pervasive mapping platforms. These connections neglect non-Western forms of democracy and how democratic pursuits can be upended via technological use. Morozov cites factions in Russia using Google Maps to target immigrants as an example. Such are the dangers of seeing maps as neutral artifacts on which ideals of democracy may be projected and enacted without complication.[18] President Trump's use of aerial imagery from President Obama's inauguration to cover up the far smaller crowd at his own inauguration, as well as the online circulation of crowd photos from the 2016 Cleveland Cavaliers and 2019 Liverpool victory parades with false attributions of documenting a Trump rally crowd and a British crowd of supporters during Trump's 2019 UK visit respectively, highlight the dangerous decontextualization of the aerial image.[19] When publics lack access to needed information on this front, never mind the means of producing their own aerial imagery to refute such lies, the object at hand becomes a matter of fact in the Latourian sense, rather than the more complicating agent – a matter of concern.[20]

The strive for the complete map, moreover, has justified expanded surveillance, and can help realize a society of control. Another Deleuzian concept, the society of control involves integrated devices that guide, grant, and restrict access to different spaces of everyday life, encouraging efficiency and disciplining in ways beyond the Foucauldian emphasis on spaces of enclosure. These include the spatial designs of hospitals, schools, and prisons and how they facilitate a disciplinary gaze – be it a doctor over patients, teacher over students, or guards over prisoners.[21]

The Disney-Pixar film *WALL-E* exemplifies the society of control through the Axiom space station the corporation Buy-N-Large operates. Residents of the space station live there due to human activity rendering Earth uninhabitable. They live in pods that route them from place to place,

ushering them from one station of everyday activity and consumption in the Axiom to the next.[22] A well-mapped network of tracks, a prime concern for platforms like Google Maps in routing and advertising to consumers, is vital toward this efficient consumer subjectivity.[23]

WALL-E, at the same time, introduces the import of cultivation as a countermeasure to the society of control. The protagonists, WALL-E and EVE, discover a plant on Earth early in the movie, signifying Earth is ready to sustain human life again. By the film's end, they register the plant within an Axiom chamber to set a return course to Earth for the residents of the Axiom to inhabit again. *WALL-E* thus pits the organic (a major project theme in discussing grassroots mapping) as the panacea to the society of control. Put another way, *tending* to the environment and to each other, rather than being *attendant* in the disciplinary mold, provides the way out the programmatic, scripted life control imposes.[24] The ability to create and tend through the rhizomatic – creating new worlds and the very possibility of different worlds – is key to seeing what our understanding of maps can gain from the purview of communications and media studies.

Mapping, Communication, and Culture

Media's role in such transformations is complex. An ecology of communication perspective does not see technology as spurring societal change on its own, but recognizes technological advancements as concomitant with changing social conditions. Their affordances and constraints have shifting ramifications. David Altheide's metaphor of a baseball field is quite useful, as baseball fields change according to abilities of the home team's players. Technologies and social uses, needs, and innovations can thus evolve beside each other.[25] The shifting field at hand here is one still experimenting with how to leverage publics in transformative and community-led mapping projects.

The nonprofessional mapping subject in the digital age is one who is invited to chart terrain as it is experienced both within and outside of its everyday activity. The latter has long been the case; the former is by comparison more contemporary. Todd Presner, David Shepard, and Yoh Kawano historicize the ambition to view the world as an observer somehow outside of it as one does on digital mapping interfaces. It is equally present in Christianity, the Renaissance, colonialism, the Enlightenment, militarism, and now, phone application design.[26] It conjures the Heideggerian fear of positing the world as an image for the subject to imagine means of order and rationalization of space, a concern of Frankfurt scholars.[27] As second-order cybernetics would point out, such visualities posit wrongfully that one can be outside of any system they are observing.[28]

The critique of mapping as omniscient practice is prevalent in work in STS and media studies.[29] Seeing digital mapping interfaces as media – as meaningful stand-ins between a space and how subjects grow to see a space due to our reliance on media forms – is necessary to see how those interfaces both extend this historical view and afford unintended use. The latter invites "observers" to recognize their role in this broader visual system and subvert it as necessary. This project sees geospatial media as cooperating with both beneficial and detrimental formations and sees mapping projections in terms of what they afford and what they constrain.[30] Tracing imaginaries and discourses surrounding public-produced maps as well as the unintended ways corporations and citizens have employed mapping can illuminate these dimensions.

Spaces are never separate from the media that represent them. Frankfurt School cultural theorist Walter Benjamin elucidates emerging media always come with nuanced space-times through his example of film.[31] Benjamin theorized that film cuts up, reassembles, and alienates the viewer from the original performance or space being captured. The subsequent distance art now enjoys – first with mass printing and now with the internet, both modes of mechanical reproduction – from the particularities of its production may compromise the uniqueness of its existence and its

experience (what Benjamin terms as aura). Bringing space and the image closer for consumption, to Benjamin, also makes it further away; art that depicts increasingly smaller-scale phenomena through such technologies (as maps have now been applied to do) equally compromise.[32] Maps, in their capacity to capture communities remotely and portray them from afar without local knowledge or input, demonstrates similar capacities in their production and circulation requiring critical attention.

Mediation equally saturates science, which fashions ecologies of media in its dialogue with its instruments to represent largely invisible formations. These formations, rather than being clarified through tools and maps, can blur and become more unsettled due to what maps materially introduce. Takes on the use of visualization tools that focus on grounded practice thus have merit.[33] While Marshall McLuhan's famous adage that "the medium is the message" contends media extend human sensorial capabilities, the ways media materially permit and alter what is captured within scientific visualizations must be teased out, as well as differences in how different cultures interpret and use their output.[34] This involves, to STS scholar Stefan Helmreich, "tangling with theory . . . , recognizing that ways of seeing . . . are always informed, performed, and deformed by their medium."[35] Studying maps should speak to "the attention to media, materiality, and method in humanities scholarship, [and] the . . . ways in which cultural-historical questions are articulated, investigated, and emplotted as arguments," as cartographer Denis Wood equally implores.[36]

From the 1960s on, mapping research has seen maps as a mode of communication, but mostly in terms of optimization in design.[37] Studying mapping and how its communities are imagined is thus well-warranted. Wood questions why mapping is so often seen as scientific rather than as a mode of argumentation, writing, and dialogue that performs and does not simply present.[38] Keith Harries concurs that "[i]n cartography, as in medicine, art and science are inseparable. The perfect map blends art and science as an effective tool of visual communication."[39] These associations contrast the conventional communications paradigm concerned about the effects of a

message, rather than what it may represent, how it might be interpreted, or how it circulates.[40]

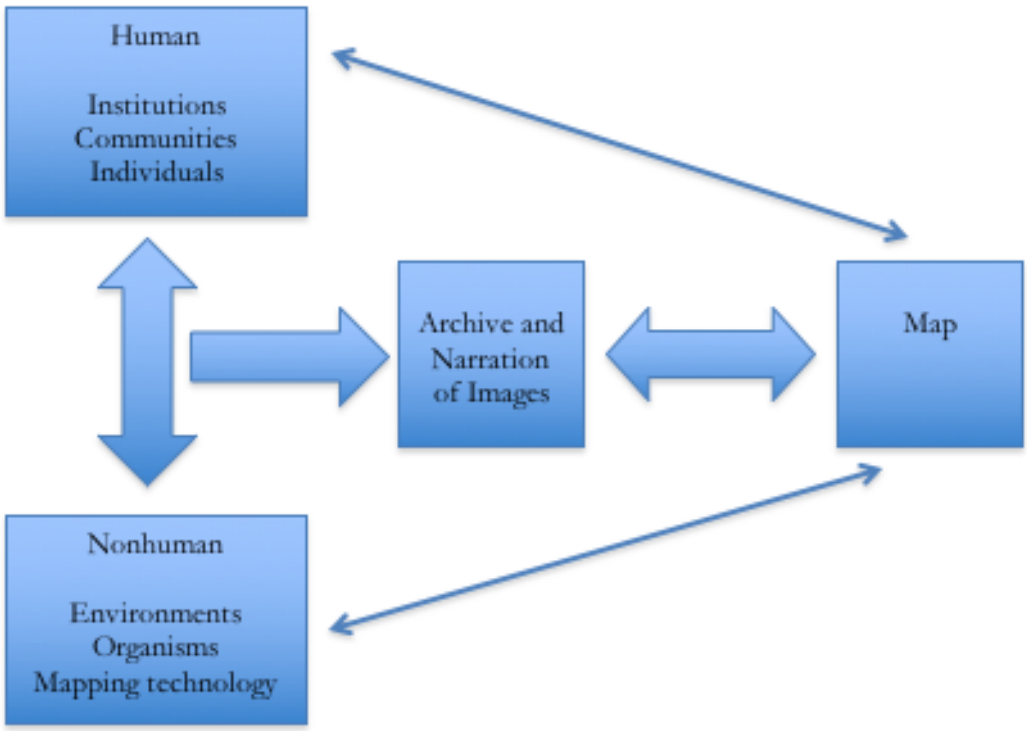

Figure 1.1: A Proposed Model of Communication in Mapping Ecologies. Human and nonhuman elements interact in the act of mapping. This influences subjective interpretations of the encounter, affecting the constructed archive and narrations of images. These are ultimately what the map (which circles back into the human for reflection or reuse and represents or ignores the nonhuman, setting it up to resist or conform to its given spatial vision) is built from. It then sets the stage for further interaction between human and nonhuman elements in its use. Mapping is thus a constant negotiation of space and its communication.

Ecologies of Digital Mapping thus identifies and questions a historical blind spot in studying maps. It thinks through maps in a communication framework going beyond the human, considering ecologies (or, broader systems maps and mapmaking are placed within) fully. Maps are entwined within different cultural processes, understandings of space, archives of data, legal understandings of who owns and can use data, and media forms capturing nonexpert-produced spatial data. A practice-based approach toward mapping highlights these networked ties, which exist "between many different artefacts, technologies, institutions, environments, abilities, affects, and individuals." Their nature, to Chris Perkins, mandates an ethnographic approach pitting maps "as part of an ongoing

cultural process" that reveals the evolving, contentious role social relations and the nonhuman play in mapping.[41] As I image below in Figure 1.1, what the digital nature of mapping affords in terms of the capacity for transformation of spatial imaginaries accords with the role of interpretation between the object or text, reception, and transformation of the object or text that media studies elucidates.

There are various material considerations to this process at the level of media. How digital mapping platforms run off constantly updating image archives, rendering them consistently created anew – a montage, not a snapshot – is often unexamined.[42] Montage itself derives from the French "monter," meaning "to assemble." Editor and editing share similar etymologies across the Spanish and Italian languages. The easiest metaphor of the assembly at work in montage lies in the use of archived footage within documentary film, which breaks the times and spaces of capture that each source captures and assembles them together to create a meaningful interpretation that emerges out of their being woven together. The nature of how particular documentarians assemble arguments through this practice are not innocent; it manifests particular political and ideological decisions.[43]

Ecologies of Digital Mapping shows that mapping as a process – especially under grassroots and crowdsourced frameworks – deserves a similar perspective. The montage as a frame for digital mapping borrows from media and cinema studies and better reflects how such platforms are crafted. Like juxtaposing shots, mapping e-waste, for instance, renders an invisible and fragmented formation both visible and contiguous via mediation.[44] From these associations, one can see an opportunity for communication and media studies to intervene in contemporary matters within digital mapping, thinking through the particular crafting and modes of production in both dominant and community-driven platforms. The technologies and platforms enrolled in practices involved in both serve as spaces for the deliberation of methods and epistemologies, ones inextricable from the media forms enrolled in the virtual community environment and the physical environment.

What these media capabilities provide, to Benjamin, has outpaced abilities to make sense of them. They are often used for destruction; the imperial use of maps and GPS is no exception. Use of both isolates and targets as Benjamin fears with technological development. The point is to recognize the politics that such artifacts have, rather simply seeing what they afford in visuality and knowledge.[45] One must thus see geospatial technologies' participation in structures of "inclusion and exclusion, empowerment and disempowerment," as critical/cultural scholars contend. The historical inattentiveness to marginalization in Geographic Information Systems (GIS) projects "is linked to the ensuing exclusion of their needs . . . from policy and decision making."[46] This reflects how practices of archiving can silence the marginalized. Since the archives geospatial projects have conventionally been built from, such as census and property data, do so, so too can those projects.[47]

One can thus argue that the motivation for lay public involvement within mapmaking in a broad sense is to speak back to representations that can often mediate and stand in for reality precisely in the manner that Jean Baudrillard identifies in his discussions on mapping as simulation via Borges' "On Exactitude in Science." Though investments in maps as simulations are a strong undercurrent to popularized digital cartography, I argue the modes of production involved are attempts to correct how the "shreds" of the territory "are slowly rotting across the map" as Baudrillard laments within his model of simulation.[48] A living map does not safeguard itself from this rotting inherently; as with any map, it is (as the aphorism holds) "not the territory." But it is not as immutable as Latour's vision of the conventional print map, and can thus be more in time with the territory, provided that the production model open platforms idealize via low barriers of entry for non-professionals continues to contribute regularly.

Mechanical reproduction increases the number of potential cartographers, many of whom are not professionals. Through the capturing technologies employed, these subjects see more at more and more particular scales. This is not simply a matter of extending sensorial capacities

through media, but, through its affordances, the nature of the agency it too has in revealing new formations. In turn, the next section covers the intersections of digital mapping not just with notions of contemporary spatialities, but with identities, materialities, and technological agencies.

Mapping, Modernity, and the Monstrous

As postcolonial scholar CLR James attests, one must look at the popular to gain a sense of the modern and everyday life and gauge the cultural work of one's creative labor. Such work relays the imaginative potential and tensions inherent in modernity, including tensions between artistic ideals and the everyday.[49] Modernity itself is plagued increasingly with questions of where one is and how one gets from one station in life to the next, as Marxist theorist Frederic Jameson's concern with cognitive mapping reflects.[50]

Jameson and media theorist Lev Manovich concur with Benjamin that digital technology production outpaces the human capacity to gauge its utility, resulting in the spaces and flows maps represent never being fully grasped as absolute.[51] Additionally, Jorge Luis Borges' oft-cited flash fiction in humanities-oriented discussions of a map so well-scaled it exists as the "real" space itself justifies how modern maps' "improved" scales confuse representation with referent and dissipate distinctions between the simulated and the "real."[52] These simulations encounter and inform the "real," assuming reality's status in their supposed objectivity despite being mediation.[53]

The way maps name places, for instance, can change users' everyday experiences with those places. The existence of paper towns, towns labelled on maps that initially do not exist in the lived environment but become real due to their existence on a map, shows this at work. Dominant digital representations like Google can equally name places in ways that differ from how communities label them yet eventually become the name by which those communities are referenced.[54]

Rather than seeing the power of maps to dictate the "real" as absolute, one must be mindful of the power identity and difference can play in spatialities. Postcolonial feminist Chela Sandoval reframes cognitive mapping in terms of oppositional consciousness.[55] Oppositional consciousness rejects the notion that subjects' sense of space is so disoriented due to global capitalism that means and sites of resistance cannot be located.[56] Sandoval additionally points out the supposed "schizophrenia" Jameson invokes is one colonial and intersectional subjects have long resisted by tactics incorporating different identity formations the subject inhabits. The idea is to resist being so fully ingrained in a single component of one's identity that it occludes the ability to position and see oneself within ever-transforming modes of oppression.[57] Mapping can thus serve as a form of place-making in increasingly uncertain times, wherein locating the self is seen as increasingly difficult.

Materialities must also be considered alongside spatialities. These are considerations various scholars find lacking in the postmodern treatment of space as well as some of the work emanating from digital media studies.[58] Sociologist Saskia Sassen, for one, attends to the constant interplay between the local and the global as characteristic of postmodernity, but cautions against approaching globalization in terms of flexibility alone, which can ignore important fixities underpinning it.[59]

The performance of the material – meaning, how the material shapes the worlds of its use as much as users do in what their material qualities afford and prohibit – is equally crucial. In "Carbon Democracy," Timothy Mitchell outlines how carbon's materiality, for example, altered modes and practices of human production, in ways that came to define "a certain kind of democratic politics."[60] The switch from coal reduced the need for human labor in energy production, avoiding potential labor disputes and strikes and creating a new ecology of energy production. Carbon's liquid nature also enabled the transportation of energy through pipelines rather than railway networks, with less potential for interruptions in the event of a strike and reduced need for human labor.[61]

The material affordances of maps and mapping technologies enable certain kinds of politics (namely, colonial, militaristic, and anti-democratic) similarly that cannot be divorced from who is using them to what ends. The map as a physical object, unlike what it charts, can traverse territories and freeze entities susceptible to change. This is what Latour means when he calls maps "immutable mobiles."[62] They enable states to rearrange space in forging optical consistency - that is, mapping "allows translation without corruption" in its acceptance of a standard language.[63] Latour thus situates maps as one of many different inscription devices which, when combined, centralize records for improved management of space. Power emanates from assembling these inscriptions the best.[64]

The ability of maps to render space in absolute terms shapes much of their use historically. Cartography has deep ties as a form to power. Mapping has long provided militaries with "ever more precise locating systems" for guidance of both soldiers and missiles.[65] Colonialism overall positions space like a map; the Cartesian sees colonies as spaces to act on and be observed by an Enlightened subject (to Mitchell, "like an exhibition set up before an observer").[66] Maps thus empower attempts to possess nature and knowledge about it.[67] This is why the production of maps is typically seen in terms of strategies for the state to manage space, rather than tactics for the disenfranchised to assert power in their communities.[68]

The capacity of mapping to create monstrous realities when employed strategically must be acknowledged. Maps should be seen no differently than other contemporary information technologies in this respect.[69] From Frankenstein to the viral, the tropes new technologies are often cast into are ample.[70] These technologies, always embedded within broader sociotechnical systems, are simultaneously of our making within the mundane activities of everyday life and emergent formations beyond the control of any identifiable agent – hence the need to complicate the "living" nature of emerging map forms.[71] In turning the other way on these disparate effects, according to Latour, we leave technologies ("*the creature*") to their own devices.[72]

Debates surrounding automated, crowdsourced, and proprietary digital mapping lie in these broader conversations on algorithmic phenomena within STS scholarship. They interrogate who or what algorithms include or exclude, what modes of knowledge or expertise they render legitimate or illegitimate, and what counts as objective or subjective within what they yield. Such questions straddle between utopian and dystopian depictions of technology. They examine the extent to which algorithms might prove meaningful and socially progressive in matters like ecological devastation or rapidly spreading diseases or serve power in their capacity to rationalize and surveil.[73] An informed examination on this front must embrace thinking through the performative and the experimental in relation to technologies and their uses as a method in and of itself.

While paper towns and Google Maps' place naming are aforementioned examples, gerrymandering is another significant example of mapping abetting the monstrous**.** The term gerrymandering originated in a political cartoon from the early 19th century by Elkanah Tisdale. Tisdale drew a realigned voting district from Massachusetts crucial to the gubernatorial election of Elbridge Gerry as a "winged salamander." The term "gerrymander" is a portmanteau of Gerry's last name and the word salamander.[74]

Gerrymandering is thus a monster by its etymology, born out of a mutated politics gone further amiss than in Gerry's time. In areas like Austin, Texas, the political leaning of a community matters little in political representation thanks to partisan districting. Liberal-leaning Austin is split into six districts, with only one represented by a Democrat.[75] Many blame gerrymandered districts for allowing incumbents to Congress to gain re-election in spite of widespread negative polling.[76] The dilution of votes based on political affiliation hampers the import of voters' free expression.[77]

The effect of gerrymandering on both sides of the aisle make it a hot button issue. Academics and activists alike are submitting different measures to prove gerrymandered electoral maps stifle democracy. Part of the issue is a lack of established means to assess which district shapes

are aberrant.[78] Recently, the Supreme Court ruled in cases of Wisconsin and Maryland gerrymandering – the former Republican-leaning, the latter Democratic-leaning – that there is a need to prove clear bias or individual injury to warrant redrawing maps.[79]

Mapping can either hinder or enhance citizen participation – often an explicit frame for grassroots projects – depending on the parameters of their use, with gerrymandering easily exemplifying the former.[80] Seeing maps as engaging in a broader intertextual dialogue according with the rhizomatic means seeing that standing archives and means of producing geospatial data and imagery can be reimagined in ways that expose the politics and agencies embedded in cartography as a form. Overall, the ways and media by which we represent space have ramifications that imprint upon what can be seen or known through different maps. Spatial representations like maps and aerial images are always already political, subjective, and unsettled. Acknowledging those valences (as this dissertation does) can place these ramifications front and center. In the next chapter, I detail the slate of theories and methods by which it does so.

The broader strokes of what this preface presents as a fuller conceptualization of digital mapping are important facets of the analysis that follows. After the introduction, chapters to come respectively present how public use of GPS resulted from imaginaries which framed it as buttressing standing government and corporate power; how publics grew to understand the role of GPS in sustaining contemporary data economies that were largely unanticipated and how to "detourn" such technologies as a mode of critique; and how the platforms and projects that result can still, in "monstrous" capacities, augment such structures of power in ways that speak to how projects positioning themselves as grassroots can be co-opted in complex ways that public-based digital mapping pursuits must keep in mind. Given this trajectory, I begin the next chapter with a discussion of the meanings that the "grassroots" has embodied, both in a popular and a scholarly sense, to establish what it signifies toward this more critical analysis.

[1] Steve Coast, "It's Time to Make OpenStreetMap Your Only Street Map," *Steve Coast*, last modified January 30, 2014, https://stevecoast.com/2014/01/30/its-time-to-make-openstreetmap-your-only-street-map/.
[2] Paolo Cirio, "Street Ghosts," accessed July 27, 2017, http://streetghosts.net/.
[3] Gabriella Coleman, *Coding Freedom: The Ethics and Aesthetics of Hacking* (Princeton: Princeton University Press, 2012), 3.
[4] Denis Wood, *Rethinking the Power of Maps* (New York: Guilford Publications, 2010), 1.
[5] Bruno Latour, "Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts," in Wiebe E. Bijker and John Law, eds., *Shaping Technology/Building Society: Studies in Sociotechnical Change* (Cambridge, MA: MIT Press, 1992), 161-162.
[6] See Gilles Deleuze, *Foucault*, ed. and trans. Sean Hand (Minnesota: University of Minnesota Press, 1988), 30-35.
[7] Jonathan Murdoch, *Post-structuralist Geography* (London: Sage, 2006), 90.
[8] For historical context, see Richard Unger, *Ships on Maps: Pictures of Power in Renaissance Europe* (New York: Palgrave Macmillan, 2010), 25, and Wood, *Rethinking the Power of Maps*, 31.
[9] Laura Kurgan and Eric Cadora's *Million Dollar Blocks* maps how much money the government spends to continually incarcerate residents of cities, zooming in on different blocks to find that such efforts often require "millions of dollars [spent] on a single block." The Counter-Cartographies Collective's (3Cs') *disOrientation guide*, authored by a group of UNC-Chapel Hill students, counter traditional orientation publications for students new to campus to point out the imbrication of universities in systems of racism, sexism, capitalism, and militarism. Brian Holmes' *Movements of Capital* takes the standard Mercator rendering of the globe and maps out flows of currency and trade agreements between different international collectives. Lize Mogel and Alexis Bhagat's *An Atlas of Radical Cartography* gathers activists around maps of myriad issues, including "migration, globalization, extraordinary rendition, surveillance, urban ecology, and waste management." It includes Trevor Paglen and John Emerson's project mapping CIA-used plane routes which "transport people to countries where they are interrogated using methods that are not legal in the USA. Conor McGarrigle's NAMAlands project, which maps NAMAproperties (ones bought by Ireland's National Assets Management Agency, which inadvertently led to a "collapse of the banking system" during the global financial crisis) around a user's position via mobile location functionalities. See Brian Holmes, *Escape the Overcode: Activist Art in the Control Society* (Van Abbemuseum: Eindhoven, 2009), 194;.Conor McGarrigle, "Augmented Resistance: The Possibilities for AR and Data Driven Art," *Leonardo* 19, no. 1 (2013), 110-11, http://www.leoalmanac.org/wp-content/uploads/2013/01/LEAVol19No1-McGarrigle.pdf; Lize Mogel, "Disorientation Guides," in *GeoHumanities: Art, History, Text at the Edge of Place*, ed. Michael Dear, Jim Ketchum, Sarah Luria, and Douglas Richardson (London: New York: Routledge, 2011), 189, 190 and 192.
[10] Michel Foucault and Bruno Latour's views on preserving uncertainty in one's analysis of the social are key here. See Foucault, *The Archaeology of Knowledge*, trans. A.M. Sheridan Smith, New York: Pantheon Books, 1972, 21, and Bruno Latour, *Reassembling the Social*, Oxford: Oxford University Press, 2005, 22.
[11] Carl Giaimo, "Why Map Historians Are Annoyed with Boston Public Schools," *Atlas Obscura*, last modified March 29, 2017, https://www.atlasobscura.com/articles/mercator-peters-boston-map.
[12] Colin Dwyer, "Boston Students Get a Glimpse of a Whole New World, With Different Maps," *NPR*, last modified March 21, 2017, https://www.npr.org/sections/thetwo-way/2017/03/21/520938221/boston-students-get-a-glimpse-of-a-whole-new-world-with-different-maps.
[13] Unger, *Ships on Maps,* 2.

[14] Object label, Norman B. Leventhal Map Center, *Women in Cartography: Five Centuries of Accomplishments*, Boston Public Library, Boston, MA.
[15] Keith Hamon, "Mapping the Rhizome," *Communications and Society* (blog), January 26, 2010, https://owl.purdue.edu/owl/research_and_citation/chicago_manual_17th_edition/cmos_formatting_and_style_guide/web_sources.html.
[16] James Carey, *Communication as Culture* (Boston: Unwin Hyman), 1989, 11-12.
[17] Randall Munroe, "State Word Map," last modified June 2, 2017, https://xkcd.com/1845/.
[18] See Jeff Warren, "Grassroots Mapping: Tools for Participatory and Activist Cartography," (Master's thesis, MIT, 2010), 24.
[19] See "Trump's @POTUS Twitter Account Used Obama Crowd Image," *BBC*, January 20, 2017, https://www.bbc.com/news/world-us-canada-38698837; Kyle Swenson, "Don't Be Fooled Again: That Huge Crowd Photo is Not a Trump Rally," *The Washington Post*, August 24, 2017, https://www.washingtonpost.com/news/morning-mix/wp/2017/08/24/dont-be-fooled-again-that-huge-crowd-photo-was-not-a-trump-rally/?utm_term=.8c52bb2cb7af; David Mikkelson, "Does This Photograph Show a Crowd of Trump Supporters in London?" *Snopes*, June 5, 2019, https://www.snopes.com/fact-check/trump-london-street/?fbclid=IwAR0fc628MJj6Eh2vBUjsroJRbkM2txnVT9Ob_Czz4lM4tBy7l7qQvdCPX0U.
[20] Bruno Latour, "From Realpolitik to Dingpolitik: or How to Make Things Public," in Bruno Latour and Peter Weibel, eds., *Making Things Public: Atmospheres of Democracy* (Cambridge: MIT Press, 2005), retrieved from http://www.bruno-latour.fr/sites/default/files/downloads/96-MTP-DING.pdf.
[21] See Gilles Deleuze, "Postscript on the Societies of Control," *October* 59 (1992), https://cidadeinseguranca.files.wordpress.com/2012/02/deleuze_control.pdf.
[22] Eric S. Jenkins, "Walt and WALL-E in Control Society," in *Special Affects: Cinema, Animation, and the Translation of Consumer Culture* (Edinburgh University Press, 2014), 198-200.
[23] With this example, it is worth noting that the integration of digital mapping and location-aware capabilities into smartphones and applications means devices are increasingly becoming one-stop shops relying on a range of information from biometrics to user profiles and other sign-in information. They afford mobility and impose barriers in both virtual and physical sites of consumption and labor.
[24] Jenkins, "Walt and WALL-E in Control Society," 200.
[25] David L. Altheide, *An Ecology of Communication: Cultural Formats of Control* (Walter de Gruyter: New York, 1995), 1.
[26] Todd Presner, David Shepard, and Yoh Kawano, *HyperCities: Thick Mapping in the Digital Humanities* (MetaLAB projects, 2014), 87. See also Lisa Parks, "Zeroing In: Overhead Imagery, Infrastructure Ruins, and Datalands in Afghanistan and Iraq," in *Communication Matters: Materialist Approaches to Media, Mobility and Networks*, ed. Jeremy Packer and Stephen B. Crofts Wiley (Routledge, 2013).
[27] Ibid, 88.
[28] See Heinz von Foerster's perspective on related misconceptions surrounding the act of observing in "Cybernetics of Cybernetics," in *Communication and Control in Society*, ed. Klaus Krippendorff, (Gordon and Breach: New York, 1979), http://faculty.stevenson.edu/jlombardi/pdf's/cybernetics/cybernetics_cybernetics_hvf.pdf.
[29] For examples, see James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998); William Cronon, *Nature's Metropolis* (W.W. Norton, 1992); Peter Galison, *Einstein's Clocks, Poincaré's Maps: Empires of Time* (New York: W.W. Norton, 2003); Presner, Shepard, and Kawano, *HyperCities*; and Kim Fortun, *Advocacy after Bhopal: Environmentalism, Disaster, New Global Orders* (Chicago: University of Chicago Press, 2001).

[30] Ball State University Libraries, *Maps and Cartography: Map Projections*, PDF slides, retrieved from http://www.bsu.edu/libraries/collections/gcmc/tutorials/pdfs/mapscartographymapprojections.pdf. The Mercator projection is perhaps the one most discussed in this regard; see Albert Rios, "Mercator Map of the World," accessed May 24, 2018. http://www.public.asu.edu/~aarios/resourcebank/maps/page10.html.
[31] Presner, Shepard, and Kawano, *HyperCities*, 29.
[32] Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction" (1936), accessed May 22, 2018, https://www.marxists.org/reference/subject/philosophy/works/ge/benjamin.htm.
[33] Stefan Helmreich, *Alien Ocean: Anthropological Voyages in Microbial Seas* (Berkeley: University of California Press, 2009), 42.
[34] Ibid, 39.
[35] Ibid, 47.
[36] Presner, Shepard, and Kawano, *HyperCities*, 53.
[37] Chris Perkins, "Cultures of Map Use," *The Cartographic Journal* (2013), 150-158.
[38] Wood, *Rethinking the Power of Maps*, 120.
[39] Keith Harries, *Mapping Crime: Principle and Practice* (Washington, DC: US Department of Justice, 1999), https://www.ncjrs.gov/pdffiles1/nij/178919.pdf.
[40] Angharad Valdivia, *Introduction to the Media*, Urbana: University of Illinois, 2016.
[41] Perkins, "Cultures of Map Use."
[42] Presner, Shepard, and Kawano, *HyperCities,* 95.
[43] See Louise Spence and Vinicius Navarro. *Crafting Truth: Documentary Form and Meaning* (Rutgers University Press, 2011).
[44] Max Liboiron, "Mapping Waste When Waste is Invisible," *Grassroots Mapping Forum #6* (2014), https://publiclab.org/wiki/mapping-waste-when-waste-is-invisible.
[45] For a highly cited take on the politics of artifacts, see Langdon Winner, "Do Artifacts Have Politics?" *Daedalus* 109.1 (1980), 121-136.
[46] Sarah Elwood, Nadine Schuurman, and W. Matthew Wilson, "Critical GIS," in *The SAGE Handbook of GIS and Society,* edited by Timothy N. Nyerges, Helen Couclelis, and Robert Brainerd McMaster (Los Angeles: SAGE, 2011), 97.
[47] Ibid, 97.
[48] Paul Hegarty, *Jean Baudrillard: Live Theory* (London: Continuum, 2004).
[49] See Anna Grimshaw, "Introduction," *The CLR James Reader*, ed. Anna Grimshaw (Oxford, UK: Blackwell, 1992), 1-22.
[50] Frederic Jameson, "Postmodernism, or, The Cultural Logic of Late Capitalism," *New Left Review*, https://www.marxists.org/reference/subject/philosophy/works/us/jameson.htm.
[51] Ibid. Manovich specifically discusses the incessant updating of the Google Earth and maps interfaces to exemplify how users must orient themselves to how power is constructed anew, with each update in data a new representation of the world. See Deborah Lupton, *Digital Sociology* (Routledge, 2014), 25.
[52] Jorge Luis Borges, "On Exactitude in Science," in *Collected Fictions*, trans. Andrew Hurley, retrieved from https://www.sccs.swarthmore.edu/users/08/bblonder/phys120/docs/borges.pdf.
[53] Jean Baudrillard, *Simulacra and Simulation*, trans. Sheila Faria Glaser (University of Michigan Press, 1994), 4.
[54] Jack Nicas, "As Google Maps Renames Neighborhoods, Residents Fume," *The New York Times*, August 2, 2018, https://www.nytimes.com/2018/08/02/technology/google-maps-neighborhood-names.html.
[55] Chela Sandoval, *Methodology of the Oppressed* (Minneapolis: University of Minnesota Press, 2000), 33.

[56] Ibid, 1.
[57] Toward this, Sandoval points out that what Jameson refers to as "schizophrenia" – the schism of signifiers from signifieds – is something the colonial subject has long experienced and written about. See ibid, 34.
[58] See especially Caren Kaplan, *Questions of Travel: Postmodern Discourses of Displacement* (Durham, NC: Duke University Press, 1996), 1 and Coco Fusco, "Questioning the Frame," *In These Times*, Dec. 16. 2004, retrieved from http://inthesetimes.com/article/1750.
[59] Saskia Sassen, "Spatialities and Temporalities of the Global: Elements for a Theorization" (*Public Culture*, 2000), 222.
[60] Timothy Mitchell, "Carbon Democracy," *Economy and Society* 38, no. 3 (2009): 399.
[61] Ibid, 407.
[62] Bruno Latour, "Drawing Things Together," in *The Map Reader: Theories of Mapping Practice and Cartographic Representation*, ed. Martin Dodge, Rob Kitchin and Chris Perkins (Chichester: Wiley, 2011), 69.
[63] Ibid, 67.
[64] Ibid, 71.
[65] Galison, *Einstein's Clocks, Poincaré's Maps,* 285. See also Parks' assertion that the aerial view of mapping propagates conceptions of "the world as a target," using the military campaigns in Afghanistan and Iraq as examples in Parks, "Zeroing In," 79.
[66] Timothy Mitchell, *Colonising Egypt* (Berkeley: University of California Press, 1991), 177.
[67] D. Graham Burnett, *Masters of All They Surveyed: Exploration, Geography, and a British El Dorado* (Chicago: University of Chicago Press, 2000), 2.
[68] Michel de Certeau, *The Practice of Everyday Life*, http://www.ubu.com/papers/de_certeau.html.
[69] See Donald MacKenzie, *An Engine, not a Camera: How Financial Models Shape Markets* (Cambridge: MIT Press, 2006).
[70] See Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Technology* (Cambridge: MIT Press, 1977) and Kelli Fuery, "The Discursive Practice of the New," *New Media: Culture and Image* (Palgrave Macmillan, 2008).
[71] Donna Haraway, "Promises of Monsters: A Regenerative Politics for Inappropriated Others," in *Cultural Studies*, edited by Larry Grossberg, Cary Nelson and Paula Treichler (Routledge, 1991), 295-337.
[72] Bruno Latour, "Love your Monsters," *Breakthrough Journal* 2 (2012), 21-28, https://thebreakthrough.org/index.php/journal/past-issues/issue-2/love-your-monsters. The quote appears italicized as in the original version.
[73] See Yuval Noah Harari, *Homo Deus: A Brief History of Tomorrow* (Vintage Publishing, 2016) and Shoshana Zuboff, "Big Other: Surveillance Capitalism and the Prospects of an Information Civilization," *Journal of Information Technology* 30.1 (March 2015), 75-89. For the sources I draw from in explicating how technologies have been theorized as monstrous, I am indebted to the IFIP 8.2 2018 Working Group's "Living with Monsters? Social Implications of Algorithmic Phenomena, Hybrid Agency and the Performativity of Technology," accessed July 14, 2018, http://2018conf.ifipwg82.org/files/IFIP%208.2-2018-CFP.pdf.
[74] See Wood, *Rethinking the Power of Maps*, 113.
[75] Ashley Lopez, "After Supreme Court Punts on Gerrymandering, Democrats Make it a Campaign Issue," *NPR*, July 22, 2018, https://www.npr.org/2018/07/22/630635629/after-supreme-court-punts-on-gerrymandering-democrats-make-it-a-campaign-issue. A prior federal court decision argued that several of Texas' districts were drawn according to the spatial distribution of race, an act aided by the Supreme Court invalidating a piece of the Voting Rights Act that alleviated the need for

federal permission to enact voter ID laws and redraw districts. See Laurel Wamsley, "Federal Court Rules Three Texas Congressional Districts Illegally Drawn," *NPR*, March 11, 2017, https://www.npr.org/sections/thetwo-way/2017/03/11/519839892/federal-court-rules-three-texas-congressional-districts-illegally-drawn?utm_source=facebook.com&utm_medium=social&utm_campaign=npr&utm_term=nprnews&utm_content=20170311.

[76] Sarah McCammon, "Redistricting Reform Advocates Say the Real 'Rigged' System is Gerrymandering," *NPR*, March 18, 2017, https://www.npr.org/2017/03/18/520551499/redistricting-reform-advocates-say-the-real-rigged-system-is-gerrymandering?utm_source=facebook.com&utm_medium=social&utm_campaign=npr&utm_term=nprnews&utm_content=20170318.

[77] Mark Joseph Stern, "Does Partisan Gerrymandering Violate the First Amendment?" *Slate*, June 19, 2017, http://www.slate.com/articles/news_and_politics/jurisprudence/2017/06/does_partisan_gerrymandering_violate_the_first_amendment.html.

[78] Mathematicians have set to correct this by defining "compactness" – a standard already written into various state constitutions.[78] The efficiency gap, a percentage expressing the difference in how many votes in both parties ended up being meaningless, is another attempt.[78] See Shannon Najmabadi, "Meet the Math Professor Who's Fighting Gerrymandering with Geometry," *The Chronicle of Higher Education*, February 22, 2017, accessed July 24, 2018, https://www.chronicle.com/article/Meet-the-Math-Professor/239260 and Eric Petry, "How the Efficiency Gap Works," *Brennan Center for Justice*, accessed July 24, 2018, https://www.brennancenter.org/sites/default/files/legal-work/How_the_Efficiency_Gap_Standard_Works.pdf.

[79] Nina Totenberg, "Supreme Court Leaves the 'Wild West' of Partisan Gerrymandering in Place – For Now," *NPR*, June 18, 2018, https://www.npr.org/2018/06/18/606017026/supreme-court-punts-on-partisan-gerrymandering-leaving-status-quo-in-place.

[80] Emmalina Glinskis, "Meet the Community Scientists Shaping the New Environmental Resistance," *The Nation*, July 19, 2018, accessed July 24, 2018, https://www.thenation.com/article/meet-community-scientists-shaping-new-environmental-resistance/.

CHAPTER 2

THE CULTURAL WORK OF GRASSROOTS MAPPING

A few things strike me about the OpenStreetMap approach and the community . . . . There are other maps out there that include ways to access an area by foot, by car, by mass transportation. But the fact that OpenStreetMap is the first one I'm aware of that also has that level of detail for people with disabilities is really empowering and touching and affecting your lives on a personal level . . . . [W]hat strikes me about what you're achieving here is the collaborative kind of grassroots approach contributing, enriching that map in a myriad of ways.

- Colonel Christopher J. Luria, a retired astronaut, speaking at State of the Map US 2017

Much of the focus on the communities at hand outside of this dissertation lies in the modes of organizing and production online they employ, as the quote above from a recent State of the Map US demonstrates. What receives less discussion (even if more pronounced in Public Lab) is the import of this labor and its associated practices as situated and as activating place. Given this oversight, this project can serve as a place-opening move in mass communications research, and an opportunity to consider more fully the methods by which one can study such work and practices.

This introduction first surveys critical theorists' reference to the organic to assess beliefs and values often associated with grassroots work and media within academic work more critically and to apply them to digital mapping. I then incorporate feminist approaches toward work, practices and universal aspirations specifically through conceptions of ecologies and frictions. Outside of the project's broader orientation toward Jürgen Habermas and Michael Burawoy on the methodological front, my keenest interlocutors include scholars in critical cartography and feminist STS. The former specifically includes Chris Perkins; Rob Kitchin and Martin Dodge; and Denis Wood. The foundations for such perspectives were largely established in the preface, and run throughout what follows. The latter includes, as outlined in the next section, the work of Susan Leigh Star; Anna Tsing; Laura Forlano and Megan Halpern; and Donna Haraway. These approaches show how

particularities communities, global institutions, modes of mediation, and places can further understandings of mapping systems and public-led mapping interventions.

The rest of this introduction provides initial descriptions and documentation of the communities of focus before detailing the methods and contents of the dissertation chapter by chapter. It argues that the project's use of archaeological analysis, Critical Discourse Analysis (CDA), and participant observation provides a striking sense of the issues that now surround mapping as a process and as an experience. To study assembly in mapping equally requires an assembly of methods that can highlight its diverse work and dimensions, as the corpus of methods here does.

The purpose of assuming a multimethod approach is thus that digital mapping as an object of study warrants studying genealogies of technologies that underpin it, discourses that inspire those in the public sphere to imagine alternatives, and practices that reinvent both imaginaries and inventive use. As critical cartography underscores, cultures always surround a map (whether they are recognized within it or not) that find different meanings and different uses for it.[1] The ways such cultures get included or excluded in the ways we discuss, practice, and form assemblies around mapmaking thus requires a diverse palette. One further finds in this dissertation moments of statistical aggregation and analysis that analyze the nature of contribution in the case studies at hand.

Before going further, I will note many of the key terms this dissertation explores (especially those of the grassroots, ecology, and archaeology) are quite fraught. The latter two especially have legacies within the study of communication and media that leave much to be desired. I explain these deficiencies more specifically in what follows. Yet I find these conceptions carry potential within the field. I thus do not seek to disregard them, but reconsider them in ways that can illuminate current digital cartographic production.

Relevant Theory: The Grassroots, Ecologies, and Frictions

In light of the ramifications of mapping on public participation that the preface mentions, defining the "grassroots" in grassroots mapping is warranted, especially for a project that distinguishes itself in part due to explorations of this particular term as a descriptor for mapping work. A proper definition merits seeing the grassroots both as a populist discourse and as a focal point within critical/cultural communications. Senator Albert J. Beveridge of Indiana delivered an address that would define grassroots as a term at the Chicago Coliseum in 1912. The Coliseum was packed with delegates supporting Theodore Roosevelt's campaign for an unprecedented third presidential term. In describing the new Progressive Party, also known as the Bull Moose Party, Beveridge exclaimed, "This party has come from the grass roots. It has grown from the soil of people's hard necessities."[2] The party platform, predicated on cementing a sense of "public welfare" in a governing system increasingly instrumentalized by corruption, was strongly against monopolies and supportive of women's suffrage as part of various party policies toward social justice.[3]

Like most etymologies and origin stories, this narrative may not mark the first invocation of the grassroots.[4] What is clear, however, is that over a century later, the term grassroots is pervasive in the American political climate. Beveridge's image of a politics born from everyday working class concerns rather than corporate lobbying and in opposition to the American two-party system remains within grassroots activism, organizing, and media.[5] In line with this, in mapping, grassroots interventions and techniques define themselves against dominant corporate satellite imagery efforts.

The agricultural metaphor of the grassroots is hardly surprising or exclusive to political life. Williams' *Keywords* elucidates how conceptions of culture and media hinge on metaphors of cultivation and agriculture.[6] The meanings Williams finds in the Germanic *kultur* equate culture with discourses of the civilized, but also the cultivated. Both the grassroots and the cultural draw in such

meanings to signify means of cultivating relationships.[7] The study of the "grassroots" within grassroots media from a critical/cultural purview is thus fitting. The cultivation of online networks through a different production model for maps and aerial imagery equally establishes cultures surrounding map use that must be assessed for their capacities and the role modes of communication play in cementing them.

Cultures are not givens; they are activated, passivated, and reinvigorated in ways that accord with the metaphorical area of the grassroots. The term grassroots operates as synonymous with culture, specifically the need to establish a culture around a given set of ideas to build a movement. Though Carey critiques that an attention to culture is lacking in American critical thought, perhaps such synonyms show that the attention to social movements in a ritualistic sense is in fact prevalent.[8]

The term "broadcasting," referencing the act of planting over a sizeable space as a descriptor for mass communication, exemplifies the agricultural metaphor in media. John Durham Peters dissects broadcasting as the one-sided dissemination of information, rather than the facilitation of dialogue over implications, policies or possibilities in light of said information.[9] State and corporate interests can exert more influence on its one-sided content, and different interpretations a given message may elicit – ones impossible to anticipate in advance – may not be as visible.[10]

These valences of the grassroots, of course, merit a qualification. "Grassroots" organizing and campaigning can be just as "manufactured" as the formations it seeks to critique. As one example, practices of "astroturfing" – corporate-sponsored campaigns often conducted via NGOs and meant to seem organic – epitomize a "fake grassroots." The populism of such campaigns is but a mere façade.[11] Even aside from astroturfing, there is a dangerous populist association to the grassroots this dissertation has already explored. It opens up opportunities toward the forms of authoritarianism that disguise themselves as populism that are becoming globally prominent. All of

this establishes a need for critical analysis of media campaigns that purport to be grassroots to learn more about the entanglements embedded in such appeals, even when their work is genuine in intent.

The metaphor behind the grassroots also carries over to more dangerous formations within information ecologies. One can consider data harvesting, the aggregation of user data, in this metaphorical area. It equates the process to the gathering of crops for value creation. As crops will continue to grow with proper tending, so too, as the metaphor goes, will corporations profit off user data if users continue to share them. Data harvesting as a term skirts the ethical questions that surrounds profiting off the "fruit," as it were, of others' data. It implies the naturalization of this theft, portraying it as organic rather than extracted.[12]

Location-aware functions in platforms and apps driven by user content make mapping increasingly a matter of data harvesting toward targeted advertising. But grassroots instantiations of mapping can tie into earlier connotations of the harvest as a grand, religious, and social occasion, ones relevant to Williams' view of the cultural as tied to the organic. Mapping is thus not only embroiled in data extraction, but in organic, community-driven spatial interventions.

In contrast to broadcast media, grassroots media sponsors more dialogue and is often community-produced. It thus constitutes more organic production.[13] It holds both of Carey's models of communication – the transmission and ritual models – in a productive tension, needing to both faithfully communicate to provide a sense of unity and generate a sense of culture around that constructed commonality.[14] What the grassroots can point toward in mapping is a thus more ritualistic model of production over spatial representations than dominant platforms do. Considering the authority of transmission models within the practice and study of cartography historically speaking, the exploration of mapping here as ritualistic is distinctive as a communication model fashioning mapping as a negotiated process, not a faithful, "objective" message.

Connections between the organic, contemporary media, and contemporary data ecologies merit considering the grassroots and the organic within 20th century scholarly thought, when the grassroots first gains use. Foundational scholars in critical/cultural communication theorize the grassroots as a means of reinvigorating the social. Williams, as referenced previously, sees the organic as a referent to a self-organized body of "natural" connection. Henri Lefebvre, better known for his writing on the extension of Marxism to the production of space, relatedly writes on autogestion. Autogestion is a mode of bottom-up governance he equates with "self-management," "workers'" and "grassroots" control.[15] He even fashioned its nature as that of "a humble plant" (which resonates with the import of cultivation from the *WALL-E* example) which "comes to threaten the huge state edifice."[16] The thrust of autogestion is to counter states' closed, centralized structure that works against public participation and restricts information flows.[17] These fears mirror those of Peters in the perceived lack of public feedback within broadcast media. In contrast, the role of critical theory in relation to autogestion (as Lefebvre sees it) is to set conditions for "revolutionary spontaneity" – what he deems as "the organic."[18] In its rhizomatic nature, the living map and the structure of its platforms means (ideally) that it can be used as a supporting infrastructure for transformative projects aided by crowdsourced labor.

Fellow Marxist philosopher Antonio Gramsci's work on organic intellectuals formalizes potentialities and limits toward this sense of revolutionary spontaneity. Organic intellectuals, being born out of the particular concerns of the given class they emerge from, are more intimately entwined with situated class realities than their more conventional, "assimilated" counterparts. Due to the situated awareness of the organic intellectual, the organic intellectual is the agent inspiring the class or community the organic intellectual comes from to realize its own power, interests, and capacities.[19] Organic ideology by definition expresses power that binds different social groups together and is articulated within civil institutions (including media systems). The organic intellectual

is thus one who aligns these diverse interests and motivates these transformations. The organic intellectual sets the stage for "ideological absorption" to sustain the organic ideology. The mapper, in this sense, can be seen as an organic intellectual taking advantage of maps' living dimensions (in contrast to its capacity to freeze space) to position community spatial visions toward absorption.

Within Gramsci's work, the state apparatus in turn absorbs these diverse interests, legitimating Peters' and Lefebvre's concerns on corporate control. Gramsci, however, fashions statecraft as legitimated within such negotiations to maintain consensus and thus power. As such, these processes are dialectical, manifesting a struggle for interests to rise from minority to dominant status to then necessitate the incorporation of further emerging interests over time.[20] Public interventions in mapping also follow this dialectical enterprise, with the ultimate goal of its work being absorbed into the dominant representations of space.

Accordingly, a major contention of this project is that the grassroots and the governmental, often fashioned as separate poles, need to be thought of more dialectically in this fashion. As the preface established, maps are tools of governance that can segregate, isolate, and integrate via data. Due to that, this dissertation is as much about the current state of information capitalism as it is about mapping. They cannot be separated easily.

Michel Foucault's points on liberalism, a transition from power residing in the sovereign to power residing in the individual (an experience of freedom that defers responsibility to control and regulate conduct to citizens themselves), and biopower pertain to these dimensions of the propagation and diffusion of power that one might usually associate with a governmental perspective. Foucault defines biopower as a translation of the organic (most notably in terms of the social body) into the biological (the population). Technologies of discipline, which include systems of ordering like those that maps provide to locate bodies within a defined spatial field, accomplish this.[21] The role of discipline in the practices this dissertation explores is to facilitate not only the

normalization and examination of different environments, but also the crafting of the category of mapper itself as a productive citizen and a critical data consumer.

One can learn much about the nature and intent of knowledge production by tracing these technologies of discipline, especially in relation to mapping. STS has long been concerned with such Foucauldian formations insofar as the scientific ordering of space, through maps or other laboratory translations, is used to name, target, and care for both human and nonhuman populations.[22] These modes of ordering through geospatial technologies are often in the name of profit from consumer tracking. They often do not align with public opinion on the subject.

Various pursuits in the standing literature on location-enabled advertising, including comparative studies on the efficacy of push and pull methods of location-based advertising, show public perceptions of ethical considerations involved in tracking outweigh the convenience factor for consumers. While push location-based advertising does open the door for efforts to enhance a consumer's impulse purchasing, consumers often perceive privacy concerns as outweighing the affordances of such advertising.[23] Tracking and monitoring are obvious concerns within mapping applications and fuel debates that extend throughout the body chapters of the dissertation. Each community exhibits concerns of ethics surrounding their practices and within uses of digital mapping systems more broadly. These concerns are evident on both a discursive level in community conversations and framings to nonpractitioners as well as within data aggregation practices.[24]

Applying mapping functions toward activism means rethinking their histories of use through both discourse and practice. Activism itself involves imaging ethics, in ways that anticipate futures – entailing a mapping of what the world *could* and *should* look like.[25] As much as transnational information capitalism creates demographic communities to target through data, critical making initiatives are carrying out projects as struggles over data with the ultimate goal of creating new communities and subject positions (i.e., mappers) for those community members. Such formations

additionally align with Émile Durkheim's distinction between organic and mechanical solidarity. "Functional interdependence" – not a shared sense of unity based in a homogeneity of work, but rather a dependence on the different cultures of expertise which comprise a society – characterizes the former.[26]

Recent discourses on alternative modes of mapping in media studies, the digital humanities, and GIS such as experimental geography, tactical cartography, spatial humanities, GeoHumanities, and GIS and Society reflect this mode of organization toward improving society specifically through inclusive mapping.[27] Grassroots mapping, a similar discourse, surfaces in civic technoscience, crowdsourced mapping, development strategies, accessibility studies, interactive documentaries, and civic hacking projects.[28] Beyond these discursive ties, however, this project takes interest in understanding the ecologies behind mapping that such work forms in relation to dominant infrastructures and practices.

Of the groups this project discusses, Public Lab has the strongest discursive tie to grassroots mapping. But all the communities covered here express affinities with its mode of organizing nonexpert labor toward more accurate emancipatory spatial knowledge production. I focus on what grassroots forms of mapping look like and how, alongside individual subjectivities and nonhuman elements of mapped environments, maps might best be characterized as part of ecologies.

Susan Leigh Star's ecological perspective sees the nonhuman in fellowship with the human within ecologies.[29] Ecological thinking recognizes locations and actants as shaped by situated versions of time and space.[30] Further, Jane Bennett's "thing-power materialism" fittingly pits the human, following Star, "always in composition with nonhumanity, never outside . . . an ecology."[31] These agencies shape each other. Nonexpert tactics in mapping particularly offer a unique opportunity in how dense arrangements of such agencies cement spatial visions.

An ecological take on digital mapping fits with a cybernetic communications perspective. Gregory Bateson's "Form, Substance, and Difference" in *Steps to an Ecology of Mind* invokes mapping to exemplify how all phenomena are mediated. Representations cannot then convey the fullness of the territory, and always beget further and more diverse representations, as Figure 1.1 attests. There are obviously both physical and perceptual considerations to Bateson's sense of the ecological. Star adds the institutional to this sense of ecology, all the while concurring with Bateson in his vision of action and memory as, in Bateson's own terming, "not limited by skin," part of "an economics of information" that encompasses the circulation of ideas that he in part defines as an ecology.[32] Spatial data capture, accordingly, goes beyond the skin at various levels, including institutional, infrastructural, technological, and natural. While this is often, again, obfuscated in dominant platforms in the name of authority and objectivity, an attention to nonexpert community practices can illuminate these dimensions – not to demystify per se, but to further complicate investments in these constructions within the production of actionable imagery.

While perhaps the most prominent ecological metaphor in media studies lies in media ecology, which the conclusion explores, the take on the ecological here (in one of several important contrasts from the former perspective) recognizes how a nexus of aforementioned forces operates as an ecology and shapes geographies. Specifically, maps, exerting agency as part of the "stuff" of politics, can refigure or be refigured by global ideas.[33] Nonhuman agencies, often ignored in universal or global ideas since they complicate those ideas, are pivotal.[34]

Common criticism of the media ecology perspective renders it simplistic and anthropocentric. While some have sought to reorient the ecological within media studies to account for "the stuff of communication," sufficient attention is still lacking to feminist STS perspectives that have long approached the inherent partiality of knowledge produced and the imbrication of space-times inherent in any situation.[35] In short, STS has provided a better sense of ecologies as a

theoretical framework, one I believe media scholars have not been as keen to take on overtly as they should.

The significance of STS to this project, however, goes beyond its fuller conceptualization of ecologies. Instead of approaching such matters solely in terms of universalizing mobility or cultural specificity, Anna Tsing, for one, frames forces like capitalism as encounters between the two – as shaping and shaped by the culturally specific. Friction's implications as a theoretical construct toward these ends matches its implications in physics. As Tsing describes, "A wheel turns because of its encounter with the surface of the road; spinning in the air it goes nowhere." Through this metaphor, "friction reminds us that heterogeneous and unequal encounters can lead to new arrangements of culture and power.[36] Frictions between local spaces and global institutions and trade-offs between lay publics and experts must thus be seen as co-constitutive and not prohibitive. This dissertation shows how frictions play out in living maps not just in their dialogic status, but also in the human-nonhuman relations (whether enrolling the algorithmic or the natural) underpinning their production.

The frame of friction can illuminate such relations well, particularly in Laura Forlano and Megan Halpern's application toward studying ties between automation and labor. They apply friction to studying labor activism and technology so as to imagine more equitable futures for labor and advocacy. I take a cue from this research to conceptualize frictions between philosophies framing geospatial technologies and philosophies of grassroots mapping. I establish these sets of philosophies via archaeological analysis and CDA respectively, warranting in part the multimethod approach this dissertation presents. This enables exploration of what the tensions between the two obstruct and what they enable. This exploration mandates the incorporation of new materialist perspectives, which see technology neither as mystical and all-powerful nor completely in the control of the human.[37]

My research questions, informed by these ecological strains, are as follows: what is the cultural work of grassroots mapping? Can it be described as an ecology of practices? What frictions and entanglements might exist between philosophies surrounding geospatial technologies and those within grassroots activism? What do these frictions obstruct? What do they enable? What range of meanings, subjectivities, and motivations are involved in now-popularized mapping practices? How might this range – especially in light of the entanglements and frictions involved – both amplify and contradict intended applications for publicly available mapping capabilities?

The criticality these questions adopt strives to be practical (rather than assumptive or grand), attuned to politics and subjectivities involved in such communities and their practices, and honed on the multiplicity of meanings mapping engenders. This approach mirrors Adrienne Rich's thoughts on the role of theory in her approach to the politics of location, one intersectionality and constructions of difference inform.[38] More broadly, Stuart Hall notes that feminist scholarship in Cultural Studies provided pragmatic orientations opening its research to more everyday and overlooked aspects of the contemporary.[39] Accordingly, criticality will reveal the positives and negatives of grassroots mapping to further social equity in spatial knowledge production.[40]

What is distinctive about the dissertation's critical perspective is its attention to practical applications of mapping in crowdsourced and community contexts. Here, the object of knowledge is not simply something that is acted upon in the act of capture, but a collaborator in the knowledge that is produced.[41] Being open to this, to Donna Haraway, "makes room for unsettling possibilities" rather than continuing to reify settled narratives, along similar lines as Tsing's project.[42]

The impetus for grassroots work in mapping is simple: the standing political economy of digital mapping platforms and terrestrial imaging disempowers subjects. Be it the global drive to rationalize space toward profit or the scientific drive to simplify and forge "objective" knowledge,

modern constructions of space can neglect what is happening on the ground.[43] Their ability to reduce local complexities are their power in enrolling subjects into institutional logics.

This form of mapping comes, however, at the price of accuracy. It requires the modern subject to speak back to it and shape institutional knowledge, pointing out the dynamics it is bound to overlook. This dissertation is thus embedded in scholarly theorization of technology, modernity, subjectivity, textual production, and science. Such conversations must be re-oriented to recognize the politics of the distributed nature of mapping and the imagined communities that result.

Project Overview and Community Descriptions

The distribution of mapping practices and associated objects toward investigating different contexts merits thinking through implications of the virtual, the practiced, and the nonhuman within mapping activities. Mapping now must be seen not as just a virtual act, but a virtual world, as it is instantiated in these communities.[44] I focus mainly on two communities (OSM and Public Lab) to avoid presenting a case study on one without a point of comparison for the discourses and practices involved. More, meanwhile, would seem overly ambitious. The next sections introduce said communities in terms of their activities, modes of communication, and contribution statistics.

OpenStreetMap (OSM) and Humanitarian OpenStreetMap (HOT)

OSM uses a crowdsourcing model to ensure as updated of a spatial representation for a global mapping platform as possible. Descriptions of OSM as "the free Wiki world map" associate it with other nonexpert collaborative platforms within the open source movement.[45] OSM welcomes beginners and offers various user guides and other services through which users can gain required

technical practices. One of its pages has users from around the globe upload traces in .gpx form for downloading and use on an OSM editing interface.[46]

Mappers communicate through a variety of OSM-associated platforms. The site's Users Diaries, for instance, range from fixing errors in the platform and its code to sharing tips, interviews, shapefiles, resources, platforms, and experiments.[47] There are several new diary entries per day that community members may comment on. Entries span from posts on insights gained from mapping, mapping techniques and fixes, and mappers' State of the Map presentations. Anyone who visits the OSM website, member or not, can see the most recent entries immediately.

Member interactions occur both online and offline. Slack channels now help facilitate a great deal of OSM mapping work. HOT, in particular, hosts a Slack channel in which mappers can quickly get feedback on what they are seeing in aerial imagery, as well as listservs and forums that can address broader legal and technical questions. Mapathons, in turn, can gather remote mappers as well as mappers that can attend the physical site it is held in (rendering them blended settings) to train mappers and guide them through specific campaigns that need contributions. State of the Map events also serve as larger face-to-face gatherings for community members.

Barnraisings are to Public Lab what State of the Map events are to OSM; they are a prime site for workshops and socialization. Yet barnraisings are distinct in emphasizing making over presenting. State of the Map activities can still lean more toward the latter. This is not to say State of the Map events exclude such concerns. The most recent State of the Map US, for instance, made various efforts to incorporate the city of Detroit into issues of open mapping practices, holding various events to learn more about the Detroit community and to get it better represented on OSM.

Regardless of the context of interaction, OSM is often celebrated for being open to all who wish to contribute. The vision of many for OSM and its associated projects is that any user can survey data on the ground and add it to OSM. That vision often overlooks considerations of

diversity. To many OSM contributors, with no technical barrier for participation in the platform as an open source project, how could problems of inclusivity exist? Problems of diversity are reduced to a technical parameter of "openness," stripped of the complex social dimensions that also drive the site as a community of participation. It is a comparable reduction as OSM's "on the ground" principle. Within this principle, how a street or building is named in the built environment is what gets logged into OSM, even if there are different cultural or social understandings of the demarcated area. This can erase politics inherent in any physical space or online community.

As the author of one of several gender-focused user diary entries I have come across conveyed, "There are issues with how OSM collectively manages diversity, inclusion, and community engagement. To what extent are we 'open'? It is not simply about the license, the open data, or FOSS. It is a mentality and a culture of 'openness.'" The nature of the comments on the post were anything but surprising, and questioned what gender and diversity have to do with OSM and mapping. "Here we share our enthusiasm for mapping and helping the other (HOTOSM)," one user stated, "and I can't really get what you're saying." The colonial tone in invoking the "other" to reference remote mapping initiatives (whether HOT-sponsored or not) marks another dimension of difference this project explores, with Western perspectives imposing technological solutions upon developing contexts as a means to fix what the West perceives as problematic in them. Corporate interventions using OSM data toward enhanced internet penetration, as Chapter 6 details, provides one obvious example of this at work.

Many members, however, more broadly question what politics has to do with OSM. As another comment on the thread contends, "OSM . . . is already open and doesn't discriminate . . . . In view of that it is better for us to focus on mapping and, as much as possible, stay away from politics. At best politics divides us, at worst it can get some contributors or the project itself in trouble." Others asked for evidence or data, suggesting the anecdotal nature of the author's claims

was divisiveness for the sake of dividing. Many prominent male members of OSM chimed in to confirm occurrences of harassment and silencing. But comments then started picking apart arguments of the male members, amid others mansplaining definitions of gender, diversity, listening, and hearing with Merriam-Webster entries.

Another sub-community within OSM, Geochicas, responded directly to requests for data to justify claims of gender inequity within OSM. In a separate diary entry from the same time as the post, a member of Geochicas posted results from a survey of 54 members spanning nearly 15 different countries. The results indicate almost six in 10 women felt silenced in their male-dominated local OSM communities. Nearly three out of every four men also felt gender-based silencing was a problem in their local chapters. One in three women faces overt hostility in their mapping communities according to the data, with eight in 10 men reporting no such problems.

There is more balance between male and female mappers on beliefs that lower female representation in the OSM community has a negative effect on the platform, its data, and its impact – about one in four mappers in both groups. Ironically, the commentary on this post took a different turn from the previous one, with a mapper asking for evidence of mappers expressing that gender inequity *is not a problem*. The author then underscores attitudes within the community that largely dismiss the issue as a broader (and, to many mappers, natural) disinterest among women in STEM fields at large and cartography specifically.

This is erroneous from a historical perspective. Women particularly have been at the forefront of the production of maps, urban population mapping, mapping of the ocean floor, GIS, and digital cartography. Cartographic histories underscore men's labor without full consideration of who often published maps, owned shops selling maps, and crafted printed maps in overlooked trades like engraving and coloring in prior centuries - often all the product of women's labor.[48]

Tensions in OSM's global nature also show how a mapping community being "open" or "participatory" does not keep it free of politics**.** Perkins focuses on tensions between OSM desires to map what is on the ground and laws forbidding the mapping of military sites affecting the Russian OSM community as well as a tension between default mapping options and legal restrictions on right of way for footpaths within the UK community. In such instances, the universal aspiration ("the open project ethos") collides with spatial contingencies and local regulations, a collision mappers must negotiate in intriguing ways that fuel inventive approaches.[49] While this project expands such notions of friction in relation to mapping, it is thus clear that limited prior ethnographic work in mapping communities sets a precedent for that frame. Particularities, rather than hindering modes of remote mapping, have fueled further oversight and positive campaigns.

In terms of remote mapping, OSM also has an expansive humanitarian effort – the Humanitarian OpenStreetMap Team (HOT) – that engages in crowdsourced disaster mapping, including the 2015 Nepal Earthquake Map.[50] HOT interventions in disaster relief began with self-organized efforts on OSM to map in support of emergency response to the 2010 Haiti earthquake. The Public Lab community also emerged in the exact same year (and only a few months later than HOT) to respond to the media blackout occurring around the BP Oil Spill. The popularization of cartographic work is hence tied to disillusionment in disaster response and the imperative among citizens to assist in skyrocketing and increasingly devastating large-scale disasters.

In HOT disaster campaigns, mapping of different buildings and infrastructures aids first responders and others on the ground. On wiki-style pages, administrators outline different tasks for mappers and refer to them by assigned numbers. They are categorized in terms of which require expert mappers and which do not.[51] These efforts demand social interaction. At least two mappers are necessary for a block on the map to be considered complete: one to fill out the block, complete the given task, and to mark it as complete, and another to validate that the work on the block is

correct and "complete." While HOT's user guides reference how interactions can be "terse" in real time, it also assures that it should not dissuade mappers (particularly beginners) from HOT's work.

HOT's output also proves significant to charting terrain for humanitarian NGOs in developing contexts. The chart below takes a small sample of projects related to tasks involved in malaria eradication (which Chapter 5 covers in more depth) with data available via OSM Analytics. Organizations involved in the launch of tasks from this sample include the Clinton Health Access Initiative (CHAI), Médecins Sans Frontières (MSF), and the Peace Corps.

Table 2.1: 2014 and 2018 Building Counts in HOT Malaria Mapping Campaigns[52]

Task Number	Country	Organization	Percent Mapped	Percent Validated	Before Task	After Task
2136	Guatemala	CHAI	94%	92%	0	21,009
2166	Guatemala	CHAI	100%	100%	0	36,953
3327	Senegal	N/A	100%	93%	9	12,546
3979	Senegal	N/A	100%	100%	0	480
3980	Senegal	N/A	98%	100%	0	1,484
3981	Senegal	N/A	100%	100%	0	190
4168	Mali	MSF	82%	2%	2,527	20,198
4265	Mozambique	Peace Corps	100%	39%	0	5,444
4304	Mali	MSF	99%	4%	16	22,742
4305	Mali	MSF	100%	3%	851	3,661
4317	Botswana	CHAI	100%	100%	114	24,599
4338	Botswana	CHAI	100%	100%	0	2,261
4339	Botswana	CHAI	98%	100%	9	10,258
4340	Botswana	CHAI	100%	100%	0	3,789
4341	Botswana	CHAI	100%	100%	0	2,032
4382	Botswana	CHAI	100%	100%	1	9,365
4425	Mali	MSF	100%	2%	1,346	21,018
4433	DRC	MSF	100%	47%	0	2,416
4439	Mali	MSF	75%	3%	38	21,146
4633	Papua New Guinea	MSF	99%	8%	0	18,665
4746	Mozambique	Peace Corps	97%	76%	7	45,877
4762	Mozambique	Peace Corps	99%	30%	0	9,348

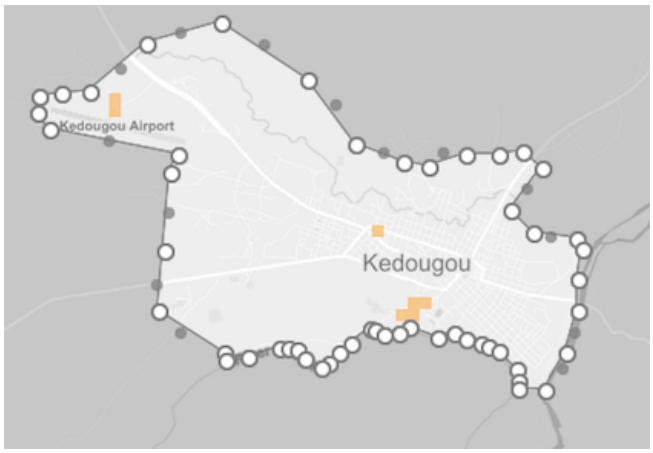

Figure 2.1: A rendering of OSM data available in 2014 from OSM Analytics of the area mapped in Task 3327 – Malaria Health Map – Kedougou, Senegal. By then, OSM members had contributed nine buildings to the area.

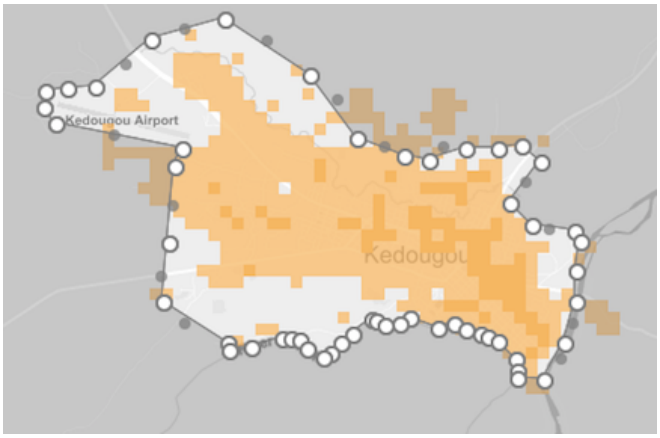

Figure 2.2: A rendering of OSM data available in 2018 from OSM Analytics of the area mapped in Task 3327 – Malaria Health Map – Kedougou, Senegal. By then, OSM members had contributed 11,950 buildings, in larger part due to three different HOT tasks.

As the data suggests, HOT campaigns serve as an impetus to map areas that barely have a footprint, if any, on OSM, or any other mapping platform. The new base layer data that results can then be available for any future aid campaigns that may be needed in those areas.

The historical context of digital mapping itself lies within epidemiology. John Snow, a prominent figure in genealogies of lay cartography, convinced members of British Parliament through mapping that significant changes in water and sewage infrastructure were merited to stop

the spread of cholera.[53] Snow demonstrated mapping could be "a problem-solving tool" that, when computational capacities advanced from the 1960s on to record, process, and visualize increasingly large data sets, became quite powerful and applicable in an increasingly digitized world. Implementations of GIS at the level of governance – first within the Canadian Land Inventory, then within the US Census Bureau and the UK's Ordnance Survey – realized these ideas at a broader governmental scale, making government analyses an important level of study for this analysis. With commercialized software and exponential increases in computational capacity – alongside the lifting of Selective Availability (SA), a key focus of Chapter 3 – accuracy and the potential for innovation furthered extensively. Open source approaches, the focus of this dissertation, certainly fall within the latter.[54]

Projects like OSM, Public Lab and their offshoots exemplify internet-enabled projects of self-organizing communities around environmental and humanitarian data. They all exhibit reflexive stances on the ethics of mapping, data capture, and data visualization, even if those critiques can look different in their framing or execution. To appreciate this work, one must consider the changing nature of nonexpert collaboration and critical making in spatial matters. I begin my discussion of Public Lab's work with such considerations.

Public Lab

The invocation of the public within Public Lab and of the open within OSM and HOT accords with shifts in public interventions within contemporary knowledge production. Professionals and lay publics operated on the same plane "until the late 19th century," not long before the grassroots begins to circulate as a political discourse.[55] They read the same materials, operated within the same collectives, and published within the same publications until professionals excluded lay publics through degree requirements, academic societies and publications, and

increasingly costly tools and laboratories. Experts deemed such materials and spaces necessary for "legitimate" findings.[56] These trends are also evident across various areas of study involved in the topic of this dissertation, from ethnography to cartography.[57]

In the US, lay publics' role in scientific knowledge production regained prominence with the environmental justice movement and the popularity of the internet toward publishing and resource sharing.[58] While presumptions of a lack of discipline and rigor to lay publics' findings on environmental matters still remain, these views are beginning to shift with transformations in how science is produced.[59] Civic technoscience, a term inspired by Steven Shapin and Simon Schaffer's work in *Leviathan and the Air-Pump*, interrogates who is seen conventionally as a credible actor in scientific knowledge production by rethinking materials, spaces and practices it typically employs.[60]

As applied to mapping, scholars worry that "material technologies for satellite imaging preclude the engagement of people inhabiting the sites they map; communities cannot direct the path of satellites or opt not to be imaged."[61] Sara Wylie, Kirk Jalbert, Shannon Dosemagen, and Matt Ratto frame Public Lab and grassroots mapping as a critique of satellite infrastructure itself, citing its practices as evidence that critique can be active rather that solely descriptive.[62] They invoke Latour's views on mapping alongside the work of other mapping scholars to reinforce maps' colonial, imperial, and corporate applications given their capacity to enable actants to enact control from a distance. This often leads to data being closed off from afflicted communities.[63] More broadly, to Warren, a founding figure in Public Lab, a public better able to conduct low-cost mapmaking "will empower bottom-up cartographic activism and circumvent the current power structure of mapmaking." Grassroots mapping thus sets out to challenge cartography's power structure and inspire creating maps toward social transformation.[64]

Public Lab champions low-cost methods toward community technoscience. Its MapKnitter interface enables users to stitch aerial images over a map of an area. It is free, open source software

Public Lab uses to archive over 2500 user submitted maps.[65] Public Lab situates tools and mapping kits they sell online (including balloon and kite mapping kits) as part of its Grassroots Mapping Curriculum, ongoing since 2011. Their website offers various wiki entries and videos for non-practitioners on how to use the interface and map using their kits. For new members, the new MapKnitter interface, its second version, even has a chat room to consult community members.

MapKnitter submissions ideally knit overlays captured during a balloon or kite flight onto either a Google or OSM mapping layer. They are collages of aerial images, sometimes over various different mapping visits. Members capture images through cameras attached to kite strings using carabiners and/or DIY rigs made with everyday materials like rubber bands, foam cut-outs, or plastic bottles. Cameras shoot continuously over a given area during the flight. With the investment in collage, there is no pretense toward a single snapshot of the landscape as in dominant platforms.[66] While MapKnitter submissions often lack descriptions, some members (though not a majority) situate their mapping in profiles and research notes that link to other Public Lab pages and projects.

Part of how Public Lab seeks to transform how spatial knowledge is produced is by establishing social infrastructure that can critique assemblages which shape knowledge production, ones both social and material. Warren's drive for such a community harkens back to Benedict Anderson's imagined communities.[67] As grassrootsmapping.org, founded in Warren's vision, became Public Lab, the community evolved into one more broadly thinking ecologically about environments of concern as well as about infrastructures that set dominant senses of space through mapping. Rebecca Lave, a geographer of science, discusses Public Lab for how it "serves as . . . inspiration for how academics can substantively contribute to democratizing environmental knowledge production."[68] A component of this inspiration lies in applying lessons from critical making communities to interrogate the means by which scientific findings become legitimate and the exclusivities of professionalized science.[69]

Matt Ratto defines critical making as "a mode of materially productive engagement intended to bridge the gap between creative physical and conceptual exploration."[70] Through critical making, Ratto sets a goal "to make concepts more apprehendable, to bring them in ways to the body, not only the brain."[71] Public Lab, in turn, gets attention for recognizing "citizen science" as lacking in critical making and less opportunistic for publics, primarily data gathers in such efforts.[72] Critical making can create alternative technologies designed with ethics in mind in the ways mapping systems warrant, as aforementioned public perceptions on tracking underscore. It can help see how technologies influence and are influenced "by social, economic, political and cultural contexts."[73] Maker communities thus have unique, spatially informed constraints.[74] Instead of presuming their politics and subjectivities, one must follow and situate the range of both at hand critically.[75]

Though Public Lab's website is active, a small percentage of its members supports its work, equally a trend in other open source communities like Wikipedia.[76] One must keep such dynamics in mind to resist portraying collaborative open source communities as utopian.[77] What follows charts the concentration of MapKnitter contributions at different moments of this research.

Table 2.2: The Concentration of MapKnitter Users Behind MapKnitter Output[78]

Time of Data Collection	Total Number of MapKnitter Users	Users Contributing Multiple Maps	Users with More Than Three Maps	Users with More Than 10 Maps
Early 2016	1272	394 (30%)	89 (6.9%)	13 (.01%)
Early 2017	2431	535 (22%)	121 (4.9%)	23 (.9%)
Early 2019	3937	729 (18%)	157 (3.9%)	26 (.6%)

Those who contribute the most can be quite close-knit. Members often converse via research note comments and Google group lists, some organized by region and others around interests.

Many who participate the most in Public Lab are university-affiliated or alt-ac scholars. While Public Lab distributes tools necessary for community interventions in local environmental

issues and engages such communities actively, a great deal of the dialogue seems deeply involved in academic networks. The community is fairly transnational, but is still largely led by American figures. While Public Lab organizers (community leaders who incite Public Lab projects), represent 12 different countries, most hail from the states.[79] 12 of the 13 members of the team running the organization are also from the states.[80] At least one member of its Board of Directors is from outside the United States. Aside from its organizational structure, Public Lab has also hosted projects in Chile and Israel and highlights them as focal to its history.[81] A quick glance at recent MapKnitter contributions could range from American sites to international sites like Spain, Colombia, the Netherlands, and Australia.[82]

Public Lab has several modes of communication of feedback for work despite its distributed community. Aside from notes, comments on the site, and email lists, Public Lab hosts OpenHour Zoom calls regularly. Their topics vary. Past OpenHours, which Public Lab has run since 2014, have ranged from mapping, air quality monitoring, thermal imaging, and hydrogen sulfide monitoring.

Face-to-face interaction largely occurs within barnraising events. Formerly, Public Lab held barnraisings at the Louisiana Universities Marine Consortium (LUMCON) in Cocodrie, Louisiana each November. This has now shifted to events on region-specific projects – including monitoring Chicago pollution and Appalachian mountain top removal – held in those areas. As a "location-based event," they attune to the location hosting the gathering. The genesis of the "barnraising" name falls "[i]n the spirit of bringing a community together to collectively raise a structure such as a barn." Its drive to gather diverse actors around situated problems to develop equally situated questions, tools, and approaches demonstrates more organic political engagement.[83]

The situated occasions grassroots mapping provides highlight such contingencies within mapping. The following published anecdote from a Public Lab mapping trip demonstrates this:

> In grassroots mapping, the tools themselves become vectors for analyzing local conditions, but also provoke unexpected connections . . . . [O]n a balloon mapping expedition in Louisiana, [a mapper] noticed spider webs that had caught all the way up the line connected to the balloon, forming a shimmering silk ladder as far as the eye could see. Without the line in the air above them, the mappers would never have noticed the spider webs flying around them. This experience provoked new questions about the surrounding ecosystem and reemphasized that these are dynamic inhabited spaces. In this case the mapping apparatus became a tool for learning.[84]

The rhizomatic moments Public Lab hosts show how human-nonhuman interactions spawn new information and questions within the ecological. Within ecologies, subjects and environments are inextricable within what is produced and mobilized materially.[85] This project seeks to highlight similar narratives through participant observation experiences with the communities at hand. Further, it sets the stage for the insights such community anecdotes yield through archival and discourse analysis that identifies what issues public GPS use emerged out of and continues to face.

Methodological Framework

Experience and storytelling are central to cultural studies and STS. Cultural studies is "alert to contradictions, ambivalences and silences across different narratives," bringing omissions to light just as much as what subjects underscore.[86] It looks at lived experience both as it is framed and as it is made. The subject always experiences both processes at once; subjects simultaneously absorb experience as it is produced and act upon experiences as an already established product.[87] Experiential facets of grassroots mapping, in turn, both produce grassroots framings toward data capture and are a product of the framings which underpin the grassroots. This renders the grassroots as a category continually made and remade within the work of the communities at hand.

Narrations mediate between process and product, self-identity and distancing, histories and futures.[88] STS scholars Natasha Myers and Joe Dumit relay this sense of mediation in studying scientists' gestures while describing scientific phenomena. They coin haptic creativity to describe

bodily performances within "moments of not knowing."[89] Narrations in such moments become vehicles concretizing "new phenomena" within science, showing science is always performative. For scientists, embodied narration navigates different possibilities to narrow down phenomena for description.[90]' These examples from cultural studies and STS stress that experience both narrated and practiced simultaneously, justifying the focus on both through the methods this project uses.

The methodological palette of this dissertation attends to a need for immersion in the texts that foreground the object of study as well as immersion with the object itself. Rather than engage in "multi-sited" approaches of other anthropological takes on communication and media, this dissertation argues for the merits of a "multi-method" approach. The focus is not exclusive to different environments of use, but the general climate of the use of the technology itself within institutional, de-institutional, and emergent formations.[91] This dissertation, taking a cue from grassroots and ecological metaphors, sees media and technology policy transformations as setting the stage for cultures to germinate around technologies and those cultures as generating new, unintended, and workaround uses for said media in relation to policy.

Perceptions of technology are paramount in constructions of the grassroots and its pastoral imaginings. Leo Marx' *The Machine in the Garden*, a seminal take on the pastoral within American ideology, traces the nostalgia for the bucolic within the psychoanalytic and within early American literature.[92] The pastoral juxtaposes the "artificial"; the deeper one gets into industrialization, the more one sees contrasts between noisy machines and tranquil landscapes in American literature.[93] Here, Marx draws from Alfred North Whitehead's analysis of William Blake to regard such moments as "a protest on behalf of the organic view of nature."[94] To extend out, this contrast of the organic with the technological is one that the Habermasian distinctions this dissertation explores equally play into. As this tie shows, Marx' points are by no means exclusive to literary motifs.[95]

Grasping grassroots mapping's entwined discourses, communities, subjectivities, and practices requires a multifaceted research design in line with Douglas Kellner's calls for "multiperspectival" approaches to media and culture. This is meant "[t]o avoid the one-sidedness of textual analysis, or audience and reception studies."[96] Though researchers often see discursive approaches as averse to audience and interpretive research, there is precedent for discourse analysis projects to incorporate elements of audience research – be it through surveys, focus groups, participant observation models, and ethnographic designs. The pairing can cement findings from discourse analysis without making them seem like presuppositions.[97] Norman Fairclough equally makes this clear in *Analysing Discourse,* a methodological text central to the dissertation.

The study of mapping itself is diverse methodologically. Work on thick mapping (a play on Clifford Geertz's thick description) manifests a "blended approach" resulting from methodological quandaries in mapping. Debates resound between quantitative approaches critiqued for their positivism and critical approaches critiqued for committing to mapping for its metaphorical value, not its technical side. Blended approaches, by contrast, "situate and investigate historical questions on spatial platforms, without uncritically embracing or cavalierly dismissing GIS."[98]

My focus on the historical and the discursive while investigating the technical and the practiced through participant observation is similar in intent. While my approach is more eclectic than blended, it recognizes the latter's intent to historicize without being overly optimistic or critical about technologies in practice. My methods also tune to the focus on the organic in the corpus of critical theory the project works from. Part of the rationale for my methodological framework is to incorporate thick description, through which structures of difference can rise organically within the analysis. This can illuminate the vibrancy the grassroots inhabits within diverse perspectives. Within an ecological metaphor, the organic necessarily folds and feeds new life and tactics. Guy Debord's

work, for one, addresses problems in the short-term viability of the tactical for the working class. Such work does not always think about such issues cyclically, as Deleuze does via the rhizomatic.

Michael Burawoy's extended case method approach also informs the method sequence. It adopts a particular relationship between theory and method in participant observation - one of being reflexive, using immersion to more carefully craft theory, and tuning it to the particular spatialities and temporalities of practices studied.[99] It uses this relationship to apply what is found in particular contexts toward the macro-level, orienting present local circumstances to historical conditions to forecast possibilities.[100]

Accordingly, this project revisits relations between technological systems, grassroots work, and social life within Habermas' work, a body of theory with connections to CDA. Habermas sees a need for both structural and cybernetic approaches to communication, with the former as a means of examining lifeworlds as encompassed by cultural codes and communicative action and the latter as a means of examining systems, such as those of media and political economy.[101] In his own theorization of systems, Niklas Luhmann similarly sees a singular global system with various sub-systems (nation-states, legal systems, religious systems, and so on) constituted by codes within global and local communication respectively.[102] The lifeworld is bottom-up, while the system is top-down, if not exterior. When supposedly objective forces like the market are taken as self-regulating panaceas, this occludes possibilities for dialogue and assembly (both residing within lifeworlds). The deliberation of common values, in other words, is lacking, if not nonexistent.[103] Lefebvre's endorsement of self-management is absent; modes of intervention become hard to map.

The online communities this dissertation hones on and the dialogue they sustain over best practices, technologies, and partnerships for the work they engage in encompass this need for public deliberation. In his fears, Habermas echoes Herbert Marcuse's endorsement of remaking science and technology to be applied more to human concerns than to contexts of control.[104] Ideally, a

Habermasian society is more invested in rationalization toward arriving at autonomy, norms, and values (in Habermas' terms, interaction) than for increased control and production (work).[105] It is thus discursively a different investment in rationalization than "top-down" perspectives, one that community-based mapping movements facilitated over distributed online platforms seek.

Investments in mapping and tracking within information capitalism manifest the anxieties Habermas harbors**.** Capitalism flips the priority of Habermas' society, privileging work to interaction as part of a monolithic system.[106] Within liberalism, for instance, the economic became an all-encompassing, reified system best left to its own devices; within the 20th century, the state emerged as an active agent intervening in the market through the technological and the scientific. This both legitimates the state and leads to a crisis of legitimacy for a public left powerless in determining what is best for society.[107] The public's absence leads scientific and technological applications to have little consideration of the ethical. Both applications become seen as somehow separate from ideology.[108]

By looking at discursive framings surrounding digital mapping, I show how digital mapping has largely been reified as a system in the Habermasian sense, with the organic work of grassroots initiatives epitomizing Habermas' call to incorporate concerns of lifeworlds into systems. Yet I also seek to reorient Habermas' conceptions (following in Kellner's footsteps) to the production and role of data in contemporary society through insights from these case studies**.**

One can assess the discursive dimensions of a community in how members narrate its operations via interviews, but one also needs participant observation to access non-discursive dimensions - what the community crafts and how. Accordingly, what follows is a methodological framework that abides by the extended case method's links to discourse analysis, interviewing, and participant observation. I propose a chapter-by-chapter approach wherein chapters employ different methods toward complicating grassroots mapping's meanings. I detail what their concerns are, what they can yield, and why they pertain to a project on mapping communities.

In this methodological sequence, archaeological analysis identifies the discursive formations in play, CDA defines the problems grassroots mapping initiatives face in relation to those discursive formations, and participant observation relates community practices and technological use back to the defined problems and discursive formations. In a Habermasian sense, archaeology examines public mapping at the level of the system, CDA at the level of the lifeworld, and participant observation within interactions between the two.

Archaeological Analysis and Media Archaeology

Foucault argues that an analysis of discourse, "the group of statements that belong to a single system of formation," must attend to the "dispersion and redistribution. . . of statements," which he terms as the discursive formation. Statements belong to discursive formations that constrain what can be said about a given realm of knowledge.[109] Commonalities in how and where they appear ("regularity") and how they spread ("dispersion") define discursive formations.

Archaeological analysis, which Foucault equates to an act of mapping, follows trajectories of discursive formations, diagnosing conditions for what is deemed true.[110] Rather than conclude a truth or an origin, archaeology follows how a discursive formation appears and moves.[111] It investigates how a truth is settled, not what the "truth" is, reframing history. What was said, how it was framed, and how that frame comes back in unanticipated ways is the point of analysis.

Contemporary media scholarship extends archaeological analysis in media archaeology. It takes up Foucault to investigate how media emerge as "new."[112] Media are often deemed "new" without thinking critically about temporalities (as all "old" media were once new) or recognizing unforeseen applications of different technologies (as many technologies have unintended consequences deviating from their encoding).[113] The power behind describing media as "new" speaks to entanglements of discursive constructions – among them, that media being deemed "new"

can speak to vulnerabilities brought about by emerging media (the new as "the viral"), interdisciplinary perspectives opened up by media, or brand attempts to give media a unique value.[114]

Media archaeology applies Foucault's view of the archive in an updated way. In it, the archive becomes more rhizomatic, "rearticulated less as a place of history than a dynamic and temporal network of software, a social platform for memory and remixing."[115] In line with Benjamin's views on history, media archaeology believes in reworking the historical through present perspectives. Technological advancements in approaching old categories, including via mapping visualizations, thus do not merit replacing prior meanings of these categories completely.[116] Associations of mapping with class subjugation, colonialism, gendered spatialities, and racism throughout its history continue to be relevant to digital mapping broadly and open source geospatial knowledge production specifically.

Media archaeology equally underscores media is always material and that evolving configurations of institutions and cultural forms experiment with archives media draw from. Media archaeology is thus a project of theorizing, historicizing, and critical making. Together, these tactics reconfigure space-times in ways that support a Latourian view on how geographies are produced.[117]

Media archaeology borrows Foucault's method of tracing discursive formations and their interrelations. A critique of it is that media archaeology only takes from the methodological side, and does not overtly address institutional dynamics or power relations as Foucault intended.[118] This is a critique I take fully to heart. I believe my pairing of an archaeological analysis (rather than a media archaeology) with other methodological perspectives helps to tease out these institutional dynamics in a more immersive sense that translates to the present moment. I take up the Foucauldian sense of the archaeological to trace how power relations help shape the meanings that a discourse of public GPS inhabits on the state level and the opportunities it constructs for citizen participation within the work of governance. Tracing the operations of such a discourse is more attuned with how Foucault

sees the enactment of power as both everyday and productive.[119] While archaeology alone is insufficient for a project focused on discourse, subjectivity, and practices, it sets the stage toward other critical approaches I deploy, particularly CDA.

Critical Discourse Analysis (CDA)

Archaeological analysis pinpoints how institutions create subject positions by returning to archives. CDA more broadly follows patterns in the linguistic that prove ideologically resonant. Archaeology is not as much an attempt at identifying an "ideological grammar" as it is about identifying institutional shifts language is embroiled in as an institutional tool managing subjects.[120] Archaeology examines how institutional initiatives mobilize subjects toward productivity around clear institutional goals – often as subjects of these broader formations.

CDA is not necessarily as top-down in its analysis. In employing CDA, researchers start "with a social problem which has a semiotic aspect" – not necessarily one that begins with the actions of a given institution – and pinpoint barriers toward resolving it within both practice and discourse.[121] For this project, the issue at hand is the aforementioned exclusion of publics from mapping their own communities in ways that can speak back to power. The archaeology chapter comes before the CDA chapter in the chapter sequence largely as a matter of chronology. My use of CDA traces contemporary discussions and use of mapping among publics that extends and rubs up against threads from the government imaginaries Chapter 3 explores. Many of the entanglements Chapter 4 explores were unanticipated within such imaginaries.

Thinking about interrelations between practice and discourse (as the broader methodological process implies) considers individual agencies and recognizes patterns of language (styles, genres, or institutional rhetorics) they fall in line with or remix inventively.[122] Practices may be informed by a discursive frame, but inventive practices may result that could not have been anticipated by it.[123]

CDA employs textual analysis toward these ends. Norman Fairclough attends to semantic relations, grammatical relations, intertextual relations, narrations of subjects and social events, modes of speech, and mood (alongside his focus on genre, discourse, and style) within CDA to examine the social significance of a text and its nuances in a given order of discourse. CDA correlates with notions of the co-evolution of societies and sign systems (both material and discursive) in social semiotics, ones Robert Hodge and Gunther Kress' *Social Semiotics* perhaps best expresses.[124]

CDA also speaks back to theory. It can operationalize thinking from figures like Habermas and David Harvey, making CDA a fit with the project's theoretical purview. For the former, an analysis of discourse can show how systems of expertise and the state hold an elevated status within modernity that seeks to "colonize" everyday practice. For the latter, it can reveal how texts participate in the social construction of space-times, particularly the relation between local and global.[125] Harvey thinks the contemporary moment marks "an intense phase of time-space compression that has had a disorienting impact upon political-economic practices . . . [and] cultural and social life."[126] Jameson suggests forming mental maps that can be flexible with the growing flexibility of spaces within multinational capitalism to reassert their positionality. Globalization constantly rearranges spatial flows; navigating this is to him the prime political project within postmodernism.[127]

Keeping means of resistance in mind here is critical. Sassen's focus on the material and the temporal reveals various creative means of resistance, such as processes of slowing down.[128] One can use technology, for instance, to slow down the temporalities of modern life to organize and enact resistance. Public Lab identifies this as a tactic via grassroots mapping explicitly, one of various frames of its practices that Chapter 4 outlines.[129]

Fairclough admits CDA, like archaeological analysis, is likely a component of a more diverse methodological palette. CDA, to him, pairs well with ethnographic approaches when projects seek

"to reach a deeper understanding of how people live within the new capitalist order . . . and how discourse figures as an element in their ways of living."[130] I thus pair archival and textual analysis with participant observation in these communities, both digitally and at organizational events.

Participant Observation of Digital Communities

Stances on location-aware media (often seen "as placeless and homogenizing" in critical theory yet highly dynamic in its social, material, and spatial implications in the practice turn) are problematic.[131] Various scholars in critical theory have deemed one's sense of place compromised with the rapid pace in which people, information, and capital now spread through global communications infrastructures.[132] But more ethnographic perspectives on such media can examine their role in activating a sense of place and diverse cultures of use.[133] Discourse ethnography equally covers this methodological ground.[134]

The participant observation chapters for HOT, OSM, and Public Lab respectively follow the archaeology and CDA chapters largely, again, as a matter of chronology. The community work and practices those chapters document manifest applications of public GPS (the focus of Chapter 3) and attempts to navigate ethical issues inherent in public initiatives in digital mapping (the focus of Chapter 4). I approach this research largely as an outsider to these communities, which can be beneficial. Outsiders are able to reflect on gaining the level of technical skill underlying practices in ways that can reveal facets of communities and their practices that may be left unexplored otherwise.[135] Indeed, participant observation steeps researchers into "the social frame" of community practices. When applied to the digital, researchers gain membership into virtual communities as well as community members' trust and insights through their involvement.[136] When applied to mapping, participant observation, extending the utility of ethnographic approaches as a

mapping of practices according with Geertz's notion of culture as comprised of "webs of significance," can itself map in bounding a community and gauging interaction.[137]

The ways participant observation is applied are thus highly situated, not universal. A participant observation design must be "authentic in that culture's own terms" and "depends on the research question, fieldsite, and practical constraints." A constant, however, throughout different applications of participant observation is a deep time commitment into different facets of the community.[138] Another is that participant observation lets researchers justify insights on community dynamics with anecdotes of social interactions across social settings over time. Much of culture is resistant to articulation and only emerges through practice and performance.[139] Interviews, however, additionally reveal how informants situate community practices and meanings generated out of them, and prove important to participant observation research designs.

Interviews

Community practices may be unconscious, part of what Pierre Bourdieu deems a "habitus." Interviews thus do not highlight all mechanisms of meaning-making in a community. They can, however, gauge the frame community members have for practices, experiences, motives, and values. Bourdieu's *Distinction: A Social Critique of the Judgment of Taste*, for instance, incorporates interviews alongside surveys and textual analyses to investigate cultural consumption as a facilitator of class distinctions.[140] Interviews also provide powerful anecdotes that speak to a given community's hidden genealogies, power dynamics, and cultural practices. Likewise, in one-on-one interviews, community members may share insights they otherwise would not in the presence of other members.[141]

This project thus incorporates insights from select semi-structured interviews with community members. Semi-structured interviews, designed with a "mix of preparation and flexibility," are key to participant observation designs. Tom Boellstorff, Bonnie Nardi, Celia Pearce,

and T.L. Taylor suggest using a modest list of open-ended questions and follow-up questions when warranted. Keeping interviews semi-structured can also be done by simply allowing for questions during the interview that give informants the opportunity to elaborate on particular statements that may need more time to fully flesh out. Questions should also include letting the informant ask questions, or allowing the informant to provide further information they think the researcher should know and/or are missing in their line of questioning. Since research designs are built to be flexible, this can then be used to re-orient research questions or theoretical perspectives as necessary.[142]

The theoretical emphasis on the ecological matches many of the motivations behind the methodologies examined here. The conditions by which certain questions or lines of thinking are more feasible than others (a Foucauldian take); the intertwining of practices and discourses within ecologies (meriting methodological approaches that account for both); the pursuit to make knowledge production seem less monolithic and inaccessible to publics (as Habermas fears); and the recognition of a multiplicity of space-times governing subjects, environments, and actions (reflecting Harvey's contentions on the dialectics of space) are all defining philosophical orientations within ecologies.[143] More broadly, at the core of ecological study is the methodological matter of reconciling the language and maps of practitioners to describe their practices; our own as researchers; our maps of communication flows through different spheres; and a mapping of the social networks in play.[144] This lies equally at the heart of participant observation approaches. The proposed chapter sequence, the final section of this chapter, develops how I intend to apply these methodologies.

Chapter Sequence

Chapter 3, "An Archaeology of GPS and Grassroots Mapping," deploys an archaeological analysis of imagined applications of GPS during the Clinton and Bush administrations, when work

toward public GPS use was most active. The presidential archives foreshadow surveillance, economic, military, aviation, and modernization implications in the proliferation of public GPS. The analysis shows that while such self-organizing community work through the opening up of mapping practices as this dissertation focuses on was largely unanticipated, it is not a surprising consequence given visions of governance the state imagined publicly available GPS would afford. The ties between mapping and governance are thus still afoot in the imagining of public GPS use, which makes the value of such use in augmenting government data and initiatives equally unsurprising.

The analysis traces how the fascination with accurate, public GPS was, again, one of enhanced government and corporate power. The state postulated making GPS available to the public would improve economic potential, emergency responses, government efficiency, and citizen productivity. I argue these framings reflect a moment in which citizens conduct more and more of the work of governance in ways that have now been extended through public mapping capabilities. To this end, I pay particular attention to the Reinventing Government and E-Government initiatives within the Clinton and Bush administrations respectively, both of which enroll GPS. The placement of public GPS use within a "reinvention" of government, or as part of governance in an age of pronounced electronic mediation, syncs with notions of efficiency and public participation that resonate within contemporary nonexpert mapping interventions.

The import of the archaeological analysis lies in establishing such connections within policy documents, fact sheets, press briefings, and the like, grounding findings from the dissertation within an archival analysis that has not been carried out elsewhere on a comparable scale in work on digitally mediated mapping. Following this discussion, I connect these archival findings with projects that identify themselves as ones of grassroots mapping. These include the DroneLab produced mapping app, Grassroots Innovations for Inclusive Development (GRIID), Mapability, *Hollow*, and Public Lab. The significance of grassroots mapping and what it can mean in different contexts

becomes clearer in tracing discursive connections between these projects. These include discourses of civic hacking, digital life, and the internet as an environmental technology present within the framing of these projects. These connections substantiate the participatory framing of grassroots interventions and their opposition to the uninformed interventions of "forces looking in." However, as previously mentioned, the entanglements between these interventions and forces prove far more complex than on the surface level. Chapters that follow further establish this.

The communities at hand, though, distinguish their work through such constructions to relay the monstrous capacities of dominant mapping systems. Chapter 4, "A Critical Discourse Analysis of Public Lab," exemplifies this by applying CDA to analyze select Grassroots Mapping Forum articles; Jeff Warren's Master's thesis; and an *Information Society* article centered on Public Lab. These texts situate the supposed "democratization" of mapping following the public availability of GPS as an issue of new capitalism and activate mappers as critical data consumers while portraying state and corporate actors as being out of touch with on the ground perspectives. The publications also frame grassroots mapping as much about producing dialogue and critical consumption of data on moral grounds as about producing tactical mappers.

Chapter 4 also applies Kellner's views on the work of Habermas specifically to examine the relation between organic intellectuals and media use that grassroots tactics speak to. The chapter equally situates how the normalization of surveillance within more conventional mapping forms reflects Habermasian fears of the reification of the state as somehow operating as a system above, let alone separate from, everyday social life. This leads to the image of the citizen as a subject of and consumer of data, rather than an active agent shaping the capture, maintenance, and lifespan of data.

To this end, Public Lab constructs grassroots mapping as local, reciprocal, and dialogic while constructing government and corporate use as global, one-sided, biased, and invasive. The phrase "community satellite" in itself implies communities typically have no say in how data is captured or

used via GPS or which actors (both state and corporate) such data serves. This phrasing implies the grassroots serves as an organic inversion of power; satellites, instead of being taken as given and as solely technological constructs, become cultivated through social ties and around community. Yet a key point of friction from this chapter is the aim to speak back to dominant spatial representations while also seeking incorporation from those very platforms as a means of legitimacy. This serves as the ultimate benchmark of success for many of the more prominent interventions mappers stage on MapKnitter. The strive for absorption within recognized platforms troubles the "top-down" and "bottom-up" distinction in mapping; these perspectives are in constant negotiation and in many cases, mapping work cannot be easily separated into these categories.

This is not to discount the function of such communities as assemblies, or that much of the reason for their critique has to do with ethics and structures of ownership within digital cartography. Latour's conception of assembly, spanning several of his texts, teases out the assembly for its double meaning; it refers to both groups of humans gathered in a specific setting toward the pursuit of a common interest *and* the process of assembling a machine or object. It is this dual meaning Latour contends politics should better reflect: the need to create a space for subjects to deliberate issues based on shared interests and to assemble objects and spaces pertinent to those discussions.[145]

Understanding practices and technologies forged in the assembly and how they sustain community work is necessary. Toward this, the remaining body chapters of the dissertation center on participant observation experiences in HOT, OSM, and Public Lab. The main contribution of participant observation is to understand how communities not only frame mapping, but how their mapping practices match up with their espoused views and how these communities might be described ecologically as highly situated, not universal, endeavors. It thus continues the focus on mapping as it has been applied in self-proclaimed grassroots contexts. Even if some of these

projects do not fall under an explicit framing of "grassroots mapping," they can nonetheless invigorate a study of grassroots initiatives in mapping more broadly given their modes of organizing.

Chapter 5, "Humanitarian OpenStreetMap (HOT)," begins this sequence by describing ecologies of disaster mapping and crisis mapping campaigns, HOT microgrant projects, and remote mapping efforts. These include assisting with CHAI's Eliminate Malaria Mapping campaign (an obvious extension of the governance argument behind the expansion of GPS use within Chapter 3) and mapping refugee networks. Much of this can also be seen as an outgrowth of the lab and the modern hospital, work increasingly falling in the hands of NGOs and citizens within crowdsourcing.[146] Within this, the thematic legacy of programs like Reinventing Governance and E-Governance as discussed within Chapter 3 clearly resounds and becomes a point of focus.

This chapter discusses my participation in an experimental internship program (the first of its kind within HOT) that demonstrates the large and longitudinal problems HOT tackles through partnerships with governments and NGOs. These interventions demonstrate OSM's on the ground policy can get reworked in complex ways in relation to larger scale formations like disaster relief – a point further examined in Chapter 6 with bus route mapping. The more complex this work gets, the more such projects need to reach out to (or are contacted by) satellite companies, dominant online platforms, and government agencies for imagery sets and population density imaging, rather than building local capacities for mapping as grassroots initiatives in theory espouse and practice. While one of the pronounced framings of grassroots approaches to mapping, galvanizing local mapping capacity does not always translate into community practice. This is due not just to co-optation of grassroots labor, but also because of the real-time nature of the pressing challenges such labor can address. The modes of production entailed and open nature of the output can augment governmental and corporate capacities (with Facebook efforts being the notable example from this

particular chapter), ones at times out of step with desires identified within the public sphere, as addressed in the analyses of Chapters 3 and 4.

Likewise, members often frame these disasters as meriting cartographic proficiencies by the wider citizenry, which can then gain digital literacies as a mode of self-entrepreneurialism. Outside of disasters, the same logic applies to other complex problems in urban planning Chapter 6 focuses on – be it mapping transport networks, bike routes, or even traffic patterns. Within these initiatives, OSM also cements self-tracking as a mode of knowledge production countering "official" data and questioning their authority over community knowledge production.

Chapter 6, "OpenStreetMap (OSM)," focuses on local level OSM activities (particularly surrounding the recent bus route mapping series of mapathons), the motivations behind mapathons more broadly, and themes of projects and discussions from a recent State of the Map US conference. As is the case with HOT's disaster mapping work, OSM work being recognized more and more as "off the ground" as it is in such settings contrasts from values and philosophies that have typically defined the community. In demonstrating another complex entanglement at the core of the ecologies this dissertation discusses, it encounters structures of data governance that ultimately shape and constrain its potential, revealing frictions intellectual property (IP) policies and automated modes of mapping pose. Closed data practices have proven motivating to formations like OSM, and mapping more complex problems reshapes mapping practices. In turn, automated forms of mapping reinvigorate, rather than replace, the need for human labor in digital mapping processes. Such findings demonstrate ecologies at work in digital mapping practices, be they corporate or community-led.

Perkins' work establishes how particular circumstances and politics of mapping communities make mapping highly situated. This renders complete and accurate mapping, as is OSM's articulated mission, an ultimately impossible project. Chapter 6 submits as a corollary that IP policies of

different nations and organizations equally signify this. Though some in the community believe OSM is somehow free of politics and use this to excuse its lack of diversity, working toward open data is inherently a political project, one set against institutions that keep their data closed.

Chapter 6 also charts how an ever-expanding and equally ambitious ecology of applications, interfaces and techniques factors in, at times in ways that may support the flip side of the project of a complete and accurate mapping that Warren identifies. This includes, similar to points from the prior chapter on Facebook's internet penetration mapping efforts, data from increasingly popular means of contribution being co-opted for foreign mapping of military bases and corporate efforts toward mapping for autonomous vehicles. As mapping on OSM grows more and more off the ground and more reliant on modes of automation and machine learning, the restrictions, opportunities, and drawbacks of public interventions in spatial knowledge capture via crowdsourcing become more apparent and more pressing moving forward.

Chapter 7, "Public Lab," ties philosophies of grassroots mapping to Public Lab spaces, workshops, and research. It details interface logistics entailed in MapKnitter contribution and the logistics of capturing aerial images via its most recent innovation in DIY aerial imagery production: its mini kite mapping kit. It equally follows beliefs amongst select Public Lab members that one might typically associate with the grassroots and the organic. They often define themselves through shared opposition to dominant pedagogical and political economic paradigms in relation to technology, mapping, and data.

As Chapter 7 shows, grassroots mapping within Public Lab mapping is deeply pedagogical, highly interdisciplinary, and committed to the adhocratic as a mode of organizing. Conforming to the politics of the top-down visual system grassroots mapping sets itself against in order to create an ideal submission serves as an additional point of friction from this chapter. This complicates understandings of mapping in that the oppositions of top-down and bottom-up or on the ground

versus off the ground emerge as faulty distinctions. Negotiations between the two shape the mapping representations at our disposal significantly. Such frictions can constrain possibilities for subverting dominant structures and platforms while nevertheless enabling the impossible pursuit of the "complete" map, often toward further social equity. This displays the caliber of complex entanglements with forces often constructed as opposing that I find constitutive of such grassroots projects, as does the use of the MapKnitter platform to perpetuate spam during the research period.

The conclusion, "Maps as Ecologies," brings the findings of all the chapters together. It revisits the project's research questions; establishes a sense of the evolution public applications of geospatial data, infrastructures, and technologies have taken; and summarizes the ecologies and frictions cartographic work inhabits within online communities. As such, this dissertation establishes a critical framework for contemporary work in community-driven cartographic production within open source mapping communities, but also shows the ramifications of the theoretical and methodological framework it establishes for communication and media research more broadly.

Methodologically speaking, this dissertation details relevant archival holdings and discourses within nonexpert and crowdsourced mapping communities, both as they occur online and within offline events or sites of collaboration. It uses findings from these different threads to assess how we arrived at this moment in digital mapping while pairing that with deep engagement in current work these communities conduct. This includes, but is not limited to, collaboration in online disaster mapping projects, bus route mapping, and mapping of Champaign-Urbana waterways via mini kite mapping. All three general types of mapping are relatively new formations in the area that recent technological changes – be it through smaller and more lightweight technologies or advances in data extraction – have made possible while simultaneously expanding the purview of disciplinary projects.

In assuming these areas of work, the dissertation counters critical traditions in related work through a twin focus on the textual and the participatory as a means of full immersion in the topic at

hand. Epistemologically, this focus incorporates the ways community members communicate and practice community philosophies as ways of knowing different terrains and communities' work. Foucault's stance within archaeology and Latour's focus on seeing the social as an assembly (rather than already assembled) are of obvious influence to this focus.[147]

The latter's focus on assembly in large part inspires the methodological palette this dissertation constructs. I join archaeology, CDA, and participant observation together in the dissertation to examine the complex modes of communication underpinning popular mapping contributions. Ontologically, this emphasis refuses typical divisions (those between the ideal and the material, the universal and the particular, the narrated and the practiced, and the abstract and the concrete) and argues both sides of each pairing are remade alongside each other continually.

In terms of not only method and theory, but also relevant policies within the techno-legal frameworks that both afford and constrain the work this dissertation documents, I am claiming further literacy in mapping as a pedagogical practice, as a living entity participating in both emancipatory and suppressing formations, and (most importantly from a policy perspective) as a fundamentally ecological pursuit can help bring concerns of the public sphere into mapping as a system when fully embraced. Moving toward these considerations in mapping can help promote self-managing and self-sustaining networks toward its output. Government imaginaries of public GPS may have missed the mark on this particular mode of labor in its prognostications. This labor, while serving as a critique of the state, proves far more complex in its entanglements to digital mapping infrastructures, platforms, and modes of representation. I begin to establish this in the next chapter by examining these imaginaries closely before documenting debates, practices, and gatherings within the mapping communities at hand in subsequent chapters.

[1] Perkins, "Cultures of Map Use."

[2] JoEllen McNergney Vinyard, *Right in Michigan's Grassroots: From the KKK to the Michigan Militia* (Ann Arbor: University of Michigan Press, 2011), 1.
[3] "Progressive Party Platform of 1912," November 5, 1912, *The American Presidency Project*, accessed May 11, 2018, http://www.presidency.ucsb.edu/ws/?pid=29617.
[4] Years earlier, for instance, a potential running mate being vetted for an earlier Roosevelt campaign applied the term as a descriptor for the progressive movement of the time. See "Boom for Gen. Torrance: Movement to Make Minneapolis Man Roosevelt's Running Mate," *The Salt Lake Herald*, September 23, 1903, http://chroniclingamerica.loc.gov/lccn/sn85058130/1903-09-25/ed-1/seq-6/.
[5] Generally speaking, the emergence of Roosevelt's Bull Moose Party is still discussed comparatively to the conditions in the current moment as to whether a legitimate challenge to the two-party system might be possible. From Vermont Senator Bernie Sanders' 2016 presidential campaign on the Democratic ticket to the rise of the conservative Tea Party movement during the Obama administration, the invocation of the grassroots (though born from a progressive framework) occurs along both ideological poles. See Newsday, "View from Away: Are We Watching the Decline of our Big Political Parties?" *Kennebec Journal and Morning Sentinel*, April 28, 2018, https://www.centralmaine.com/2018/04/28/view-from-away-are-we-watching-the-decline-of-our-big-political-parties/.
[6] Raymond Williams, *Keywords: A Vocabulary of Culture and Society* (Oxford University Press, 1985), 87.
[7] Ibid, 90-92.
[8] Carey, *Communication as Culture*, 16.
[9] John Durham Peters, *Speaking into Air*, University of Chicago Press (1999), 211-212.
[10] Peters, *Speaking into Air*, 211-212. Additionally, the recent controversies surrounding Sinclair Broadcasting's market share, its staggeringly uniform and conservative-leaning messaging across its outlets, and its endorsements from Donald Trump serves as an obvious example of these conversations. See Eli Rosenberg, "Trump Said Sinclair 'Is Far Superior to CNN.' What We Know About the Conservative Media Giant," *The Washington Post*, April 3, 2018, https://www.washingtonpost.com/news/style/wp/2018/04/02/get-to-know-sinclair-broadcast-group-the-conservative-local-news-giant-with-a-growing-reach/?utm_term=.a86425f78fc3.
[11] LastWeekTonight, *Astroturfing: Last Week Tonight with John Oliver (HBO)*, YouTube video, 18:33, https://www.youtube.com/watch?v=Fmh4RdIwswE.
[12] Steven Poole, "Data Harvesting: Why the Agricultural Metaphor?" *The Guardian*, March 22, 2018, https://www.theguardian.com/books/2018/mar/22/cambridge-analytica-data-harvesting-steven-poole.
[13] Valdivia, *Introduction to the Media.*
[14] Carey, *Communication as Culture*, 16.
[15] Neil Brenner and Stuart Elden, "State, Space, World: Lefebvre and the Survival of Capitalism," in *State, Space, World: Selected Essays*, Neil Brenner and Stuart Elden, ed., University of Minnesota Press (Minneapolis, 2009), 14, 17, 37, and Henri Lefebvre, "The Worldwide Experience," in *State, Space, World: Selected Essays*, Brenner and Elden, ed., 287.
[16] Brenner and Elden, "State, Space, World: Lefebvre and the Survival of Capitalism," 47.
[17] Ibid, 16.
[18] Neil Brenner and Stuart Elden, *State, Space, World: Selected Essays*, 141-142.
[19] Valeriano Ramos, Jr., "The Concepts of Ideology, Hegemony, and Organic Intellectuals in Gramsci's Marxism," ed. Paul Saba, *Theoretical Review* 27 (1982), https://www.marxists.org/history/erol/periodicals/theoretical-review/1982301.htm.
[20] Ibid.

[21] Michel Foucault, *Society Must be Defended: Lectures at the Collège de France 1977-1978* (2007), 241-244, 252.
[22] See Jake Kosek, *Understories: The Political Life of Forests in Northern New Mexico* (Durham, NC: Duke University Press, 2006), 68-69.
[23] Ramaprasad Unni and Robert Harmon, "Perceived Effectiveness of Push vs. Pull Mobile Location-Based Advertising," *Journal of Interactive Advertising* 7.2 (2007), 2, 5, 15.
[24] Within these formations, transnational information capitalism enlists subjects by forging consensus in appealing to consumer interests of convenience and tailored suggestions through their data contributions. Aligning with theories of the prosumer, the rise of app-facilitated mapping practices in everyday life prompt individuals to be more productive. They can buttress state power, diffuse state responsibilities into the purview of civil society, or augment corporate power. See Astrid Mager, "Defining Algorithmic Ideology: Using Ideology Critique to Scrutinize Corporate Search Engines," *Triple C: Communication, Capitalism, and Critique* (2014), 32.
[25] See Fortun, *Advocacy after Bhopal*, 2001.
[26] See Williams, *Keywords*, 229.
[27] See Trevor Paglen, "Experimental Geography: From Cultural Production to the Production of Space," http://www.brooklynrail.org/2009/03/express/experimental-geography-from-cultural-production-to-the-production-of-space; Eric Kluitenberg, "The Network of Waves," in *Hybrid Space*, Open 11, 2006, http://socialbits.org/_data/papers/Kluitenberg%20-%20The%20Network%20of%20Waves.pdf, 211; Ian N. Gregory, *Toward Spatial Humanities: Historical GIS and Spatial History* (Bloomington: Indiana University Press, 2014); Douglas Richardson, Sarah Luria, Jim Ketchum, and Michael Dear, "Introducing the Geohumanities," in *GeoHumanities: Art, History, Text at the Edge of Place,* ed. Michael Dear, Jim Ketchum, Sarah Luria, and Douglas Richardson (London: New York: Routledge, 2011), 4; and Elwood, Schuurman, and Wilson, "Critical GIS," 5, 6, 99.
[28] This span constitutes the range of use I wish to examine. See US Official News, "A New Phone App for Grassroots Mapping," May 4, 2016; Dayananda Yumlembam, "Sristi to Map Guj's Innovation," *The Times of India (TOI)*, February 3, 2011; Wendy Holdren, "'Hollow' Interactive Documentary Film Wins the 2014 Peabody Award," *The Register-Herald*, April 17, 2014; Jeanette Minns, "Students Take the Initiative on Mobility," *European Voice*, July 10, 2014; US Official News, "Washington: National Day of Civic Hacking Enlists Community Help to Meet Local Challenges," May 4, 2014; "Tech bytes," *The Straits Times* (Singapore), April 25, 2012; and Mary L. Lyndon, "The Environment on the Internet: The Case of the BP Oil Spill," *Elon Law Review*, 2012.
[29] Susan Leigh Star, "Introduction," in Susan Leigh Star, ed., *Ecologies of Knowledge: Work and Politics in Science and Technology* (Albany: State University of New York Press, 1995), 2.
[30] Ibid, 3, 13.
[31] Jane Bennett, "The Force of Things," *Political Theory* 32, no. 33 (2004): 365.
[32] See specifically Gregory Bateson, "Form, Substance and Difference" and "Comment on Part V" in Gregory Bateson, *Steps to an Ecology of Mind* (London: Jason Aronson Inc, 1972), 461, 464, 467, and 472.
[33] I borrow the phrase "the 'stuff' of politics' from Bruce Braun and Sarah J. Whatmore, "The Stuff of Politics: An Introduction," in *Political Matter: Technoscience, Democracy, and Public Life*, ed. Bruce Braun and Sarah J. Whatmore (Minneapolis: University of Minnesota Press, 2010), ix.
[34] See Bruno Latour, *Politics of Nature: How to Bring the Sciences into Democracy*, trans. Catherine Porter (Cambridge: Harvard University Press, 2004).
[35] Niall P. Stephens, "Toward a More Substantive Media Ecology: Postman's Metaphor Versus Posthuman Futures," *International Journal of Communication* 8 (2014), 2040-41.

[36] Anna Tsing, *Friction: An Ethnography of Global Connection*, Princeton: Princeton University Press, 2005.
[37] Laura Forlano and Megan Halpern, "Reimagining Work: Entanglements and Frictions Around Future of Work Narratives," *Fibreculture* (2015), 41.
[38] Adrienne Rich, *Blood, Bread, and Poetry: Selected Prose 1979-1985* (W.W. Norton, 1994), 213-214.
[39] Charlotte Brunsdon, "A Thief in the Night: Stories of Feminism in the 1970s at CCCS," in *Stuart Hall: Critical Dialogues in Cultural Studies*, edited by David Morley and Kuan-Hsing Chen (London: Routledge, 1996), 282.
[40] See Norman Fairclough's definition of criticality in Fairclough, *Analysing Discourse: Textual Analysis for Social Research* (Routledge: London, 2003), 202.
[41] Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14.3 (1988), 592.
[42] Ibid, 593.
[43] For more on the ramifications of the scientific rationalization of space and nature, see Theodor Adorno and Max Horkheimer, "The Concept of Enlightenment," in *The Dialectic of Enlightenment* (New York: Continuum, 1972) and Scott, *Seeing Like a State*.
[44] Through Tom Boellstorff's broad definition of the virtual that embraces its ambiguity, writing and playing games (not just digital platforms) can be seen as virtual worlds. In this sense, mapping, whether analog or digital, can be seen as a virtual world. Boellstorff equally constitutes these activities as acts of techne, acts that craft the world. See Tom Boellstorff, *Coming of Age in Second Life: An Anthropologist Explores the Virtually Human* (Princeton: Princeton University Press, 2008).
[45] Though this is a familiar description for OSM sites, see Esha Chhabra, "UN Deploys New Tech to Make Relief Faster in Nepal," *Forbes,* last modified May 31, 2015, https://www.forbes.com/sites/eshachhabra/2015/05/31/un-deploys-new-tech-to-make-relief-faster-in-nepal/#7ae13491309e for one example of this description being invoked in relation to HOT and HDX work.
[46] This separate page is called Public GPS Traces, and can be found at http://www.openstreetmap.org/traces.
[47] These Users Diaries are available at http://www.openstreetmap.org/diary.
[48] See Wall text, Norman B. Leventhal Map Center, *Women in Cartography: Five Centuries of Accomplishments*, Boston Public Library, Boston, MA. For a small sample of what I reference here, Elena Chiozza (who directed the Total Atlas of the Argentine Republic of the Latin American Editor Center, Argentina. Sum of Geography and The Country of the Argentineans), Harriet Chalmers Adams (a prolific explorer and the sole female war correspondent during WWI who spearheaded the Society of Women Geographers), and Marie Tharp (who helped map the ocean floor, only for her labor to go unnoticed for some time with all credit going to her research partner, Bruce Heezen) are some of the most recognized female figures in cartography. The landmark Hull House, at the forefront of the women's movement in attending to Chicago's wave of European immigrants, is also notable for having women performing statistical mapping. See Object label, Norman B. Leventhal Map Center, *Women in Cartography: Five Centuries of Accomplishments*, Boston Public Library, Boston, MA and Agnes Sinclair Holbrook, "Nationalities Map No. 1," from *Hull House Maps and Papers . . . ,* New York, 1895. In Norman B. Leventhal Map Center, *Women in Cartography: Five Centuries of Accomplishments*, Boston Public Library, Boston, MA.
[49] While the former case has led to significant debate in the Russian OSM community, the latter has led to different mappers employing different languages and techniques to navigate mapping the footpaths, resulting in what Perkins terms a "mélange of different maps and cultural ways of

knowing." See Chris Perkins, "Plotting Practices and Politics: (Im)mutable Narratives in OpenStreetMap," *Transactions of the Institute of British Geographers* 39, no. 2 (2014), 304-317.
[50] See Humanitarian OpenStreetMap Team, "Disaster Mapping Projects," accessed May 25, 2018, https://hotosm.org/projects/disaster-mapping.
[51] See Step 3 of MapGive, "Learn to Map," accessed May 25, 2018, https://mapgive.state.gov/learn-to-map/.
[52] These statistics are up to date as of September 25, 2018.
[53] Critical Arts Ensemble, "Bioparanoia and the Culture of Control," in Beatriz da Costa and Kavita Philip, *Tactical Biopolitics: Art, Activism, and Technoscience* (Cambridge: MIT Press, 2008), 416.
[54] "The Remarkable History of GIS," *GISGeography*, last modified June 13, 2019, https://gisgeography.com/history-of-gis/.
[55] Rebecca Lave, "The Future of Environmental Expertise," *Annals of the Association of American Geographers* 105, no. 2 (2015), 245.
[56] Ibid, 246.
[57] See especially James Clifford's discussion of anthropology's history in James Clifford, *The Predicament of Culture: Twentieth Century Ethnography, Literature, and Art* (Harvard University Press, 1988).
[58] Lave, "The Future of Environmental Expertise," 246.
[59] Ibid, 247.
[60] Steven Shapin and Simon Schaffer, *Leviathan and the Air: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985).
[61] Sara Ann Wylie, Kirk Jalbert, Shannon Dosemagen, and Matt Ratto, "Institutions for Civic Technoscience," *The Information Society* 30 (2014), 118.
[62] Ibid, 117.
[63] Ibid, 118.
[64] Warren draws inspiration from tactical geography, particularly from the Institute of Applied Autonomy. Warren specifically brings up the Institute's work in 2002 mapping Manhattan surveillance cameras, providing both educational value about nascent technological infrastructures in the city as well as practical value of city areas one may wish to avoid. See Warren, "Grassroots Mapping: Tools for Participatory and Activist Cartography."
[65] See mapknitter.org.
[66] Wylie et al, "Institutions for Civic Technoscience," 119.
[67] Anderson attests all sizeable communities are part practiced and part imagined due to the increased reach of published material through improved technological capabilities. Audiences use such means to imagine communities around shared interests. See Sewell Chan, "Benedict Anderson, Scholar Who Saw Nations as 'Imagined,' Dies at 79," *New York Times* (New York, NY), Dec. 14, 2015, retrieved from http://www.nytimes.com/2015/12/15/world/asia/benedict-anderson-scholar-who-saw-nations-as-imagined-dies-at-79.html?_r=0.
[68] Lave, "The Future of Environmental Expertise."
[69] Wylie et al., "Institutions for Civic Technoscience," 116.
[70] Matt Ratto. "Textual Doppelgangers," in *DIY Citizenship: Critical Making and Social Media* (2015): 252.
[71] Ibid, 254.
[72] Wylie et al, "Institutions for Civic Technoscience," 118.
[73] Forlano and Halpern, "Reimagining Work," 36.
[74] Silvia Lindtner, for instance, focuses on maker communities in China, arguing that "[b]y setting up hackerspaces" engaged in technological production, "they craft alternative subject positions, for

themselves and others." Unique circumstances stemming from their location include notions like the netizen ("a new form of citizen engagement enabled by the increase in digital technologies and the rise in the number of people who have access to the internet in China") and of China as a space of assembly (unlike notions of areas like California as ones of design). Infrastructural issues also include a lack of sufficient education, funding, and standalone organizations to support nontraditional work. See Silvia Lindtner. "Making Subjectivities: How China's DIY Makers Remake Industrial Production, Innovation & the Self," *Journal of China Information* (2014), 145, 147, 151, and 160.
[75] A reciprocal understanding of subjects and spaces in these ecologies is crucial; one cannot presume subjectivities. Lindtner borrows Gabriella Coleman and Alexander Golub's "mosaic of ethical positions" in open source work to describe how some informants "are committed to starting up firms or grassroots communities, others . . . to rethink contemporary meanings of technology production through re-use and open sharing while working for larger corporations, and yet others . . . to invent new organizational models or . . . approaches to the legal system." See ibid, 153.
[76] See Dariusz Jemielniak, *Common Knowledge? An Ethnography of Wikipedia* (Stanford: Stanford University Press, 2014), 13.
[77] Jemielniak, *Common Knowledge?*, 5-6.
[78] I compiled these statistics early on in 2017 based on the data Public Lab makes available on the MapKnitter authors page. See https://mapknitter.org/authors.
[79] pdhixenbaugh, "Public Lab Organizers," *Public Lab*, September 2016, https://publiclab.org/wiki/organizers.
[80] pdhixenbaugh, "Public Lab Nonprofit Team," *Public Lab*, November 2016, https://publiclab.org/wiki/plots-staff.
[81] Jeff Warren, "Public Lab History," *Public Lab*, accessed December 20, 2016, https://publiclab.org/wiki/plots-history.
[82] This is based on entries on the first page of the MapKnitter site, which shows contributions in order of recency. See mapknitter.org.
[83] See "Events," *Public Lab*, accessed May 21, 2018, https://publiclab.org/events.
[84] Wylie et al., "Institutions of Civic Technoscience," 119.
[85] Star, *Ecologies of Knowledge*, 3.
[86] Michael Pickering, "Experience and the Social World," in *Research Methods for Cultural Studies,* edited by Michael Pickering (Edinburgh University Press, 2009), 28.
[87] Ibid, 27.
[88] Steph Lawler, "Stories and the Social World," in *Research Methods for Cultural Studies,* edited by Michael Pickering (Edinburgh University Press, 2009), 47.
[89] Natasha Myers and Joe Dumit, "Haptics: Haptic Creativity and the Mid-embodiments of Experimental Life," in *A Companion to the Anthropology of the Body and Embodiment*, ed. Frances E. Mascia-Lees (Chichester: Wiley-Blackwell, 2011), 241.
[90] Ibid, 243.
[91] See George Marcus, "Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography," *Annual Review of Anthropology* 24 (1995), 95-117 and Debbie Epstein, Johannah Fahey and Jane Kenway, "Multi-sited Global Ethnography and Travel: Gendered Journeys in Three Registers," *International Journal of Qualitative Studies in Education* 26.4 (2013), 470-488.
[92] Leo Marx, "Sleepy Hollow, 1844," in *The Machine in the Garden: Technology and the Pastoral Ideal in America* (Oxford University Press, 1964), 3, 8.
[93] Ibid, 18-19, 26.
[94] Ibid, 19.

[95] This juxtaposition equally aligns with a conventional divide between the urban and the rural. Whereas the former is seen as dense in culture and politics, the latter is seen as devoid of it. The rural becomes a vehicle of escapism from the detriments of modern life.[95] However, as is especially the case now, technology permeates across these divides. Broader global formations such as climate change equally break down this schism. See Cronon, *Nature's Metropolis*, and Marx, 22, 32.
[96] Douglas Kellner, "Cultural Studies, Multiculturalism, and Media Studies," retrieved from https://pages.gseis.ucla.edu/faculty/kellner/papers/SAGEcs.htm.
[97] Martin Barker, "Analyzing Discourse," in *Research Methods for Cultural Studies,* edited by Michael Pickering (Edinburgh University Press, 2009), 170.
[98] Presner, Shepard, and Kawano, *HyperCities*, 49.
[99] Michael Burawoy, "The Extended Case Method," *Sociological Theory* 16, no. 1 (1998), 4, retrieved from http://burawoy.berkeley.edu/Methodology/ECM.ST.pdf.
[100] Ibid, 5.
[101] Jürgen Habermas, *The Theory of Communicative Action, Vol. 2* (Boston: Beacon Press, 1984), 118.
[102] See Clemens Mattheis, "The Systems Theory of Niklas Luhmann and the Constitutionalization of the World Society," *Goettingen Journal of International Law* 4 (2012), 628, 637.
[103] I express gratitude toward the use of a Notes on Habermas's System & Lifeworld document distributed within my Learning to See Communication Systems class in the Fall 2013 semester as resource for this discussion tying Habermas' extensive work together.
[104] Jürgen Habermas, "Technology and Science as 'Ideology,'" in *Toward a Rational Society*, trans. J. Shapiro (Boston: Beacon Press, 1967): 87-89.
[105] Ibid, 90-91.
[106] Ibid, 97.
[107] Ibid, 105-106.
[108] Ibid, 112-13
[109] Foucault, *The Archaeology of Knowledge,* 107.
[110] Ibid, 160, 206.
[111] Ibid, 37-38.
[112] Jussi Parikka, "Cartographies of the Old and the New," in Parikka, *What is Media Archaeology?* (Polity, 2012), 6.
[113] Stuart Hall, "Encoding, Decoding," in *The Cultural Studies Reader*, ed. Simon During (London: Routledge).
[114] Fuery, "The Discursive Practice of the New," 16, 18, 21.
[115] Parikka, "Cartographies of the Old and the New," 15.
[116] Paul Rabinow, *Marking Time: On the Anthropology of the Contemporary* (Princeton: Princeton University Press, 2008), 3.
[117] Jussi Parrika, "What is Media Archaeology? – Beta Definition 0.8," retrieved from http://mediacartographies.blogspot.com/2010/10/what-is-media-archaeology-beta.html.
[118] James Hay, "New Media Histories," (presentation, Urbana, IL, September 9, 2014). See also Gillian Rose's discussion of Discourse analysis I and II in *Visual Methodologies* (London: Sage, 2012), 172 for its application of Foucauldian analysis in both (the first type resembling more of an archaeological analysis, the second more of an institutional critique).
[119] Fuery, "The Discursive Practice of the New," 7-8.
[120] See especially Table 8.2: Main Approaches to Discourse in Barker, "Analyzing Discourse," 153-54.
[121] Norman Fairclough, *Language and Globalization* (New York: Routledge, 2007), 209-210.

[122] The latter is what Fairclough calls attention to through the interdiscursive. See Fairclough, *Analysing Discourse,* 3.
[123] Fairclough, *Analysing Discourse*, 167. Overall, this point aligns with Gillian Rose's contention that researchers must imbricate the study of the visual with that of practices and power given the capacity of the visual to re-imagine or re-frame lived conditions. See Rose, *Visual Methodologies*. Cultural studies itself has been relatively inattentive to the visual, a growing concern within cultural studies perspectives on the digital. See Sarah Pink, "Analysing Visual Experience," in *Research Methods for Cultural Studies,* edited by Michael Pickering, (Edinburgh University Press, 2009), 147.
[124] Robert Hodge and Gunther Kress, *Social Semiotics* (Ithaca: Cornell University Press, 1988), viii.
[125] For Fairclough's discussion of Habermas in this regard, see *Analysing Discourse*, 98, 110. For his discussion on Harvey, see ibid, 135, 151.
[126] David Harvey, *The Condition of Postmodernity: An Inquiry into the Origins of Cultural Change*, Wiley-Blackwell: 1991, 284.
[127] Jameson, "Postmodernism, or, The Cultural Logic of Late Capitalism."
[128] Work in rhythmanalysis elucidates that maps, in guiding and constraining mobilities, constrain rhythm in ways that cater to standing structures of authority (including, for colonies, colonial authorities). Rhythms, though, can also be co-opted as a means of resistance, slowing the flows that constitute space to reverse the flows of capitalism and its impact on place-making. Such performances can critique the notion that every part of modern life has irreconcilably sped up. See Tim Edensor, ed., *Geographies of Rhythm: Nature, Place, Mobilities and Bodies* (Farnham: Ashgate, 2010), 7, 11, 18, and 38.
[129] For a discussion of grassroots mapping being used to counter a community's eviction from a local market, as one example, see Shannon Dosemagen, "Public Lab Five Year Retrospective," *Public Lab*, accessed December 20, 2016, https://publiclab.org/wiki/public-lab-five-year-retrospective-by-shannon-dosemagen. The maps the community generated were in pursuit of "[t]he goal . . . to create time so the community could organize next steps and create a dialogue around urban planning and displacement . . . by using the map to acquire a court injunction from local authorities."
[130] Fairclough, *Language and Globalization*, 210-211.
[131] Lane DeNicola, "GeoMedia: The Reassertion of Space in Digital Culture," in Heather A. Horst and Daniel Miller, *Digital Anthropology* (New York: Berg, 2012), 82.
[132] Walter Benjamin's take on aura, David Harvey's on time-space compression, and Frederic Jameson's on cognitive mapping are pertinent here. See Benjamin, "The Work of Art in the Age of Mechanical Reproduction;" Harvey, *The Condition of Postmodernity,* 284, and Jameson, "Postmodernism, or, The Cultural Logic of Late Capitalism."
[133] Ibid, 93.
[134] Though Fairclough is an obvious prominent figure in such use, see Jillian M. Báez, "(Re)membering the Latina Body: A Discourse Ethnography of Gender, Latinidad, and Consumer Culture," in *Globalizing Cultural Studies: Ethnographic Interventions in Theory, Method, and Policy*, edited by Cameron McCarthy (New York: Peter Lang, 2007), 189-204 for a more contemporary application.
[135] Tom Boellstorff, Bonnie Nardi, Celia Pearce, and T.L. Taylor, *Ethnography and Virtual Worlds: A Handbook of Method* (Princeton: Princeton University Press, 2012).
[136] Ibid.
[137] See Clifford Geertz, *The Interpretation of Culture* (Basic Books, 1973).
[138] Boellstorff, Nardi, Pearce, and Taylor, *Ethnography and Virtual Worlds*.
[139] Ibid.
[140] Pierre Bourdieu, "Introduction from: Distinction: A Social Critique of the Judgment of Taste," translated by Richard Nice, http://www.mit.edu/~allanmc/bourdieu1.pdf.

[141] Ibid.
[142] Ibid.
[143] Star, *Ecologies of Knowledge*, 11-12.
[144] Ibid, 8-9.
[145] Though Latour, *Politics of Nature* is helpful here, Latour most directly addresses these points in "From Realpolitik to Dingpolitik: or How to Make Things Public," in Bruno Latour and Peter Weibel, eds., *Making Things Public: Atmospheres of Democracy* (Cambridge: MIT Press, 2005), retrieved from http://www.bruno-latour.fr/sites/default/files/downloads/96-MTP-DING.pdf. Assembly is also a point of emphasis in Latour, *Reassembling the Social*.
[146] See Michel Foucault, "The Incorporation of the Hospital into Modern Technology," in *Space, Knowledge, and Power*: *Foucault and Geography*, ed. Jeremy W. Crampton and Stuart Elden (Ashgate, 2007).
[147] See Foucault, *The Archaeology of Knowledge*, 21 and Latour, *Reassembling the Social*, 1, 161.

CHAPTER 3

AN ARCHAEOLOGY OF GPS AND GRASSROOTS MAPPING

Introduction

When I first started mapping with HOT, one of the first sites I visited for training is MapGive. It is one of many platforms offering tutorials on OSM mapping in general and contributing to HOT campaigns specifically. The right side of the page pictured and quoted a young Kenyan man attesting, "If the whole world is mapped, we can manage our resources better than if it's not." The quote echoes the simplistic view presuming the "complete" map is possible. While this "complete" mapping can often be invoked as foundational to OSM, it is also a hallmark of the absolute visions of space the state presents to enact programs of management. The citation of resource management as the benefit of the complete map certainly resonates with this tendency.

The US State Department runs MapGive as part of an active partnership with HOT. Their management signals community activities sponsoring grassroots efforts in mapping have benefits to the state that the state acknowledges. To this end, the actions, concerns, and intents of the state in setting the stage for the transformations public mapping initiatives would pose in terms of governance lie at the heart of this chapter.

Archaeology can illuminate the state's sponsoring of such activities and interfaces as seminal to the basic pursuits of the modern state. It thus serves as the starting point in a multi-method approach toward the work of digital mapping communities. Accordingly, in deploying an archaeological analysis toward understanding Google Earth, Presner et al frame "[t]he fantasy of external spectatorship" that Google Earth interface encapsulates as one with a long history, being

"deeply wed to the history of empire, the rise of the nation-state, and the colonial will to know, domesticate, and control space."[1] If media archaeology proves instructive for Presner et al in establishing the relevant visualities, technologies, and spatialities within the Google Earth platform, it can do the same for thinking about public GPS use, especially in taking archaeology more explicitly in the Foucauldian sense.

The intent of archaeology as Foucault sees it is to diagnose conditions surrounding what is deemed true (not posit the "truth" of a matter) by following discursive formations.[2] The use of archaeological analysis shows specific ways imagined uses of GPS paired with discourses of economics, mobility, governance, democracy, security, and monitoring to give it legitimacy. Government figures and agencies applied GPS toward visions of maximizing production, increasing efficiency, and bolstering emergency response. This chapter traces how these visions for GPS are tied with the particular modes of governance that the Clinton and Bush administrations envisioned as ideal, ones tied to notions of enhanced citizen participation via electronic mediation.

For this chapter, I have sampled relevant documents available online from the Clinton and Bush administrations that discuss GPS and gathered LexisNexis search results that discuss grassroots mapping to present an archaeology of GPS and grassroots mapping.[3] These administrations were the most active in establishing and expanding public GPS use. Archived documents from each administration convey anticipated applications and imagined uses of public GPS. Through archaeological analysis, one can achieve a genealogy that illuminates public environmental and humanitarian work in mapping, as covered in later chapters.

I approach this chapter with two questions I return to in the chapter's conclusion: to what extent did applications and practices associated with GPS serve as conditions of possibility for the state? How do alternative modes of use measure up against that? These questions position the production of maps and the production of states in a process of co-articulation, one well-explored

within prior scholarship on mapping from an array of disciplines recognizing the historical role of mapping for states. For Mitchell, mundane practices and statistical aggregation cement states and economies. Cadastral maps, in making private property possible and reifying the state (despite their myriad inaccuracies) exemplify this work.[4] Harvey, too, acknowledges how prevalent maps are in the projects of the modern state and how it defines itself.[5] Additionally, James C. Scott outlines how states see space in their projects as absolute renderings of space. He highlights states' failed use of highly aestheticized mapping in modern projects like those of forest management, mapping private property, and agroscience that attempt to make space absolute.[6] It is an application of mapping wherein "places, people, and property rights . . . can be surveyed, surveilled, and controlled," acts that make actualizing capitalism and the state possible.[7]

Incorporating mundane, material practices considers how relational and relative views of space complicate such absolute spatial renderings.[8] Many environmental issues, for instance, spread in ways that do not confirm to absolute spatial renderings, nor do they fit neatly into typical constructions of time.[9] There is thus a need for modular forms of technology and docile subjects toward properly managing such complex issues, one I argue grassroots modes of mapping fits. As technologies evolve, so can techniques of governance that foreground the state and the economic. Grassroots modes of mapping can serve as a case study in how evolutions in mapping, even when praised as more open, participatory, and community-oriented than prior modes of mapping, do not escape the role maps play in cementing states and economies. I thus find it necessary to explore the rationale behind opening up mapping to use by corporations and publics before analyzing practices and community dynamics in the communities of focus. To merely present the latter without the contextual considerations that archaeology adds would be haphazard in the project's attempts to speak to the role of power in standing digital mapping systems and their output.

I also explore the range of meanings grassroots mapping inhabits and assess how its development connects or strays from imagined uses of GPS and associated discourses. The goal is to identify different discourses that legitimate grassroots mapping and surround the use of geospatial technologies. At the end of this chapter, I situate these findings for how they support theorization on the surveilling, productive political subject, the algorithmic, and the prosumer, which I outline below before proceeding with the analysis.

Critical media scholarship addresses GPS and the surveillance narrative in which it is often imbricated. Marc Andrejevic, specifically in his focus on iMonitoring, is explicit about GPS functionality and its range of tracking uses, which includes tracking Alzheimer's patients, pets, and even political figures in danger of kidnapping.[10] Through GPS-enabled technologies, "[c]onsumers and citizens are invited to adopt a similar set of imperatives to those of the authorities: reducing uncertainty, increasing efficiency, and maintaining control at a distance." He uses the example of the Teen Arrive Alive service that implements cellular signals and car chips to show how "the power of law enforcement is extended and amplified through the actions of . . . monitoring individuals."[11]

Locative media certainly encompasses part of this monitoring, but it is also important to see it as *productive*. It creates new kinds of relationships with people and new kinds of experiences within urban settings that a narrative of surveillance alone may not fully illuminate. Location-aware technologies like RFIDs not only locate users, but react to their environment.[12]

Algorithms' power in imagining and creating realities across space disciplines users and signals the resonance of Foucauldian approaches toward space, beyond his emphasis on spaces of enclosure.[13] For Foucault, discipline is a spatial project dependent on a political subjectivity characterized by docility. Algorithms are now key to this docility. Different algorithms encourage subjects to buy into different realities and modes of conduct which subject them toward different productive ends differently.[14]

In line with Foucauldian governmentality, work on location-aware platforms and algorithms demonstrates how they encourage acts of monitoring within the citizenry that augment government power. Andrejevic alludes to this in writing, "Thanks in part to the technological developments associated with the information society, citizens provided with the tools for accessing information are increasingly assigned the responsibility for tasks hitherto relegated to the state."[15] This means that the responsibility of the state to tackle inequity and promote welfare becomes "obviated." Users now have technologies which render such matters their responsibility.[16]

Through iMonitoring, Andrejevic concludes that soon enough "we will no longer be merely passive objects of surveillance in the interactive era. We will also be active participants in the process – ostensibly for our own good."[17] This identifies governmentality at work in media, where one's everyday actions are not simply leisurely, as perspectives on transnational information capitalism concur.

Manuel Castells' notion of the informational mode of development proves pertinent to how this supports the construction of the state itself. Castells' informational mode of development describes how the output of the contemporary knowledge economy is not necessarily a material product, but rather an innovation – a change in the production of value or a recombination of pre-existing ideas, objects or spaces. The knowledge economy resituates the state as an entity invested in meeting technological needs to further innovation and buttress a global economy predicated on precarious labor that can withstand the flux that comes with this investment.[18] Investing in crowdsourced means of gathering citizens around a sense of public good in aiding environmental activism and humanitarian efforts provides one such additional mode of precarious labor. This labor self-organizes to address whims of nature that often prove the result of human activity surrounding industrial capitalism and its environmental impact.

Conceptions of the prosumer are equally relevant. Christian Fuchs relates Google's rapid ascension since being founded in 2004 to the rise of the prosumer, coined by Alvin Toffler. The term refers to "the 'progressive blurring of the line that separates producer from consumer.'"[19] This echoes Dallas Smythe's finding that audiences are increasingly productive in their leisure time by supporting advertiser-supported content.[20] Dallas Smythe identifies critical research's inattention to audience labor as a "blindspot," one that now extends to locative media.[21]

Smythe's extension of Marxism to studying audiences shows how relative surplus value invades in leisure time through media.[22] What Fuchs calls "Google capitalism" is constituted similarly through users' surplus value, contributing data that in itself is a commodity and gets further commodified through targeted advertising.[23] In line with Google capitalism, Google users' recent ability to pin locations as lists to share in their networks generates value via data aggregation.[24]

Users are thus also placed in the world continually based on their proximity to different objects, commodity sites, cultural sites, and transportation networks. Much of the time, this placement of subjects occurs in relation to personal interests calculated and deployed algorithmically. Indeed, this chapter's main argument is that the economic and productive dimensions of digitally mediated location were in the sights of government imaginings for publicly available GPS from the start, even if said imaginings did not anticipate how these strains would play out in the present with dominant search engines like Google targeting and aggregating information toward these ends.

The state is an important entity within transnational capitalism, but one that aids larger formations like Google that ultimately help construct and reinforce it as a mode of power. Globalization thus cannot reify nation-states as pre-existing actants. William I. Robinson critiques reading globalization through this reification as "nation-state-centric." Instead, it should treat them historically as constructs ultimately formed through such social relations.[25]

The fact that more accurate GPS capabilities for civilians would eventually lead to increased responsibilities being deferred onto them is never explicitly acknowledged. The attention, however, paid toward GPS affordances of increased efficiency and productivity certainly sets the stage for such use. The frame of citizen involvement that grassroots mapping projects champion extends the work of governance, with what has typically been state responsibility placed onto citizens themselves – not just with community advocacy, but also environmental management.

GPS and the Clinton Administration

The Clinton administration's entanglement of the discourses this section examines is perhaps most evident in Clinton's 1997 State of the Union address. With the air of a countdown for collaborating toward "a land of new promise," Clinton notes the day after the speech will mark 1000 days until the new millennium. I begin with this speech given this identification of the particular cultural moment and how it resonates with government initiatives framing GPS within its discourses. Early in the address, Clinton speaks of the burgeoning "new" economy, along with "[t]he new promise of the global economy, the Information Age, unimagined new work, [and] life-enhancing technology" all in one sentence. He uses these terms to characterize a moment America must take advantage of, rather than rest on its prior successes.[26] Though the address does not mention GPS explicitly, this section demonstrates that GPS carried similar weight to these ideas in the Clinton administration.

GPS relies on various media and technologies as a system – among them, atomic clocks, radio receivers, and satellites.[27] GPS operates by positioning a receiver, calculating its distance from four global satellites that rely on ground stations spread globally. Satellites emit signals to the receiver that it compares to its own and then, using basic precepts of Einsteinian relativity, uses the

delay in signals to calculate its distance from each of the four satellites. When combined, this pinpoints the receiver's location.[28]

GPS initially fit military purposes, specifically Air Force navigation.[29] This is a familiar pattern within communications and media research; technological experimentation and deployment in the military before public adoption and use is also evident in Raymond Williams' history of radio telephony.[30] From WWII to the Cold War to now, mapping technologies have provided "ever more precise locating systems" for top-down navigation and guidance of both soldiers and missiles.[31] In its eventual public extension, however, one must consider how this sense of "navigation" sublimated into guiding consumer-citizens toward more productive actions.

During the Clinton administration, this new tone of guidance through GPS was mostly only recognized in terms of ensuring citizens' safety. A Department of State document from the administration discusses the transition to citizen guiding thusly: "the Global Positioning System, based on U.S. technology, is bringing major advances in air traffic safety, and is also guiding millions of hikers, boaters and motorists all over the world."[32] Various precursors to GPS, including LORAN (Long Range Aid to Navigation), Transit (the Navy's early navigation system), and NAVSTAR, a leading Air Force project early in the 1970s that emerged from the pack out of all the separate systems, would eventually combine to generate GPS. This work of combining the projects with added functionalities began midway through the 1970s. It made news when President Reagan, after an incident of Russia shooting down a Korean Airlines plane, commented that public accessibility of GPS for commercial flights would be freely available when the system was ready, a benchmark nearly within reach by the time Clinton took office.[33]

The Department of Defense (DOD) deemed GPS ready at the end of 1993. At the time, it was a system of 24 satellites, with accuracy within 100 meters.[34] Six months later, the Federal Aviation Administration (FAA) would take up GPS use in its Wide-Area Augmentation System

(WAAS).[35] While it increased accuracy for civilians, it also conjured fear over the inherent security implications, fears the sheer commercial potential of the improved system helped assuage.

The Clinton Presidential Library sums up this perceived commercial promise:

> In 1992, the Japanese were installing 35,000 GPS receivers a month in automobiles. The commercial market for Japanese GPS products was estimated at $240 million. In the United States it was estimated to be $480 million with potential to grow to a $60 billion dollar industry by 2000.[36]

The administration, in fact, attributed enhanced GPS capabilities in Operation Desert Storm to commercial GPS innovations. It saw technology overall as "the engine of economic growth" and government investment in technology as a major impetus "for long-term economic growth and higher living standards."[37] A Presidential announcement made on GPS technologies, after all, indicates that GPS was "expected to create 100,000 jobs over the next five years as part of a global market of $8 billion," half of which was expected to center in California-based companies.[38] The administration thus posited GPS as a job-creating agent.

The administration exhibited great resolve to realize this potential. In a 1995 review directive, while issuing a review of space policy, Clinton also ordered a review of standing GPS policy. A year later, Clinton would release PDD/NSTC-6, which not only assured citizen access, but guaranteed removing the barrier of SA, the intentional degrading of GPS accuracy for civilian use, within the coming decade. It also specified what different agencies would be tasked to do to maintain the system and what policy guidelines should be followed.[39]

Spectrum, for instance, would pose issues. Policymakers had to ensure enough spectrum for GPS, an American system, as well as international global positioning systems like Galileo and GLONASS.[40] Other considerations included leaving enough spectrum for safety of life systems, satellite broadcasts, and air traffic control.[41] The administration's FY 2000 budget created two public GPS signals – one for general applications and the other allocated toward aeronautical safety

applications – as insurance toward this.[42] Hence, issues of spectrum allocation also became steeped in a frame of GPS as a life-saving service.[43] GPS was deemed so vital in this respect that other new innovations, including ultra wide band technologies, would need further testing ensuring they would not interfere. The administration deemed testing important since GPS was one of various "life-saving services" that could be affected by such new technologies.[44]

Another notable instance of this frame is the discussion of ALERT cars. The ALERT system (an acronym for Advanced Law Enforcement Response Technology) imagined a compact, touch-screen computer within ambulances and law enforcement vehicles with GPS navigation to allow officials more freedom in managing the tasks at hand.[45] Such a system mirrors what President Clinton mentions in the conclusion of a May 2000 statement on eventually dispelling the use of SA:

> Civilian users will realize a dramatic improvement . . . with the discontinuation of SA. For example, emergency teams responding to a cry for help can now determine what side of the highway they must respond to, thereby saving precious minutes. This increase in accuracy will allow new GPS applications to . . . enhance the lives of people around the world.[46]

The administration thus articulated GPS as a life-saving service as much as it articulated GPS in terms of military navigation and modernization, which the statement also invokes.[47] The framing of the utility of GPS in this manner connects to issues of monitoring, surveillance, and biopower, and is one that arguably disseminates into its later popular use as Andrejevic shows.

Fittingly, the FCC first approved GPS-enabled functionality on cell phones during the Clinton administration to provide location data on 911 calls.[48] Documents from the administration also highlight the use of GPS to locate seemingly mundane aspects of the built environment, such as manholes and fire hydrants, which become vital in snow emergencies.[49] These applications, like the ALERT system, signal a care for citizens through civilian use of GPS. It is a frame that scholars have continued in inventive ways. Artist kanarinka's locative project *It takes 154,000 breaths to evacuate*

Boston encompasses "an attempt to measure our post-9/11 collective fear" and "new geographies of insecurity" through mapping the efficacy of Boston evacuation routes by measuring the number of breaths it takes to complete them.[50] Unintended use via locative projects thus extends this focus on safety through geospatial technologies.

GPS also emerges in disaster management discussions "to pinpoint the location of damaged areas."[51] In a Mitigation Division flow chart, FEMA listed mapping, GPS and GIS under the heading of Risk Assessment and Reduction Pre-Disaster.[52] GPS thus found itself aligned in a project of "building disaster-ridden communities."[53] Other projects of security and safety GPS is mentioned in include the securing and reopening of Sarajevo Airport (captured early in the Bosnian War and later used by the UN for humanitarian efforts during the war), the transport of dangerous chemicals, and air traffic management (in which GPS is again invoked as a safety of life system).[54] The emphasis on security and safety differs from contemporary media scholarship's frame of GPS, in which GPS signifies, ironically, everything *unsafe* about the current moment. These, again, were fears present in building out GPS, but eschewed in favor of its vast and lucrative commercial applications.

In an e-mail dialogue over editing one of First Lady Hillary Clinton's speeches, for instance, the editors agree eventually that the audience might take issue with the example of the surveillance of one's children online through video feeds. They prefer, instead, invoking the monitoring of one's family through GPS tracking, forecasting what Andrejevic discusses.[55] Similarly, a document discussing the potential for supervising offenders through GPS tracking attested that such actions would be permissible in that it would not involve monitoring the offender, just the equipment.[56] The guiding function of GPS to lessen the obstacles distance poses and manage control from afar is deemed innocuous in comparison to other technological functionalities such as video surveillance.

This is a materialization of the "rule at a distance" which telecommunications techniques afford for the state, even as it espouses different benefits toward use of those technologies that can

empower citizens. Indeed, the safety of life frame is built on monitoring. Vulnerable subjects, populations, environments, and arenas of trade must be "monitored" in order to ensure their preservation and an appropriate infrastructural response to carry that preservation out.

GPS's simultaneous connotations with safety and surveillance reveals governmentality within how government administrators imagined its use and put it to practice. Part of this is now realized through wearable devices under a framework of the care of the self. Situating GPS, then, under a framework of governmentality is more encompassing than one of surveillance to analyze assemblages in which geospatial data operates and how these assemblages construct location.[57] This framework coordinates the citizen toward productive use for the state while at the same time enticing media consumers through notions like individualism, self-branding, and self-knowledge.

Citizens' mobility is situated within such assemblages in telling ways. The Department of Transportation (DOT), active in testing and funding GPS, pairs a discussion of the public availability of GPS with a quote from Vice President Al Gore within a document on mobility – "the promise of new discovery and new technology has made it possible to renew and strengthen our oldest and most cherished values."[58] Several documents herald public use of GPS as a hallmark of "the new economy," specifically as a facet of that economy that simultaneously furthers the operations and profitability of the old economy. One example is that of GPS aiding truck drivers, making for more efficient routing and deliveries.[59] Not only does public use of GPS, then, open up new economic opportunities, it enhances the efficiency of standing modes of economic production.

Though documents do not specifically allude to GPS tracking as a gauge for productivity, one on GPS notes that "[p]roductivity is poorly measured in many old economy industries" and references economist Joseph Schumpeter in contending that "excess profit comes from innovating ahead of competitors."[60] This reflects how prognostications of GPS use were not separate from its

ramifications in tracking to manage and maximize productivity, and underscores Castells' associations of innovation as alteration and recombination of means of value production.

The administration equated the long-running government investment in GPS alongside various other success stories in government research and development, including build-out of the first telegraph line and the internet.[61] The Clinton administration also framed GPS within its broader initiative of Reinventing Government. The initiative intended, in large part through collaboration across government agencies, "to reform and streamline the way the federal government works." It sought for a government that, in Gore's words, "works better, costs less, and gets results Americans care about." It also accorded with broader Clinton policies that sought to replace government expense with efficiency, and to move away from "entitlement" among the citizenry toward "empowerment."[62] The administration deemed the aforementioned integration of different GPS-like government projects a significant component of the Reinventing Government initiative.[63] GPS, then, takes part in this "reinvention," producing a "new" conception of governance through its transformation into a different, more efficient system.

The common denominator of efficiency reflects Frankfurt School scholarship. It is precisely the use of technology by expert systems toward efficiency that Habermas mandates be kept separate from the operations of the public sphere to ensure democratic pursuits remain uncompromised. Though Habermas' own contributions to the Frankfurt School's legacy tends to dissociate the use of technology toward democratic projects like those of grassroots mapping, Kellner attests organic intellectuals must use the very media and technologies that are becoming growingly constitutive of political, social, and economic life toward progressive ends – as is the case in grassroots projects.[64]

In turn, Marcuse's focus on technocracy holds that Enlightenment rationality leads to the extreme of efficiency being held in the highest esteem – efficiency for efficiency's sake.[65] This investment in efficiency runs counter to democratic goals; subjects work toward obtaining more

from the standing system, rather than building a better society.[66] In the opposition between efficiency and democracy, with grassroots mapping more closely related to the latter term, Marcuse presents another way grassroots mapping critiques dominant mapping platforms. Likewise, in Theodor Adorno and Max Horkheimer's emphasis on the emergence of the culture industry, producers divide audiences into demographics to target in efficient ways tailored specifically to said demographics.[67] John Durham Peters, among others, finds Adorno and Horkheimer's work even more pertinent to the contemporary media environment given such possibilities afforded to producers and advertisers in digital media.[68]

Producers' abilities through location-based services to target different demographics differently based on their search history were unanticipated at the time. The administration largely rationalized investing in GPS as part of a broader project of modernization, one that went beyond Reinventing Government. A draft of a DOD conferees letter not only discusses "the administration's strategy to make GPS more available for civilian navigational uses," but "identifies GPS as a critical component of the administration's 'modernization project.'" The draft reproaches the Senate's vote to decrease funds toward developing GPS technologies for users by $31 million.[69]

The administration overall staged "an extensive diplomatic campaign to build international awareness of the importance of GPS." Part of this campaign concerns the expansion of US interventions into outer space. For the US to continue exploration, it needed international approval of GPS standards.[70] GPS is thus once again inseparable from such broader ideological projects, as set further in motion within the Bush administration. The Bush administration continued the frame of transformation in governance and economics through GPS, but also advocated its imperial application as focal within a broader project of peace.

GPS in the Bush Administration

As GPS evolved, the Bush administration championed its range of uses. In releasing a fact sheet on an agreement reached between the US and Europe on the interoperability of their respective GPS and Galileo infrastructures, the administration conveys that GPS is "used for a wide array of economic, scientific, and military applications," affording "precise positioning and timing information." In 2004, both parties announced an agreement ensuring security of both systems, as well as a "doubling of satellites that will broadcast a common civil signal worldwide, thereby promoting better and more comprehensive service for all users." Part of the intent was fostering "a new generation of satellite-based applications and services, promoting research, development, and investment that will benefit business, science, governments, and recreational users alike."[71] Such a statement assumes universal access. This mirrors identification within media studies of a "convergence culture" that heralds the democratic potential of participatory media without considering structures of difference (such as gendering or racialization).[72]

The title of the official declaration between the US and the EU, "Strengthening Our Economic Partnership," reflects the pact's economic framing. The declaration describes the partnership as already encompassing "the largest bilateral trade and investment relationship in the world, providing jobs to millions of workers on each side of the Atlantic." But the US and the EU frame the latest agreement as "opening the way for wide-ranging commercial opportunities."[73]

While they recognize other working negotiations alongside that of the GPS-Galileo pact with wide-ranging benefits for markets and market regulation, customs agreements, transport, tourism, and pension reform, the pact echoes how so much of the work of GPS comes down to the economic, an attempt to erase the obstacles of distance in line with globalization.[74] European Commission President Romano Prodi's remarks demonstrate this:

> I remind you [of] only one figure, $2 billion per day flow across the Atlantic in investment or trade. In this summit, our cooperation has broken new frontiers. The agreements and cooperation between our two global satellite navigation systems, Galileo and GPS, is a win-win situation. I am certain that the repercussion for the global market of civilian uses of satellite navigation systems are very positive. And this system will become operational in 2008, and will create 150,000 jobs in Europe alone.[75]

As was the case during the Clinton administration, the system is seen as a job creating agent, one whose potential is extended through partnerships with other government systems.

Administration plans for GPS were not always positive for industry. There is a fair amount of email commentary, for instance, on debates surrounding Ground Penetrating Radar (GPR) causing GPS interference. While the FCC was regulating GPR use in accordance with preserving the system's integrity, geologists argued that its belief that this was needed was mistaken. They claimed these entities, in fact, are often "used in conjunction" without any degradation. One geologist relying on GPR insists, "Let's regulate the industries that need regulating, and let's not waste time and money on ultra conservative regulations that benefit no one and harm and [sic] entire industry."[76]

Imperial use of GPS, too, had notable unintended consequences. Documentation of a briefing with then-Press Secretary Ari Fleischer includes responses to reports of a Russian company helping Iraqi forces jam US GPS technologies shortly after the Iraq War began. Fleischer deemed the incidents disconcerting, indicating the US had stated concerns on similar issues for roughly a year and that President Bush had called President Putin that day to reiterate those concerns.[77]

A great deal of scholarship has already covered the blurring, voyeuristic, and often counterintuitive use of satellite imagery in the administration's argument for military intervention into Iraq.[78] Lisa Parks launches accusations of voyeurism more broadly in the use of mapping interfaces, bringing up examples of witnessing genocide through satellite images without any real impetus for intervention afterward.[79] But Parks also specifically discusses GPS as propagating conceptions of "the world as a target," citing its use in military campaigns in Afghanistan and Iraq.[80]

Parks' case study exemplifies public-private partnerships at work in the current landscape of GPS. Platforms like Google, through arrangements with the US government, can be best positioned to profit in exchange for the use of data.[81] Wood thus deems Google Maps "a faithful servant of the state." He submits that Google Earth's military applications reflect how contemporary mapping is often employed toward surveillance.[82] Terrorist groups have also used Google images for their attacks, furthering maps' view of the world as a target – a god's eye view, a colonial perspective.[83]

The Bush administration enrolled GPS in pushing for the Iraq War while framing GPS applications in projects of peace. When the Bush administration officially announced an end to SA in 2007, it framed the action as one that "reflects the United States [sic] strong commitment to users of GPS that this free global utility can be counted on to support peaceful civil activities around the world."[84] Considering the role of GPS in the Iraq War and how it fit into Bush's philosophies, this frame proves ironic. In writing about Bush speeches, Harvey identifies that "[b]ringing freedom, liberty, and democracy to a recalcitrant world in general and to the Middle East in particular became a persistent theme."[85] The Bush administration thus reduced terror to a problem that could be expressed in absolute terms so that it could be readily located, targeted, and eradicated, rather than a complex, networked, and relational problem.[86]

These intents certainly connect to the top-down visuality GPS affords. GPS can be used for large scale war one moment and framed as a free global utility toward ensuring peace the next. Then-Press Secretary Dana Perino elaborates on the administration's vision in ways that resonate with the previous administration's view:

> GPS benefits users around the world in many different ways, including aviation, road, marine and rail navigation, telecommunications, emergency response, resource exploration, mining and construction, financial transactions, and many more. All users, and their governments, have a stake in the future of GPS. The United States promotes international cooperation in the operation of civil global navigation satellite systems and continues to work to build international support for the protection of these signals from intentional interference and disruption.[87]

Like the US-EU pact announcement, this statement presumes access, according with an administration-wide rhetoric that ignores structure and the particular.[88]

While one should not blame Perino entirely for her list not being exhaustive enough, there are notable omissions: namely, the community and corporate uses this project highlights. The list reflects that such applications are not prevalent in the archived materials available. An example of the kinds of mundane use in community monitoring that government framings of GPS can ignore yet still shows up in archived materials is that of gathering samples of plankton in a North Dakota lake and storing location data for sampled lake sites.[89]

Situating the map as a means of monitoring arises in economic framings of GPS despite more mundane monitoring applications being underrepresented. As part of "Smart Border Action Plan" between the US and Canada, one which then-Office of Homeland Security Director Tom Ridge and Deputy Prime Minister John Manley approved, GPS use commenced on the St. Lawrence Seaway "to allow for more monitoring of ships" and "to enhance the mobility of people and commercial goods between the United States and Canada."[90] This shows how GPS was imagined not only in terms of value creation, but toward monitoring the mobility of subjects and capital.

Government funding also emerges as an issue in assuring the system kept pace with modern developments. A document reflecting administration views on defense appropriations in the FY 2000 budget recognizes an accommodation of administration goals toward "readiness and modernization," but does encourage revision, particularly in strengthening GPS. It contends that "GPS must be modernized in order to meet the needs of both civil and military users . . . . The total GPS funding level proposed by the Committee would be detrimental to our military modernization initiative and would prematurely eliminate options for deploying enhanced GPS capabilities.[91] This

continues associations between GPS and modernization (particularly "military modernization") found within the Clinton administration's framing, which also resisted budget cuts.

Bush justifies modernizing GPS through the particular examples of aviation and military use. What follows is an excerpt from Bush's remarks on holiday air travel to DOT that uses the image of teenage drivers as a plea to modernize the standing aviation system of the time:

> at [sic] an age when teenage drivers use GPS systems in their cars, air traffic controllers still use World War II-era radar to guide modern jumbo jets. That doesn't seem to make any sense to me. . . . Modernizing our aviation system is an urgent challenge. So today, I'm signing an executive order that makes this task a leading priority for agencies across the federal government.[92]

Bush turns to this point in other settings.[93] In his estimation, government applications of GPS, outpaced by commercial innovations, merited vast improvements due to modern dangers.

Relatedly, in his 2005 Naval Academy commencement address, Bush situates GPS within a time of "unprecedented dangers" wherein graduates will be tasked with simultaneously eradicating terrorism and reinventing forces for a new millennium. Bush sees this as part of his administration's announcement of "the biggest transformation of our global forces . . . since the end of World War II." In this transformation, Bush sees "new" technologies like those associated with GPS as central "to make our forces faster, lighter, more agile, and more lethal."[94]

This is precisely the effect of technology Foucault historicizes within a broader disciplinary project. Whereas the 17th century saw a basic spatial model in combat of having soldiers lacking in training and likely to flee at the front of the force, the 18th century saw constant study of soldiers during training to maximize their efficiency.[95] Foucault sees discipline manifest in soldiers locating themselves – a matter of self-regulation on soldiers' part where careful training teaches soldiers how to conduct themselves in a manner ensuring their highest production.[96] Discipline, then, can be considered a project of being located and locating oneself toward more efficient and productive

formations. While GPS partakes in efficiency and productivity in various ways, it is particularly evident in such discussions of tracking and maximizing US forces.

This application is extended in how the Bush administration situated GPS. As Bush underscores "the power of technology to transform our forces" and a need to "reposition" military forces and their efforts, he claims that "[i]n the 21st century, we can target the guilty and protect the innocent, and that makes it easier to keep the peace."[97] Here, Bush sees the precise destruction GPS enables as part of the universalizing project of peace his administration posited.

Bush goes further in positing the powerful targeting capabilities of GPS in his 2008 commencement address to the Air Force Academy by specifically placing it within the history of bombing. He explicates, "When the United States entered World War II, the age of long-range bombing was just beginning. There were [sic] no computer guidance, no GPS targeting, or laser-guided munitions." In contrast, Bush attests that "we can now target a regime without targeting an entire nation," perpetuating the world as target frame.[98] The efficiency of GPS is again deemed here as more of an instrument of peace in its targeting capabilities, rather than one of destruction.

Bush demonstrates how soldiers must think of creative applications for technologies like GPS, specifically by keeping "old" approaches in mind through the following image:

> Sometimes, transformation means using old capabilities in new ways. In Afghanistan our troops rode into battle on horseback -- but they did it while using GPS and advanced satellite communications to call in air strikes on enemy positions. They combined a staple of 19th century warfare with the most advanced 21st century technology, and they helped remove a dangerous threat to America. As you begin your military careers, we need you to bring that same spirit of creativity and innovation to your work.[99]

In his own commencement address to the Air Force Academy in 2005, Vice President Dick Cheney also raises the image of soldiers on horseback during the Iraq War:

> Our military today operates at a higher level of accuracy over greater distances than earlier generations could have imagined possible. We all remember the images from Afghanistan of

> Air Force airmen on horseback. They were there with laser designators and laptop computers, taking readings on enemy coordinates, transmitting them to a cockpit more than 32,000 feet overhead, and calling in precision air strikes within minutes.[100]

Bush's use of the image is also from a 2005 commencement speech. The recurring image equates GPS with precision and innovation similar to how the Clinton administration did, bridging old and new together to encourage productivity (in this case, military productivity). This encouragement fits both administrations' preoccupations with modernization. Further, as previously addressed, it is precisely this investment in the modern that makes the use of the geospatial in grassroots contexts unsurprising even if it was an unanticipated outcome. The modern subject is one imagined to aid such productive work toward governance and spatial management in innovative ways that take advantage of "new" technologies but do not lose sight of "old" approaches.

Though such discourses of imperialism and militarism are quite notable across archived materials, the discourse of Reinventing Government in the Clinton administration also relates to the Bush administration's comparable drive toward E-Government. Bush signed an E-Government Act in 2002, which, according to its description, established "a broad framework of measures that require using Internet-based information technology to enhance citizen access to Government information and services."[101] This aim "to enhance citizen access" is tied in part to GPS use. A 2007 Progress Report for President Bush's New Freedom Initiative, signed within his first 100 days in office and intertwined with the E-Government Act, highlights the Department of Veterans Affairs among others for its development of "GPS navigation for the visually impaired."[102]

Overall, the New Freedom Initiative was charged "to promote the full participation of people with disabilities in all areas of society by increasing access to assistive and universally designed technologies, expanding educational and employment opportunities, and promoting increased access into daily community life."[103] The progress report conveys that Bush saw the New Freedom Act as a means of realizing sections of the Rehabilitation Act (signed decades earlier),

which the administration by proxy saw as crucial toward improving citizen access to government data, tools, and agencies.[104] GPS is thus invoked here within broader government programs on accessibility and an informed citizenry.

As part of the push toward E-Government, various administration officials led online Ask the White House sessions to answer citizens' questions. Several sessions feature questions on the government's use, support, and integration of GPS technologies. In one such session, a user identified as Don from Sacramento asks about the role of GPS in E-Government, and how the federal government overall is faring in maintaining pace with GPS applications emanating from the private sector. Karen Evans, the Administrator of E-Government and Information Technology with the Office of Management and Budget, who was the respondent for this particular session, replies:

> Don, this is a very important issue to the federal government. Through our initial efforts on the Geospatial One-Stop initiative, various efforts throughout the federal government have been consolidated. The Department of Interior leads the initiative and has partnerships with industry and state and local governments. Their efforts for developing agreed upon standards are available at http://www.geodata.gov. Additionally, we launched the geospatial line of business taskforce to address a government wide solution for efforts going forward.[105]

Evans reinforces GPS as a priority within the administration and as, in part, a matter of scaling back redundancy in government efforts. As did the Clinton administration, the Bush administration thus imbricated GPS within its efforts at streamlining government.

Other sessions in which discussions of GPS arise include questions about tracking of soldiers (to which the respondent, Deputy Secretary of State Richard Armitage, deems GPS as "clearly the wave of the future") and questions about volcano monitoring (to which respondent Charles Groat, director of the US Geological Survey, replies with how GPS is employed "to measure the rise and fall of the sides and crater floor of Mt. St. Helens").[106] Monitoring applications for GPS thus simplify terrains toward actions of governance, be it ensuring the efficiency of soldiers in military efforts or anticipating natural disasters in emergency response efforts.

Toward the latter, GPS monitoring was also invoked in discussing Gulf Coast rebuilding. In addressing errors in Katrina recovery efforts on the one year anniversary of the catastrophe, then-FEMA Director David Paulison brings up what he believes was an inoperative module for communication between the state and federal level as well as among different federal agencies. But Paulison also attends to inadequacies of technologies in how they were employed. This showed up, for Paulison, in ordinary but critical ways, such as the tracking of FEMA vehicles carrying Meals Ready to Eat (MREs). FEMA had 160 tractor-trailers full of MREs, which could in total feed 160,000 victims for one day. These tractor-trailers, however, were not properly tracked and often never made their destinations.[107] Paulison posits GPS as part of the solution:

> We've put a very sophisticated GPS tracking system in place where we can track those tractor-trailers. We get pinged every 15 minutes of where they are, and we can tell right down to the very street corner where that truck is and which way it's heading and where it's going, and that's important for us.[108]

As such, GPS use, through yet another image of truck driving (an example Paulison invokes repeatedly), gets entangled in disaster management, furthering the safety of life frame the Clinton administration correlated with more available GPS use.[109] Relatedly, a document from the American Transportation Institute during the Bush administration also relates to the Clinton administration's telling considerations of GPS utilities for truck drivers. The document, however, pertains to monitoring via GPS-enabled systems recording hours worked, echoing Andrejevic's concerns.[110]

Aside from the aforementioned communication and tracking issues, Paulison also cites issues of "situational awareness" as a factoring predicament. In identifying a problem of situational awareness, Paulison refers to the following: "You have to know what's going on on the ground. And if you don't share that information, you're not going to have that knowledge." It is no coincidence that what goes wrong within how such "top-down" perspectives manage these responses is a significant component of the critique grassroots mapping sponsors.

Assessing the Emergence of Grassroots Mapping

Grassroots mapping asserts that communities present diverse perspectives into the operations of complex global systems. It contends that these systems can benefit from incorporating rather than ignoring such perspectives, in accordance with a Habermasian frame. This section demonstrates this at work, outlining largely overlooked applications of geospatial technologies through various media projects that claim to incorporate or embody grassroots mapping.

Grassroots mapping emerges during the 2010s, with ties to discourses of democracy, the economy, and the technological particular to the moment. It is oriented toward producing communities around more egalitarian knowledge production through mapping and more real-time disaster imaging, resonating with discourses of security found previously. It is invoked often as a tactic toward the environmental movement, itself a grassroots movement emanating from Rachel Carson's publication of *Silent Spring* in 1962.[111] But not all projects that invoke grassroots mapping as a term are specifically geared toward environmentalism.

One of the most overt discussions of grassroots mapping aside from those of Public Lab occurs via a project highlighted in an American Association for the Advancement of Science (AAAS) news release from 2016. The news release discusses a recently launched app emanating from the DroneLab at the University of Exeter in terms of discourses of democracy and community explicitly. Two quotes from Dr. Karen Anderson, who heads the lab, stand out in this respect.

The first is Anderson's contention that "[t]here are now more mobile devices than humans on Earth. This global distribution of devices offers a great opportunity for democratic mapping but until now, there have been no apps that exploit the comprehensive sensor sets in modern devices in this way."[112] While the proliferation of emerging technologies is not always seen in a positive light in

grassroots mapping projects, Anderson presents the rise of the internet of things here as an opportunity to enhance citizen participation in mapmaking.

The second is a clear admission of the current state of digital mapping, representing smartphones as data harvesting objects that supply user information to third parties:

> Currently the sensors on mobile phones harvest data about their users and send this information to third-parties. We wanted to start using this data for beneficial purposes such as community-led mapping. Alongside recent developments with lightweight drones and a growing public appetite for open-source, free to use mapping data, we are excited to see the variety of mapping applications for which our new app will be used.[113]

While Anderson recognizes the way current digital mapping functionalities operate in service of the political economy of the internet, Anderson sees community mapping as a turn on the current state of digital mapping, with the app design using user-generated information via community members' phones as a means for community knowledge production.

Anderson thus pits community as the antithesis to corporate interests in mapping. Anderson characterizes open source work as freeing mode of geospatial information, as an avenue of welcoming unanticipated and unintended use. The app is available, perhaps ironically given this frame, for download from Google, with the code being publicly available via GitHub.[114]

The app's production led to an academic article in PLOS ONE entitled "A Grassroots Mapping Toolkit Using Live Coding, Smartphones, Kites and Lightweight Drones." As the title suggests, the app's designers herald its use of live-coding, which leaves it modifiable in how the camera captures what the user intends to capture rather than fixed in how it does so. This enables use of the technology "in an open-ended manner." The framing of the app as "accessible to anyone in the world with an android device" equally falls within the open source ethos.[115]

The developers contrast the open, community approach the app takes toward mapping to models in citizen science initiatives that are fixed. Technologies in these initiatives often cannot be

modified depending on the particular uses and circumstances of a given community. The app developers also find that a grassroots mapping approach offers "a more flexible means of timely and responsive survey" suitable for disaster mapping and searches for survivors or for community claims. Its use of "a lightweight and portable platform" in using smartphones and drones or kites proves ideal for local data collection given their various sensing capabilities and their ubiquity. The app thus seeks to use these capabilities "to generate ready-to-use spatial data from lightweight aerial platforms such as drones or kites." It saves metadata which it uses to create GeoTiff imagery and relies on open source approaches. It was imagined to support "decision-making in . . . disaster-relief zones, in teaching or for grassroots remote sensing and democratic mapping."[116] Chapter 7 covers the ties between grassroots mapping tactics and pedagogy in more depth. For now, not only does this use carry over the framing of disaster management for GPS use, its modularity also affords a more ideal subject position for such work. The mapper can innovate in accordance with on the ground conditions that an outside perspective would likely not know about.

While smartphone capabilities can certainly afford this versatility for sensing, according to the most recent Pew data available, the median rate of smartphone penetration in the developing world is 37% - a marked increase from the previous year's data, but still low enough to merit qualifying the app developers' frame.[117] Problems of access thus are not sufficiently addressed, an omission considering the project's definition of grassroots mapping as "participatory and distributed" and one exacerbated by how it considers "democratic mapping" as synonymous.[118] One must be mindful that such activities are often only afforded to the privileged, who have the time to engage in such actions, rather than communities that might need such tactics the most.[119] This admission is one that OSM members can express, and Chapter 6 covers one example in the case of OSM initiatives mapping the area surrounding Grenfell Tower years before it burned down.

The attention to forming bottom-up approaches in tune with local variations occurs across invocations of grassroots mapping. Though all of the mentions of grassroots mapping found come from the 2010s, the earliest found (aside from Public Lab's work) is from 2011 in *The Times of India*. It features a project from India called Grassroots Innovations for Inclusive Development (GRIID) that maps out innovation histories, tracing how low-cost and local innovations can benefit thousands of people outside of the particular contexts and localities from which they are developed. The Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI) project maps 5,000 of these innovations.[120]

The project connects grassroots mapping to the knowledge economy. Its stated intent is to "create a knowledge network of innovators and stakeholders." The story of an early 1990s low cost tractor design and how it diffused into similar models in different areas of India inspired project designers to think of the project as a means of exploring how similar innovations diffuse differently in different areas of India, which areas are innovating the most, and the extent to which an area's environment informs its innovations. Its motivation is also in sustaining knowledge networks toward furthering local-level innovations by using GIS to "zero in on the village level."[121]

The Times of India also discusses grassroots mapping as action in opposition to third-party use like the DroneLab app. In its very title, GRIID also implies that grassroots mapping can highlight inclusive development. Press coverage of the MapAbility project, which hosts a platform for European students to report how accessible their campuses are so that handicapped undergraduates from other countries can better select where to study in Europe, does the same.

The project shows that grassroots mapping can help amplify voices left marginalized in archived data.[122] GIS research remains mired by this issue.[123] According to an article appearing in the European Voice on MapAbility, less than 1% of students from 2011 to 2012 within the Erasmus Programme (the European Union's decades long student exchange service) were disabled. This is a

fraction of their percentages within student populations. MapAbility thus responds to how little information campuses often provide on the degree to which they are accessible.[124]

GPS's link with accessibility here mirrors the Bush administration's New Freedom Initiative and E-Government Act. The project operationalizes accessibility not only in terms of the lack of physical barriers on campus (whether, for instance, there are accessible elevators and ramps to buildings), but also in "whether websites are user-friendly to the presence of a disability office and at least one suitable hall of residence." Other considerations include accommodation for support animals and proper classroom support through audio recordings or braille.[125]

The aggregate online maps MapAbility provides go building by building. Its first two months of mapping covered almost 200 campuses and over 550 buildings. The results were rather unfavorable. The project concluded "that 33% of institutions had no disability unit and 30% no hall of residence suitable for disabled students." The survey also found that much more work was being done for those with visible disabilities (such as handicaps requiring wheelchair use) rather than invisible ones (such as learning disabilities and emotional disorders).[126]

The European Voice conveys that the project, started in 2014, was slated to continue for at least three more years. The project planned to partner with local city accessibility guides, recognizing that studying abroad transcends campus boundaries. Hence, it implies grassroots mapping can help publicize inequities of public space, with accessibility as one problem it can showcase.[127]

Accessibility has often been a topic of digital mapping projects, even outside of the overt association with grassroots mapping. As one example, Canal Accessible, a media project from artist Antoni Abad, had users capture physical barriers disabled populations faced through mobile media in the mid-2000s.[128] The project, hosted on megaphone.net, heralds the technologies underpinning it and distinguishes itself from mainstream media:

> Since 2004, megafone.net has been inviting groups of people marginalized within society to express their experiences and opinions. Using mobile phones they create audio recordings, videos, text and images that are immediately published on the Web. Participants transform these devices into digital megaphones, amplifying the voices of individuals and groups who are often overlooked or misrepresented in the mainstream media.[129]

The title of the page itself that this description comes from, "Communities + Mobile Phones = Collaborative Webcasts," speaks to the production of community via the contemporary proliferation of internet-enabled devices enabling collaborative, bottom-up projects.

Mapping, now folded into popular aesthetics, visibilizes inequitable aspects of sociospatial designs. Locative art projects like Canal Accessible fall in line with Eric Kluitenberg's vision of tactical cartography, a vision which the framing of GPS assessed earlier does not anticipate.[130] Such projects highlight the role technologies play in establishing a sense of place.[131] Canal Accessible specifically seeks to do so by creating an augmented space. Projects like Canal Accessible aggregate user data, with the platform or device itself being what fosters a sense of place.[132] Accordingly, media scholarship commends locative art's "capacity to extend messages, actions, or citizen participation throughout space and time."[133] Hence, locative media projects and grassroots mapping emphasize enhancing citizen participation via technology.

Like grassroots mapping, civic hacking (a term associated with grassroots mapping) equally merits unpacking. Civic hacking enlists a broad range of identities; those who engage in it "are technologists, civil servants, designers, entrepreneurs, engineers – anybody – who is willing to collaborate."[134] This also resonates with the nature of the work of critical making communities.[135] Furthermore, civic hacking calls for local leaders to assemble and "unleash their can-do spirit by collaboratively harnessing publicly released data and code to create innovative solutions for problems that affect residents everywhere."[136] Its work thus seeks to extend from the local outward.

Civic hacking differs from popular conceptions of hacking. Rather than "people stealing personal information, breaking into websites or revealing government secrets" (a definition that only encompasses black hat hacking), civic hacking involves participants using "a minimum of resources and a maximum of brainpower and ingenuity to build, repair or enhance something in their community."[137] The genealogy of hacking one of the National Day event organizers borrows from is notable toward understanding meanings associated with civic hacking:

> my father . . . is 92, active and a veteran of WWII. He pointed out that he first heard the term 'hacker' during the early days of WWII in the South Pacific. … When fighter planes would return from action they would be shot up and in many cases crashed on landing because their pilots were injured. Each night huge teams of mechanics would converge upon the wrecked planes and 'hack' at them, removing the good parts from several and building a new plane overnight from all the salvaged pieces. He told me they were referred to as the 'hacker details.' That was because they had to use metal 'hacksaws' as they cut away the damaged panels of the planes. At 92 he seems to think that is the original root of the term.[138]

According to this genealogy of hacking (one of many for the term), hacking signifies building from salvaged parts. Civic hacking thus contrasts popular depictions of hackers as criminals, connecting it with civics and "collaboration among governments, startups, and residents" to effect change through transparent, participatory efforts – a charge grassroots mapping also embodies.[139]

Given these similarities, projects explored in civic hacking and grassroots mapping are similar. Among over 90 various different kinds of hackathons in almost 80 cities, Maine's Harpswell Coastal Academy held an event for "Grassroots Mapping of Invasive Aquatic Species" as part of the 2014 National Day of Civic Hacking.[140] While there is little mention of GPS monitoring's applicability toward tracking the spread of invasive species in the previously explored archives, said application does show up within First Lady Laura Bush's comments at a Dallas prep school discussing in part how Austin students have been using such technologies toward that end.[141] It is a stark contrast from the masculinist narrative of militarism or control over space that theorists like Harvey point out as rampant in discourses of the global and that Bush and Cheney champion in

their speeches.[142] The community ethos of such projects, not by coincidence, stems from a feminist geographical perspective, which often uses mapping toward seeing the multiplicity and situated nature of knowledge. It thus understands how GIS can perpetuate structures of exclusion and disempowerment. This shows that diverse perspectives must be invited within such projects that reflect different subjectivities, spatial locations, and temporalities.[143]

Out of all the grassroots mapping projects examined in this section, an interactive documentary from 2013 called *Hollow* garnered the most press coverage. It enlisted those who live in McDowell County, West Virginia to confront how it is portrayed, how its population has declined, and what its future might hold. An area "once known for its bustling coal industry," McDowell County "is now an economically depressed area struggling to maintain its identity."[144]

Elaine McMillian, *Hollow's* director and an alum of West Virginia University, connects it with the university's land grant drive to attend to the local in a screening held there, claiming that the documentary "is about helping to amplify a West Virginia community's voice."[145] Land grant universities have long been connected to democracy and citizenship in ways that resonate with grassroots mapping pursuits.[146] The connection of land grant institutional aims to the community ethos and attention to the local that grassroots mapping conjures continues the running thread of amplifying marginalized perspectives.[147]

Hollow had additional screenings at various prestigious festivals, including the International Documentary Film Festival and the New York Film Festival. *The Huffington Post* applauded the project as a work of "'next level' storytelling" for how it "allows viewers to chart their own unique path through the film to create a personalized, interactive experience."[148] The project thus confronts what Valdosta State Assistant Professor Jason Brown, a collaborator on *Hollow* with the college's Communication and Arts department, describes as a hollowing out of rural American areas.[149]

Hollow's press coverage details its community focus. *The Valdosta Daily Times* describes the *Hollow* as a project "by the people, for the people."[150] *The Register-Herald* claims the documentary's diverse methods (not exclusive to but including what it calls grassroots mapping), are most effective when community members are featured and help produce media about their community.[151] Yet the role of community within *Hollow* merits qualification. Of the 50 vignettes which comprise *Hollow*, community members produced 20 of them.[152] While this is a fair percentage of the content, it is still less than half. This can bring the participatory frame of the project somewhat into question.

One can still argue that Hollow is an alternative work of community media not only due to its community focus, but also in how it was funded. While *Hollow* received grants from the Tribeca Film Institute and the West Virginia Humanities Council, it also received $30,000 of its funding through a Kickstarter campaign, as Public Lab kits likewise do.[153] The documentary confronts the decrease in population counties that McDowell County have faced. This is in large part due to the move from an industrialized economy to a knowledge-based economy. It is no coincidence that this shift reflects the "old" and "new" economies Clinton administration documents suggested could both progress simultaneously with the aid of a public and modernized GPS. The administration proposing this shift and acting upon it through publicly available GPS reflects Castells' view of the role of the state in promoting innovation in a modern knowledge economy.

The lead of a *Valdosta Daily Times* article that features the project perhaps sums the problem it identifies best: "In an age of highly evolved technology, advancements in science and economic turmoil, the United States is facing a nearly silent epidemic of small, rural communities virtually vanishing from existence." The producers of *Hollow* cite demographers' estimates that "the 10 communities that make up McDowell County are just years away from extinction." Brown additionally claims that "[t]echnology and time have changed it and forced people out." Press

coverage also attributes the decline of 700 areas like McDowell County whose populations have declined at least 10% in the past quarter century to consequences "of a boom and bust economy."[154]

The project thus deals with what technologies afford and what they are perceived to transform in society, and does so via a workshop model mimicking critical making ambitions. Press coverage on *Hollow* elaborates on the ramifications of this community model:

> Most opinions formed about small rural communities come from forces looking in, but now, at least one community in America has a voice that comes completely from them.
>
> This raw and honest plethora of personal portrayals transform the issue of a diminishing community away from statistics into a person with a face, a voice, a family and a history.
>
> "If you have a genuine story that people want to hear, you don't have to go to Hollywood," said Brown.[155]

Brown's statement echoes another quote on how when it comes to whom the documentary features, "It's not Snookie and JWoww at the Jersey Shore, it's people just like you and me confessing their trials and tribulations."[156] Brown thus distinguishes between what is considered typical mainstream media content and the content of community media, which he deems more relatable. The quote also illuminates the perceived need to take such perspectives away "from forces looking in" (a passive, unnamed construction) to communities themselves.

The project's attribution of technology as part of the problem is telling, as it embodies a key point of friction. *Hollow* pinpoints that technology is destroying traditional communities, and its proposed solution is *the further use of technology* to help show that. Technology and the internet are both the problem and the solution in *Hollow* and its media coverage. This is akin to the forms of friction that Forlano and Halpern find underlying labor activism.[157]

The project's reliance on the digital has also factored into its decline. Considering the difficulties of preserving such projects online, *Hollow*'s main figures stressing that the project "isn't

just about documentation, it's about preservation" is ironic. The project's original instantiation online has not been maintained; what remains online is a map the project hosted on its website and project channels on YouTube and Vimeo with select clips.[158] This resonates with discussions of the management and lifespan of data that gets enrolled in such projects from impacted communities, a subject Public Lab broaches explicitly.

McMillian highlights the map as her favorite part of the project. Mapping itself being part of what was considered by many an innovative work of documentary underscores the resonance between mapping and assembling that the preface explores. The map invites online viewers to contribute data toward studying the "small town exodus." It collects and presents information on users' hometowns, where they may have moved to, and when, in terms of their age.[159] Given the collection of personal data, this resonates more with a typical model of digital mapping fashioning the world around users' personal data. This fascination with personal data in such visualizations is certainly present within locative art and locative-based documentary projects, with the work of Ester Polak and PolakVanBekkum being particularly of note.[160]

The project argues its use of the internet highlights community voices, not those of "forces looking in." It contends the internet enhances possibilities for citizen engagement and eliminates barriers for participation being constrained to particular places and times. Toward this, the Valdosta Daily Times writes that "[t]o make a difference or a point you don't have to be in New York or Los Angeles, you can be on the computer in your living room in a small rural community."[161] Such efforts, of course, are nothing new. Attempts at strengthening citizen involvement through computer networks are at least as old as PLATO (Programmed Logic for Automatic Teaching Operations) III, one of the earliest networks.[162]

It is equally important to see grassroots mapping as entwined with the current role of digital maps. An article found on "Digital Life" mentions grassroots mapping (alongside various other

technology news stories focused around value generation) in terms of Google's use of Public Lab's more advanced imagery in Google Earth historical layers.[163] Grassroots mapping can thus bolster more corporate and invasive modes of digital mapping that run counter to its goals. It can fit in the characterization of "digital life" wherein value creation is front and center, one Fuchs reflects.

Understanding how Google and other dominant search engines organize information in biased and harmful ways is crucial in framing tactics like grassroots mapping.[164] Corporate interests governing the internet can resist discourses of openness surrounding the internet, particularly with the role dominant search engines like Google play in disseminating information on crises like the 2010 BP Oil Spill. An Elon Law Review article by Mary L. Lyndon recounts this example:

> Visibility of the Spill's impact was a contentious issue from the beginning. BP worked to dominate public perception, purchasing top "oil" search spots on Google, asserting physical control over affected coastal areas using private security firms and local officials, and instructing its employees and contractors to limit their discussion and discourage photos.[165]

Public Lab's documentation of the spill at the community level thus critiques how search engines like Google presented information on the spill in ways biased toward corporate interests.

Grassroots mapping factors into Lyndon's article in Lyndon's discussion of the Louisiana Bucket Brigade (LABB). LABB trains local residents and provides low-cost tools toward monitoring air conditions in ways that have proven applicable to disputing expert claims. LABB was critical to accumulating such evidence during the spill. It collaborated with Grassroots Mapping (now Public Lab) to employ balloon mapping toward acquiring local data.[166] STS scholars highlight LABB's work as one of creating "boundary-crossing devices," traversing institutions and cultures of expertise in collaborations that, rather than raising questions on the worth of community involvement, evaluate said work in terms of how it follows quality standards.[167]

The Deepwater Horizon rig's eruption and subsequent destruction while drilling for oil in the Gulf of Mexico caused the spill. The resulting equipment damage resulted in Gulf pollution by

millions of oil gallons over three months. As it became clearer that government and industry were ill-equipped to handle the necessary emergency response, the internet hosted a great deal of brainstorming on the part of experts and nonexperts.[168] This accentuates the need for situational awareness in effective disaster management (one the DroneLab app also resonates with) in the way Paulison underscores when discussing failures in the federal response to Katrina.

Lyndon implies the internet democratizes scientific knowledge production on environmental hazards. In this vision, the internet enables "expanded participation in scientific research--a capacity demonstrated by a number of responses to the [BP Oil] Spill."[169] Indeed, as Chapter 2 notes, public interventions have been increasingly acknowledged as more and more legitimate and pertinent to contemporary science with the environmental justice movement and digital communities. Community perspectives on the ground are often deemed as paling in comparison to those of experts in part due to these moves.

Lyndon asserts that all complex systems come with risks beyond understanding at the point of planning. Incorporating publics as stakeholders as Habermas implores can expose oversights in sociotechnical systems before they produce such large-scale damage. Benjamin broaches such fears explicitly in contending technological capabilities are surpassing our ability to use them positively.[170]

Lyndon's article highlights the actions of citizens on the ground who mapped the effects of the spill, in ways that identified significant issues with how the EPA was monitoring the area. This, again, critiques the lack of "situational awareness" in outside perspectives. In the case of the BP oil spill, online discussion over the spill's effects outlasted mainstream media coverage of the event. In Lyndon's estimation, this activity shows that online communication can enrich possibilities for environmental politics. Lyndon thus deems the internet "an environmental technology."[171]

In the spill's aftermath, Lyndon depicts a global public that bore witness as "technical, managerial, and ecological dynamics" played out online, one that "went to web-based resources to

learn more." Lyndon, however, points out this only works if principles of net neutrality continue to ensure the internet is "robust, fair, and open."[172] The application of tactics like grassroots mapping toward increased citizen participation online, then, are thus inextricable from net neutrality.

Like the GRIID project, Lyndon focuses on building out knowledge networks and assemblies. The emphasis must be on an adaptive rather than an all-knowing framework, one that includes rather than ignores diverse perspectives.[173] These diverse perspectives complicate, and thus are often ignored or erased within the corporate and the global.[174] Lyndon concludes appropriately by arguing an open internet is necessary to allow these diverse perspectives to be heard.[175]

Not only has environment-oriented public work exploring this relationship been ignored in the past, it has also been significantly gendered. Lyndon elucidates that early attempts by lay publics to contribute to such an understanding in the 1970s as part of the environmental movement were discounted as "housewife data" – gendered and deemed somehow less legitimate, even when experts were enrolled in community findings.[176] This brings to mind the gendering of such work implied through the different framings of GPS within Bush and Cheney speeches as compared to uses Laura Bush's remarks help highlight, uses largely absent from archived content. Such characterizations reflect the erasure of women in geographical work as it became more institutionalized and moved from the domestic sphere and the myth that women have historically not participated in geographic work, deemed too "gritty."[177] But grassroots mapping, as the examined projects have begun to show, strives for inclusion and expanding the field of participants to enact change.

Conclusion

I now return to the questions the introduction poses. First, *to what extent did applications and practices associated with GPS serve as conditions of possibility for the state?* Both administrations saw GPS as

enabling improved economic potential and emergency response, whether through life-saving services for citizens, measures improving air traffic control, or responses to storms and natural disasters. Associations with control, precision and targeting are also prevalent and extend toward matters of making governments and citizens more efficient and productive. These early prognostications did not anticipate the current import of algorithms to this work, or the extent to which GPS capabilities would aid these pursuits, as Google capitalism begins to show. But tracking and monitoring toward productive ends surface in imagined uses, be they grand (military and economic) or everyday (vocational and environmental).

The remaining chapters focus on the latter. They trace how public GPS applications have expanded toward avenues of citizen labor in projects that should arguably belong firmly in the realm of governance instead, if not for a poor track record among governing bodies in such matters in contemporary times. These shifts toward public labor are ones initiatives like Reinventing Governance and E-Government – ones public GPS was imbricated in, for a variety of applications – very much so promote in large part through the expansion of technologies like GPS to facilitate governmental work. Imagined and unanticipated uses of GPS examined here constitute technologies of governance meant to facilitate a deference of state responsibility onto individuals – as do the case studies at hand as examined in later chapters.

Avenues for this include managing disasters, searching for survivors, and serving the marginalized. The role of GPS in the project of state-making thus encompasses a project of monitoring toward these ends – of managing subjects and environments toward productivity that continues on in very complex and highly unanticipated ways in the contemporary moment. Foucault's concern with the writing of history as being necessarily mindful of the present context thus informs the analysis this chapter offers.

This analysis, in turn, rethinks the "new" relations that underpin how public GPS is currently used in largely unconsidered ways judging from the content of available archived documentation. By historicizing these applications within the imaginaries these documents convey at the outset of this project, I orient this disjuncture as telling of the manner in which subjects are instrumentalized in service of such unanticipated projects in ways that fit with the rationale behind the imaginaries that are present within the archived material. This, in essence, traces transformations in what could be performed or known via public GPS use, substantiating calls for media studies scholarship to look beyond the present moment in "new" technologies and form genealogies that trouble what may have once appeared certain about them.

With this established, it is worth returning to the second question: *how do alternative modes of use measure up against that?* Grassroots mapping does not have a universal meaning among its different applications, even if shared characteristics emerge. In the projects examined, grassroots mapping is connected to the internet of things; democracy; community perspectives; disaster response; knowledge networks; accessibility; civic hacking; citizen participation; interactive documentaries; the growing rural-urban divide; mainstream media critique; the political economy of the internet; and environmental politics. While news outlets and project figures celebrate the flexibility and modularity its open technologies afford to fit community needs, they often ignore problems of access in their proclamations of the projects as participatory. My use of archaeology to highlight the projects such pieces feature has the added benefit of decentering the discourse of grassroots mapping away from its pronounced associations with Public Lab tactics and into a broader collection of contemporary media projects that manifest comparable pursuits. If mapping, as the preface established, seeks to measure the weight a bevy of forces imposes upon different spaces and realms of knowledge, archaeology – as an act of mapping in Foucault's image – does so in its troubling of established histories and discursive associations.

Further recognition of friction and the imperial, colonial, masculinist backdrop of mapping helps establish structures that can hinder participation. Such easily modified technologies afford the flexibility needed in citizens responding to what an outside view does not see or anticipate. They can empower corporate and state spatial perspectives through the situational awareness they provide. While such community perspectives have been seen as less legitimate in preceding centuries, they are now recognized as vital and thus instrumentalized toward such use, encouraged and appropriated by top-down perspectives in ways that sustain government and corporate projects. Grassroots mapping projects are emblematic of a moment Smythe anticipates characterized by prosumers, in which media consumers are expected to produce more and more data about themselves and their circumstances in order to learn more about themselves, their networks of peers, and their environments. These projects and how they are covered often do not acknowledge this context. Such citizen actions empower the capacities of the state and the corporate ties that now increasingly aid its data aggregation through public-private partnerships, partly via mapping.

To Harvey, "[l]iberating ourselves" from the absolute space of the state "is a vital first step toward freeing up our conceptual world, and so helping to define a broader terrain of 'conditions of possibility'" for progressive action.[178] It can certainly be said that grassroots mapping seeks to work toward this. But, as the project contends, the work at hand in these communities is far more complex than this would imply, and has to navigate a bevy of different debates and formations carefully. The next chapter starts teasing this out through CDA, delving deeper specifically into the branding of Public Lab tactics and organizing as "punk," its forum articles, and its more formal publications.

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[1] Presner, Shepard, and Kawano, *HyperCities*, 85.
[2] Foucault, *The Archaeology of Knowledge*, 160, 206.

[3] A brief note is warranted on the research involving the Clinton Presidential Archives. I conducted the research for this chapter in the fall of 2014. After a site update since then, many of the links provided in the endnotes are now broken. The most relevant document online from that archive when replicating the original search at the time of this writing is a document pertaining to a FOIA request from 1996, one that did not show up in the initial search. This document forms much of the basis for the historical background this chapter provides. It is available via "Inventory for FOIA Request 2015-0369-F," *Clinton Presidential Library,* https://clinton.presidentiallibraries.us/items/show/49011.
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[5] David Harvey, *Cosmopolitanism and the Geographies of Freedom* (New York: Columbia University Press, 2009), 276.
[6] Scott, *Seeing Like a State.*
[7] Harvey, *Cosmopolitanism and the Geographies of Freedom*, 270.
[8] Ibid, 270. See also 134-137 for more on these different views of space and their significance.
[9] Ibid, 275. See also Fortun, *Advocacy after Bhopal.*
[10] Marc Andrejevic, "Three Dimensions of iCulture," in *iSpy: Surveillance and Power in the Interactive Era* (University Press of Kansas, 2007), 39.
[11] Ibid, 40.
[12] Carlos Barreneche, "Governing the Geocoded World: Environmentality of Politics of Location Platforms," *Convergence* 18.3, (2012).
[13] See Deleuze, "Postscript on the Societies of Control."
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[15] Andrejevic, "Three Dimensions of iCulture," 37.
[16] Ibid, 38.
[17] Ibid, 41.
[18] See Brettany Shannon, "Castells, M. (1989). _The Informational City: Information Technology, Economic Restructuring and the Urban-Regional Process_. Oxford and Cambridge: Blackwell Publishers." June 24, 2012, https://brettany.wordpress.com/2012/06/24/castells-m-1989-the-informational-city-information-technology-economic-restructuring-and-the-urban-regional-process-oxford-and-cambridge-blackwell-publishers/.
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[20] Ibid, 43.
[21] See Dallas Smythe, "Communications: Blindspot of Western Marxism," *Canadian Journal of Political and Social Theory* 1, no. 3 (1977): 10-11.
[22] Ibid.
[23] Fuchs, "Google Capitalism," 44.
[24] Lucia Maffei, "Your Shareable Google Maps Lists May Be Really Interesting to Advertising," *NPR,* last modified February 18, 2017, http://www.npr.org/sections/alltechconsidered/2017/02/18/515564392/your-shareable-google-maps-lists-may-be-really-interesting-to-advertisers.

[25] William I. Robinson, *Global Capitalism and the Crisis of Humanity* (New York: Cambridge University Press, 2014), 3, 11.
[26] "Remarks by the President in State of the Union Address," accessed May 25, 2017, https://clinton2.nara.gov/WH/SOU97/.
[27] *The William J. Clinton Presidential Library Digital Library*, accessed October 15, 2014, http://www.clintonlibrary.gov/assets/storage/Research%20-%20Digital%20Library/ClintonAdminHistoryProject/1-10/Box%201/1224798-council-economic-advisors-1.pdf.pdf.
[28] Galison, *Einstein's Clocks,* 285-289. See also National Air and Space Museum, Smithsonian Institution, "How GPS Works," video, 2012, 1:09, http://timeandnavigation.si.edu/multimedia-asset/how-gps-works.
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[31] Galison, *Einstein's Clocks, Poincaré's Maps*, 285.
[32] *The William J. Clinton Presidential Library Digital Library*, accessed October 15, 2014, http://www.clintonlibrary.gov/assets/storage/Research%20-%20Digital%20Library/ClintonAdminHistoryProject/71-80/Box%2075/1729131-history-department-state-documentary-annex-part-2-2.pdf.
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[165] Lyndon, "The Environment on the Internet," *Elon Law Review*, 2012.
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[167] Kirk Jalbert, "Boundary Objects," *conceptsinSTS*, retrieved from http://conceptsinsts.wikispaces.com/Boundary+Objects+(Jalbert), and Gwen Ottinger, "Buckets of Resistance: Standards and the Effectiveness of Citizen Science," *Science, Technology, and Human Values* 35(2): 244-270.
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CHAPTER 4

A CRITICAL DISCOURSE ANALYSIS OF PUBLIC LAB

"In 1977, in the very heavenly dawn of London's punk-rock scene, a crude, photocopied magazine told its readers: 'This is a chord, this is another, this is a third. Now start a band.' They did so by the thousand. Now that punk aesthetic has come to science."[1]

- "Punk Science: Do-it-yourself Science is Taking Off," The Economist, Dec 19, 2017

Introduction

While Chapter 3 covered associated discourses with grassroots mapping from the results of a LexisNexis search, there was an additional related discourse that cropped up as I researched the Public Lab community: that of "punk science." A feature from *The Economist* focuses in large part on the work of Public Lab and several of its members, fashioning that work within a larger purported zeitgeist of punk science initiatives. Unlike grassroots mapping, "punk science" is not nearly as broadly applied as a term. Search results for "punk science" aside from this article mainly pertained to a stand-up comedy and music group associated with the Museum of Science in London which goes by that name or other related STEAM-punk collaborations. One particular article of note from *The Times (London)* notes the increase of science's "cool" factor by citing the increased enrollment in high school science courses and the rise of events that the Museum puts on that feature bar trivia, speed dating, drinking, and the Punk Science act.[2]

The invocation of "punk" to these case studies brings Dick Hebdige's work to mind. Hebdige fixates on punk as a contradictory mesh of musical styles forged in opposition to glam rock and mounting radical modes of critique British working-class aesthetic informed. What *The Economist* sees as "punk" about grassroots movements in science meshes with similar working class

connotations. Grassroots mapping, materially speaking, works based on what the working class has available – soda bottles, baby stockings, and the like – in order to advocate on its own behalf in ecological matters that are equally matters of capital, livelihood, and survival, in biological and economic terms. Given the conversations from the preface and the previous chapter, one can see those who engage with its tactics as organic intellectuals in the sense that those more intimately intertwined with the environments being mapped have not only heightened situational awareness, but the ability to translate the interests of local residents in ways that those residents can contribute back through (i.e. "punk" science).

More broadly, Hebdige's research surveys the complexity of the "punk" and its meanings: as threatening; as resistance meant to be reincorporated; as being chaotic and anti-establishment; as about the possibility of performance and transformation; as an alternative mode of expression; and as ironic self-abasement.[3] Grassroots mapping embodies many of these sentiments in how it heralds open source collaboration for its alternative modes of publication and resource sharing, as well as its commitment to incorporating more users into cartographic practice to counter its often exclusionary data practices.

But punk being a style that ultimately gets reincorporated is also important to understanding grassroots map production. Of Hebdidge's listed associations, it is the one that best speaks to the issue of co-opting the grassroots that this project delves into. The previous chapter, for instance, covered grassroots mapping attempts to counter corporate biases and drives toward efficiency that platforms like Google embody. This critique persists even as its work is incorporated within such platforms and their modes of value creation. In a 2012 Google LatLong blog post, Christian Adams of Google Earth Outreach writes specifically on Public Lab imagery:

> Here at Google we publish a lot of imagery, most of which comes from the satellite and aerial imagery providers with whom we partner. Last week we published something a bit

> different: images collected from balloons and kites! The resolution is amazing, and it's something that just about anyone can do themselves.[4]

Google's partners notably go unnamed. The ends of these partnerships are also excluded. But Adams contrasts the production of its imagery from that of Public Lab and provides an affective evaluation of Public Lab's "amazing" imagery.[5] Adams heralds grassroots mapping in what follows:

> Our friends at The Public Laboratory for Open Technology and Science have been working hard to make imagery collection easy, cheap and accessible. Their grassroots mapping work is based on the idea that citizens anywhere should be able to explore the environment in and around their communities, by collecting their own imagery and other data, and to do it in a way that is useful for scientific and social purposes.[6]

Adams highlights Public Lab's moral commitment to citizen involvement and ensuring democracy in scientific data collection. Adams also personalizes Public Labbers as "friends," implying camaraderie even while only referencing them as a class, without naming any members.[7]

While it would be a stretch to deem their relationship antagonistic, Public Lab positions MapKnitter as countering Google Maps. A description of Public Lab's Balloon Mapping kit on its online store exemplifies how Public Lab presents itself as counterhegemonic to Google:

> Using the open source tool MapKnitter, you can stitch . . . images into an online map -- your own "counter-cartography" version of Google Maps. Use it to tell a different story from the "official" map -- document contamination (it was used to map the BP oil spill) or wetlands loss, or to record a temporary condition like the Occupy Oakland encampment.[8]

The prescribed demands the imperative and use of direct address create strengthens the high stakes of the identified problem: that more maps are needed to question the authority of state and corporate representations.[9] The description uses elaboration in the latter halves of both sentences to substantiate those stakes.[10] In the first sentence, the elaboration personalizes the problem, inviting readers to create maps they can call their own. In the second sentence, the elaboration cites well-

known examples of Public Lab mapping. This includes its use in charting compromised wetlands and applications in protest mapping.

Adams credits Public Lab for enhancing citizen involvement opportunities accordingly. Adams applauds its development of cost-effective image capturing kits and the MapKnitter interface as an approach that "allows anyone . . . to take photos of the ground around them."[11] As discussed previously, not everyone can afford, use, or expend the time to engage in such work. The post's assumption of access can situate Public Lab's tools and practices as the solution in and of themselves, which is reductive. The ways these tools and practices sponsor dialogue is what counts, and that begins to show how Public Lab and Google manifest different sets of values on mapping.

Judging from this post, Google does not value grassroots mapping's cultural work on the same terms. The blog post renders human agents and social ties – what Public Lab highlights – invisible. Adams recognizes the technologies at hand, but does not recognize their agency in how they shape the representations grassroots mapping yields. This is notable considering Public Lab proclaims that an advantage. As mentioned previously, while dominant global platforms often ignore these agencies for their capacity to complicate, more ecological approaches as those engendered in the communities of focus here embrace their perspective and their rejection of any totalizing, "complete" view. The post similarly skirts debates of objectivity in cartography that grassroots mapping positions front and center. As this chapter shows, these concerns characterize grassroots mapping's contentions with the spatial perspectives Google representations foster.

Thus far, principles of CDA, a methodological framework toward approaching these framings empirically, have illuminated discursive aspects of grassroots mapping. CDA poses questions that attend to a broad range of textual elements in a sample of texts, including the following:

- Genre (Which genres are included? How do they convey social action and relations?)
- Difference (Is there a recognition, accentuation, resolution, or bracketing of difference?)
- Intertextuality (What actors are included, attributed, or excluded in the text?)
- Assumptions (What is conveyed as implicit?)
- Semantic/grammatical relations (What are patterns of clauses and words in the text, and how do they convey meaning?)
- Exchanges, speech functions, and grammatical mood (What is the result of the statements made and the interactions between speakers?)
- Discourses (Is there a mix? What are their features?)
- Representation of social events (Is it abstract, reliant on metaphor, or concrete? How does it construct speakers and space-times?)
- Styles (What modes of social identity factor in?)
- Modality (What do authors present as truths or obligations? To what extent?)
- Evaluation (What values do authors endorse? How are they expressed?)

While archaeological analysis identifies rules conditioning how a given issue is articulated, CDA investigates conventions of texts' overall organization and at the level of single sentences.[12] A Foucauldian approach to discourse traces shifts in discourse to align with shifts in institutional contexts wherein institutions shape subjects differently to ensure their efficiency and productivity.

Additionally, whereas my application of archaeology toward largely pre-defined archives and search results was diachronic – that is, concerned with how identified discursive formations and their conditions progressed over time – my application of CDA toward a curated archive of selected

published works online is synchronic, concerned with the moment grassroots mapping launches and the nature of its critique, rather than comparing it to the evolution of GPS as the last chapter did.[13]

Chapter 3 showed how what would unfold with the lifting of SA was not explicit, but one would hardly be surprised given the broader scope of governance – in monitoring goods, labor, troops, and both disaster and emergency response – public GPS was seen as primed to afford. Chapter 4 showcases constructions embedded within grassroots mapping that are critical of such shortsighted government and corporate visions of space and technology that are detached from concerns of the lifeworld. These include proper treatment of communities of impact on the ground and ethical considerations for digital mapping practices.

I have selected for my sample texts in which leading Public Lab mappers communicate to a broader audience the community's ethical stances and success stories. I use CDA to analyze how the community describes itself, what discussions take place through the community's work, and how the community frames its work publicly, especially in relation to the shifting institutional context of knowledge production.

This chapter analyzes four Grassroots Mapping Forum articles alongside excerpts from Jeff Warren's Master's thesis on grassroots mapping and Sara Ann Wylie, Kirk Jalbert, Shannon Dosemagen, and Matt Ratto's *Information Society* article "Institutions for Civic Technoscience."[14] Out of the larger review of forward-facing texts Public Lab members have penned, these texts stood out as conveying the social struggle the community situates grassroots tactics as primed to address best. Given the thrust of CDA, these would then be the most meaningful to analyze.

Various commonalities emerge within these texts. They blend theory, mapping case studies, and legal tensions through intertextual reference, often as modes of legitimation. Perhaps most significantly, however, in highlighting grassroots mapping as a transformative experience, these texts engage in a moral evaluation framing grassroots mapping as much about producing dialogue around

critical data and media consumption as about producing tactical mappers. I conclude this chapter by exploring these formations through select textual elements Fairclough identifies – namely, grammatical mood, exchanges, evaluation, and modality. It is clear from the discussion of these elements that feminist and community-oriented approaches to mapping – ones, as the last chapter notes, are absent from imaginings of public GPS – lie at the forefront of the tactics and practices being described. What receives less attention are the possibilities for co-opting that this dissertation has already established within grassroots initiatives.

Grassroots Mapping Forum Articles

Public Lab recently changed the name of the Grassroots Mapping Forum to the Community Science Forum (which it self-publishes) from the Spring 2016 issue on. All articles examined here are from when the publication went by the former. This was from the Summer 2011 to October 2015 issues, nine in all. The change follows the change of the community's name from Grassroots Mapping to Public Lab to cover DIY interventions beyond mapping midway through 2013.

The new title underscores community. It also reflects Public Lab's critique of citizen science in replacing "citizen" with "community." As pages on Public Lab's website, the articles provide opportunities for dialogue via the comment functionality of Public Lab wiki pages for each article. A select number of articles lead to such conversations. The articles are also available in both .pdf downloads as well as in physical forms available to buy online.

Proceeds from kits go right back into funding Public Lab. It is already currently supported by various foundations and funding agencies (including Google, NSF, the Posner Foundation of Pittsburgh, the Gordon and Betty Moore Foundation, and the 11th Hour Project) as well as a range of in-kind donations (including server space from the MIT Media Lab and Rackspace).[15] Prior

supporting organizations include the Knight Foundation, the EPA, Microsoft, MapBox, Mozilla, Development SEED, and the American Anthropological Association.[16]

The forum issues, in turn, incorporate different genres. These include more formal articles, interviews, maps, and community chapter pages. Many articles themselves mix different genres. Dosemagen's "Public Lab Five Year Retrospective," from the forum's Five Year Anniversary Issue in May 2015, is a timeline spliced with anecdotes from mappers. It thus exhibits intertextuality through reported speech and mixes two different genres.[17]

Dosemagen, Public Lab's Executive Director, uses a chronological arrangement and gives each year its own section. Dosemagen titles the first "2010: A Community Forms Around Disaster," a nod to Grassroots Mapping's origins with the BP Oil Spill.[18] Dosemagen thus gives agency to the community above all else. As a contrast, writing "A Disaster Prompts Community" instead would place less emphasis on community.

In discussing the spill, Dosemagen renders the map active and affective – able to shock and incite via actionable imagery. Dosemagen deeming Public Labbers "passionate" equally provides an affective judgment on Public Labbers that activates them over other actors. It is similar to the affective judgments of civic hacking. In both civic hacking and grassroots mapping, everyday spare parts get reused to build meaningful tools. Dosemagen recalls being sent a box of "odd materials" to further bolster the camera rigs being used at the time, including "a section of a garden hose and an old GPS unit."[19]

Dosemagen privileges mappers as social actors. Pieces of the chronology such as "Oil explosion discovered" and "The oil release was plugged" passivate actors involved with these events. They contrast with the declarative sentences (with an easily identifiable subject followed directly by a verb) that activate Public Labbers through transformative work photographing the disaster, raising funds for kits, and interacting with citizens online wishing to aid from afar.[20]

Likewise, the article includes knowledge on the spill "according to the US government," without any specific citation or agencies named. When Dosemagen conveys "[w]e were able to take detailed aerial images despite a no-fly zone order banning flights below 3,300 feet," there is no indication of what state actors put the no-fly zone in place. The article elaborates why mainstream media coverage was lacking, as reporters could not circumvent the ban. It does not specifically address failures in government response.

Instead, Public Labber efforts shine through. Dosemagen signals, "Despite the no-fly zone and the press blackout, the nascent Grassroots Mapping group photographed what was happening on the ground." Dosemagen further activates citizens in grassroots mapping efforts by specifically naming them, rather than simply classifying them in the text, citing that "[l]ocal trip organizers and leaders included Kris Ansin, Leo Denton, Mariko Toyoji, Cesar Harada, and Becki Chall."[21] These patterns in language, and others to come in this analysis, arguably leave readers with a rooting interest in the power of mappers and maps while imparting ample reason to critique governing systems in the matters grassroots tactics confront.

The article further personalizes grassroots mapping by incorporating mappers' stories. Dosemagen weaves in a quote from Public Labber Liz Berry on mapping the Gowanus canal in Brooklyn. Berry paints openness as establishing reciprocity and care within mapping.[22] Berry recounts, "our small crew were the only ones freezing our feet off, but by open sourcing our methods, we were supporting and were supported by some of the most heartfelt people across the internet–the global Public Lab community."[23] The contrastive phrase in the sentence ("but by open sourcing our methods") attributes the reciprocity of "the global Public Lab community" to its open source approach.[24] This attribution is a moral evaluation, referencing what texts construct as desirable and undesirable.[25]

Dosemagen highlights the results of Public Labber-led Gowanus project:

> groups in the Gowanus Canal have succeeded in . . . the discovery of an unknown freshwater inflow to the Gowanus First Street Basin. Their presentation to the EPA's Community Advisory Group was so effective that Superfund restoration expanded by an additional city block. Through vigilant aerial surveying, the subsequent analysis identified four active pipes and inflows that the EPA's survey missed. All this community work is leading to real improvements in the clean-up plan.[26]

This once again focuses on the transformative potential of the community, which the final excerpted sentence underscores, over entangled government actors. The passive construction "Superfund restoration expanded" does not identify who expanded it or how.

Dosemagen also features a partnership between Public Lab and the Gulf Restoration Network, a nonprofit founded in 1995 to enable concerned citizens to take action around protection and preservation of Gulf wetlands.[27] Dosemagen's description of the partnership accords with the identified pattern:

> In Louisiana, . . . Public Lab Organizer & Gulf Restoration Network (GRN) wetlands scientist Scott Eustis worked with Devin Martin of the Sierra Club to successfully capture low-altitude photos of ongoing sub-bituminous coal (the extra dirty kind) dumping in the Mississippi River. The images they secured of the coal pile over time changed GRN's understanding of the extent of Oiltanking/United Bulk's alleged environmental crimes and led to funding for further documentation and water quality analysis of this facility, culminating in a notice of intent to sue under the Clean Water Act.[28]

Dosemagen names specific figures involved in Public Lab's mapping and credits the resulting images with changing environmental understanding. But government agencies and officials at fault in their oversight go unnamed. The pattern of activation and exclusion mirrors how state spatial perspectives render publics passive, as other analyzed Public Labber essays explore further.

Dosemagen briefly indicates Public Lab's partnerships with more well-known mapping efforts like those of OSM and Google. Public Lab's initial stewardship included Mikel Maron (a well-known OSM board member who is also part of Mapbox's team) on its board of directors.[29] Public Lab's 2010 partnership with Google also incorporated grassroots images into Google layers.

Dosemagen's description of the latter passivates grassroots mappers, mirroring how Public Labbers deem corporate mapping platforms as passivating users.[30]

Public Lab's barnraising events distinguish it from such platforms as a community model for mapping. It reflects the founders' mission of establishing "a broader community science infrastructure." Dosemegan describes the first barnraising, held in North Carolina:

> We piled into tents, sleeping bags, and the borrowed space of local nonprofit Riverlink to eat, sleep, and create collectively. Embedded in the design of these events is an "unconference" ethos, hosting each gathering at a location where we can build together and then try things out on-site, whether it's a local farm, the wetlands of Louisiana, or a nuclear power plant in Massachusetts.[31]

While Public Lab has typically held an annual community-wide barnraising event in Cocodrie, LA with scattered regional barnraising events, the organization is transitioning toward regional barnraising events exclusively. Past regional events have included a "Toolshed Raising" in conjunction with a makerspace in Somerville, MA to develop the organization's Oil Testing Kit and regional barnraising events in Plymouth, MA, Chicago, and in the Appalachian region.[32]

The nature of these events and the shift toward region-specific events matches with Public Lab's invocation of the "grassroots." Dosemagen references how such a design for gathering a collective borrows from the "unconference" ethos, but the ethos of early virtual communities seems equally pertinent. Grassroots mapping may thus recuperate early countercultural tones toward online community. As with the community surrounding Stewart Brand's *The Whole Earth Catalog* of the late 1960s (a precursor to one of the earliest virtual communities in the WELL, launched in 1985), Public Lab manifests a community centered on distributed objects which foster a transformative engagement with space.[33] One might conjecture that the barnraising model also reflects a "return to the land" slant evident in early virtual communities.[34]

Public Lab may equally extend frictions inherent in online communities from these early instantiations. The new communalism captured within *The Whole Earth Catalog* that catalyzed the WELL harbored deep ambivalence toward technology. Community members saw technology as an agent of war and as part of a growing and dangerous bureaucracy. They also saw alternative use of everyday technologies in local contexts as revolutionary.[35] Public Lab might likewise, similar to *Hollow*, be situated between "antitechnological idealism" and "technophilia" in its output and its active critiques of standing sociotechnical systems.[36]

The community and dialogism in Public Lab open source approach contrasts with Google's investment in grassroots mapping. Crowdsourced funding on Kickstarter largely finances Public Lab kits, furthering this sense of community.[37] Google images do not foster conversation around mapping images and mapped artifacts (or around the process of mapping itself) as Public Lab does. What Google presses on its users is to use the images grassroots mapping generates and enjoy their high resolution, divorced from their charge to effect change.[38]

Fittingly, in the first issue of the Grassroots Mapping Forum, Warren and Dosemegan's brief "Reimagining the Data Lifecycle" critiques how data is treated in contemporary information capitalism. This is evident from the start of the essay:

> Where does data come from, and where does it go? Knowing the conditions under which data is produced, and the agenda of its authors, vastly affects how well we trust it -- one need look no further than the discord triggered by the diverse studies of the BP Oil Spill, or the controversies around the contamination of Brooklyn's Gowanus Canal. In most cases, though, we're guilty of not asking hard enough questions.[39]

This first sentence presents a wh-interrogative on the nascent circulation of data in contemporary knowledge economies.[40] The second sentence features a moral evaluation and an elaboration that highlights projects Public Lab continually underscores. The third sentence embodies another moral evaluation. Through use of the inclusive "we," it implicates the reader in information capitalism by

not being critical enough consumers. The high commitment exhibited within the non-modalized statement "we're guilty" blames consumers themselves.[41]

Warren and Dosemegan directly attribute Natalie Jeremijenko (a net artist) to legitimate problems in "our recent obsession with data visualization." Here, the reader is again implicated within structures of information capitalism through the inclusive pronoun "our." Jeremijenko's critique is that visualization designs lift data out of official archives without fully considering the conditions under which the data aggregation occurred, or what actors were involved or excluded.[42]

Warren and Dosemagen then follow with a sentence featuring a contrastive phrase embellishing what they identify as the problem: "What is lacking is not legibility, but trust."[43] Purported clarity in data does not make it inherently trustworthy. The authors thus present a moral issue, one that reflects critical scholarship on the Bush administration's investment in the "legibility" of aerial capture. As such, the authors substantiate critical postures toward state spatial perspectives.

A temporal clause follows to introduce an unnamed fisherman questioning during a town hall session how he could trust government claims assuring the safety of consuming local fish when LABB data found contaminants. While involved government actors go unnamed, Warren and Dosemagen mention LABB as well as the Louisiana Environmental Action Network. This accentuates the contrast formed between activist and government entities in these texts.

The authors again construct unnamed government entities in opposition to grassroots mapping through the following conjunctive sentence: "Yet -- disregarding local knowledge and concern -- the government maintains that Gulf Coast seafood is safe."[44] Government actors are thus deemed (as *Hollow* might suggest) a "force looking in," one grassroots mapping interrogates via community produced data. The elaborative phrase marked by dashes further sets up the opposition.

Warren and Dosemagen also contrast the quality of grassroots mapping imagery from Google's: "Over a hundred volunteers have hit the beaches to take tens of thousands of photos,

depicting slicks, oiled wetlands, and the birds, fish, and plants threatened by the disaster -- at far better resolution than Google Maps." The authors contend Google imagery does not support the caliber of resolution needed for the nonhuman to articulate itself fully in such matters.[45]

The authors subsequently voice their concern that "much of so-called citizen science treats people like data points." They depict citizen science efforts as objectifying and humanize grassroots mapping in contrast.[46] "Reimagining the Data Lifecycle" is thus a moral evaluation that citizen science reproduces problems of information capitalism. Both invite subjects as information consumers to experience their objectification as "data points" as liberating.[47]

Scholars often herald citizen science as resistant at face value, but these claims deserve more careful scrutiny. Relevant literature often includes haphazard praise of citizens' ability to "make observations at unlimited locations . . . , build public support for the environment, and [encourage] thousands of students toward . . . the environmental sciences," or research concluding that citizen science data is of as high a quality as what experts collect.[48]

Such studies neglect to mention issues in managing citizen science projects, both in terms of expense and scale.[49] One study on the creation of mapping site CitSci.org contends that "[t]he number of citizen science organizations, programs, and volunteers actively recording the location of species is growing faster than the flowers, birds, frogs, wildlife, and worms they seek to record."[50] There also remain questions of access and scale. While citizen science and related mapping initiatives have the potential to emerge as counter-networks challenging pre-existing scientific networks, Deborah Lupton finds not only that, more broadly, "many people continue to lack expertise in using digital technologies or even the kind of access to them that utopian visions of community mobilisation via the internet tend to assume," but also that such notions, particularly in discussions of mapping, "continue to take place in a context in which powerful commercial and state interests can delimit citizens' freedom of expression and action."[51]

Warren and Dosemegan critique comparable crowdsourcing efforts, including the Ushahidi platform:

> Between May 1 and July 31, over 2,200 volunteer hours, 29 outreach trips, and the support of 46 volunteers was expended towards publicizing the Oil Spill Crisis Map -- an Ushahidi map -- as a way to independently report spill impacts and to gather reports. To this end, 1,595 reports were collected during this period, but only 17% of them were reported directly by residents -- a relatively sparse portrait of the disaster, and far too little for an accurate needs assessment.[52]

The passivation of those contributing to the Ushahidi map in phrases like "the support of 46 volunteers was expended" and "reports were collected" matches how Public Lab distinguishes itself from the crowdsourced model. It does so in the use of a contrastive phrase and elaboration in the latter half of the second sentence which disputes the usefulness of the resulting map.

The piece continues this distancing in the next paragraph:

> Ushahidi is an innovative tool and its developers are adapting to these challenges. But the promise of engaging with local communities as full actors in seeking environmental justice has recently driven a group of us Grassroots Mappers to begin inventing new tools, based on the spirit of our balloon mapping kit: cheap, participatory, 'hacker' tools which produce excellent, legible, and independently produced data.[53]

This underscores notions of participation and civic hacking in grassroots mapping. It also cements the contrast from crowdsourced approaches through contrastive phrases and inclusive pronouns. But equally important is that this excerpt returns to the notion of legibility in data. Warren and Dosemagen see grassroots data as trustworthy in both its quality and its independent production, which frees it from the potential biases of state and corporate work. It is worth noting that, returning to some critical work from the last chapter, Scott (echoing a Habermasian take on legitimation) deems this legibility one of the key problematics of statecraft, as the state attempts to develop metrics to better know both subjects and environments under its governance. In doing so,

the state inherently simplifies a host of complex dynamics.[54] Given this, the previously discussed contrast between legibility and trust in distinguishing grassroots mapping furthers the distinction between constructed state and grassroots spatial perspectives.

Though grassroots mapping embodies positive technological use, it is not immune to debates surrounding geospatial capabilities. An "Unpiloted Aerial Systems Ethics" forum article is a dialogic response to these debates. Though commonly associated with "drones," now considered outdated by UAS advocates and the FAA in favor of the term Unmanned Aerial Vehicles (UAV), Unmanned Aerial Systems (or UAS) are assemblages in which UAVs are only one cog, along with receivers on the ground and their communication with the UAV.[55] The ACLU has argued that the switch in terminology, similar to the terming of data harvesting discussed previously, attempts to depoliticize these technologies from their destructive use on the part of the state.[56]

Mathew Lippincott, the forum article's author, explicates that conversation on the community's mailing list spurred it. It documents a group interview with Lippincott posing questions to four other figures with expertise in digital mapping, drones and surveillance law.[57] Before Lippincott recounts the interview, he includes an image from Christopher S. Smith of a cartoon airplane. It has a rainbow-colored tail and mane, but also a furrowed brow, intent stare, and an upper lip curled up on the left side of its mouth, showing teeth. Smith includes a ground receiver in the background and anchors the image with a "My Little Droney: Surveillance is Magic" logo.[58] This logo riffs on the "My Little Pony: Friendship is Magic" television show. The plane's rainbow-colored tail and mane aligns the image with the character of Rainbow Dash.

Though parody, Smith's pun and logo reflect the normalization of surveillance. The gravity of the issue in public consciousness is, like popular media content, pervasive. Both are also dangerously nascent, and too often assumed innocent. The naturalization of surveillance marks a broad diffusion of surveillance into the private sphere, substantiating Habermasian fears of

technology running counter to democratic goals and situating the state as a system situated not only as separate from but above the lifeworld.

Habermas fears the rational logic of such forms seeping into means of communication and depriving them of their capacity to preserve a sense of what is humane and worth valuing. But he overly values the import of face-to-face communication in that fear. He finds that technologies, much like economics and states, are "integrated action fields" from which this romantic view of communication must be protected.[59] When designed in a "punk" way, however – with an attention to community dialogue, as a tool of the citizenry made by the people and for the people, made with more accessible materials and in an open manner – technologies can serve as a route out of these formations, rather than being so strongly encoded by them as to have no potential for resistance.

Lippincott's initial question pertains to the difference between the legal implications for drones as opposed to other means of potential aerial surveillance. Privacy advocate Amie Stepanovich responds that drones afford a broader scope of surveillance. Their smaller size, lower cost, and ability to operate longer afford it. Bitworld Director Cameron Hunt adds that their automation and lessened need for human labor also factor in.[60]

A number of additive phrases pile on to the ethical implications discussed.[61] Hunt poses interrogatives to a similar effect:

> At what point does ubiquity make aerial surveillance a different type of thing? At what point does a shift in scale become a shift in type? The size is significant, because law enforcement can now fly over fences and into your backyard, around obstacles, and potentially in the window of my house— call it your personal airspace. How will that be dealt with?[62]

The wh- interrogatives precede a causal phrase that digs deeper into the ubiquity of surveillance. The elaborative phrase signaled through the dash deems it an invasion of "personal airspace."[63] This narrows the scope of the issue to bring it literally closer to home, with the patterned language conveying a sense of invasiveness.

Raymond Cha, a designer of map interfaces, then discusses the interrelations between technological development, ethics, and sociotechnical systems:

> Technology and behavior evolve faster than formal and informal ethical codes can develop . . . . Ubiquity and automated data analysis are changing our notions of surveillance, not just how we as citizens use it, but the way governments use it . . . . [A]ll technologies are tools that can be put to a number of uses, good and bad. But designs are created through the designer's ethical lens, and he or she has a responsibility to design to limit bad outcomes.[64]

There is an implied opposition here between citizen and government use. This excerpt features non-modalized statements and a conjunctive at the start of the final sentence on how technological progress shapes concepts of surveillance and their ethical implications. The designer's task is to foresee potential use and build in features that help bound it in more productive ways. This is akin to Latour's perspective on the work of designing sociotechnical systems.[65]

The interview also shows how grassroots mapping is mindful of how these designs get regulated. Coby Leuschke, president of a UAS company, anticipates relevant FAA actions in forecasting that a UAS configuration weighing "less than 2 kilos or 4.4 pounds, [sic] is probably going to have less regulatory burden placed on it.[66] The modal marker "probably" demonstrates moderate commitment to how those devices that may pose the most invasive potential (that are small and lightweight) may escape restriction.[67] It is not just the ubiquity but also the miniaturization or portability of devices that can "map" that can pose damaging effects.

There is a fear, though, that regulation might stifle an array of positive uses, such as those of grassroots mapping. This conjures geologists' argument on GPR use in the previous chapter; too much restriction on aerial technologies can hinder positive work. Lippincott addresses how grassroots mapping is mindful of surveillance considerations:

> Mathew: Yeah, there are a million ways to cause problems— we have to ask, is our hardware really making it easier? Probably not. We share similar design constraints in that we have regulatory limits, 5 pounds for kites and 115 cubic feet of gas for balloons/6ft in diameter—

> we aren't creating anything big enough, sharp enough, or fast enough— We have to take precautions, but its [sic[hard to do a lot of damage at this scale.
>
> Coby: Right. I can do a lot more damage with my truck. We focus on the positive use cases, natural resource management, disaster relief, humanitarian assistance. We're trying to keep it open, transparent, and accountable, and for us that's a good way to do business. If we're going to design something we open source it, put it out there, let the community comment on it, improve it, maybe understand it a bit better, so we don't have such intense fear of technology that's actually already out there.
>
> Mathew: I really admire your company for putting out those reference designs and open sourcing those.[68]

Lippincott conveys a strong obligation to weigh these considerations. He provides a moderate commitment to how grassroots mapping is not contributing substantially to fears of surveillance in response to the yes/no interrogative he poses.[69] Leuschke's affirmation of Lippincott's point elaborates by listing positive use and explicating how the dialogism of open source approaches sponsors understanding of technologies and practices at hand, which Lippincott affectively deems admirable.

Equally important is Leuschke's affirmation of open source approaches as "a good way to do business." Stepanovich concurs with the article's moral evaluations on open source approaches, asserting, "I can't officially speak for EPIC, but I am very pro open source. People can come in and see how it's built and understand the design. The fact that someone can come in and modify it in a nefarious fashion is outweighed by the benefits of openness."[70] Though Stepanovich's point is fair, this may be up for debate, as Chapter 6 covers the potential for bad actors (both corporations and hobbyists) on geospatial data platforms with more depth.

Though Google's closed approach is largely painted in a contrastive light throughout these texts, Hunt deems parts of Google policies admirable. Lippincott, though, provides qualification:

> Cameron: To that end, one of the things Coby and I discussed is can we take a page out of what Google has done, automatically blocking license plates and faces, and that is something

> we could insert into the video screen, with the ability to remove it, but engineered into the architecture, we have basic privacy protections for some of the most obvious things.
>
> Mathew: Trying to build firm ethical laws into designs is hard. To me, tools that encourage continuous ethical dialogue are better than those that require hard rules. With surveillance technologies, that means tools where direct engagement and negotiation between observer and observed is hard to avoid. Personal cameras have this—anybody can take public photos, but they expose themselves and have to negotiate with their subjects. Satellites are the opposite – the cameras are up there snapping away, so push for hard rules like blacking out access to certain areas in software. But I'd rather not rely on access conditions or blackouts of sensitive data, I'd like to see systems where people can pre-empt the collection of sensitive data.[71]

Lippincott re-emphasizes how dialogism is built into grassroots mapping technologies and practices. He sees capturing techniques of entities like Google are much more surreptitious. He establishes relations of equivalence and difference for "ethical dialogue" and "firm ethical laws" accordingly.[72] He associates the former with "engagement," "negotiation between observer and observed," the perspectives of "personal cameras," and the ability to "pre-empt" data collection, and the latter with "hard rules," the perspectives of "satellites" and "blacking out access." These relations continue the construction of grassroots mapping as dialogic and arguably contrast the model behind Mapillary, an app for crowdsourcing street-level imagery growing in popularity in OSM and covered in Chapter 6. By concluding through the conjunctive, Lippincott punctuates the value of dialogue in opting out over Google's blurring approach.[73]

In its dialogism, grassroots mapping yields productive exchange between the mappers and the mapped. It also strives to establish what spaces are permissible to map and to what extent. The interview builds the argument that these are opportunities other location-aware interfaces close out, proving detrimental to privacy. There are no feasible opportunities for those included to opt-out or determine the extent of their inclusion. Leuschke mentions the website Trulia as an example:

> Coby: From the technical side, if real estate sites like Trulia have access to all the accessory records that define my property, why can't there be a universal opt out, so I'd have to opt in to any data service? None of those people on Trulia opted in to a single thing other than

> they bought a house, and its public record. It's tough, I mean, I have a photography background, and think, if I put a balloon, UAV [Unmanned Aerial Vehicle], take your pick, up without asking my neighbors [sic] permission, do I have a right to take a photo of someone's backyard even if they have a 6ft privacy fence? I'd say no, it's invasion of privacy.
>
> Mathew: Public Laboratory's policy towards image collection is to either do it on public land, being [sic] very public while doing it, or if we're over private land, to get consent to photograph the space. We try to be proactive and identify ourselves. Thinking of an example to Coby's point— my neighbor can report if they think I'm watering my plants during a drought, would it change if a balloon and camera was used?
>
> Amie: Now the ethics are fairly difficult, but if we talk about this from a legal perspective, as long as you aren't out at night and using advanced imagery to determine how much water is being used underneath the soil, its perfectly legal, even if you have a 6, 7 foot fence, it's legal to fly overhead, and see what's going on in someone's backyard.[74]

This excerpt continues the pattern of hypotheticals (marked by the use of "if") and additives that portray issues of surveillance with appropriate complexity.[75] Stepanovich's use of a contrastive additionally differentiates legal implications from ethical implications. The ethical must be legal, but the legal is not always ethical. As a moral evaluation, grassroots mapping privileges ethics, and the potential for the legal to be divorced from the ethical fits within Habermas' fears of rationalization and system logic prevailing over public interest.

The interview questions the ethics of using "public" data itself. The Trulia example shows that just because data is public does not make it ethical to use. Ethics are not inherent to the "public" designation of data. Grassroots mapping argues one must be public in attaining and applying the data to be ethical. Stepanovich then concurs with the need to opt-in. Afterward, an editorial voice interjects at the end to tie the sentiment to grassroots mapping practices.[76]

The article concludes with legal material from Stepanovich under the headings "Aerial Surveillance and US Law" and "Code of Fair Information practices." While fair use eases copyright restrictions in certain creative or educational contexts so as to not hinder the cultural capacity to experiment with prior media texts, fair practice is ethically charged to ensure that datasets from

automated systems are transparent, rather than covert. It warrants that such use is informed by consent, the option to opt-out, and the need to safeguard against unethical use of collected data.

An informal citation appears beneath the former heading – *"from U.S. Dep't. of Health, Education and Welfare, Secretary's Advisory Committee on Automated Personal Data Systems, Records, computers, and the Rights of Citizens viii (1973*)."[77] The section legitimates the interview's claims through the authorization of the law.[78] Yet it omits what such laws look like in other countries and how they might shape grassroots mapping practices and technologies differently – an important topic in OSM work. Its discussion thus sticks to an exclusively American conception of privacy, one that may or may not hold up in other areas of the world. Meanwhile, María del Carmen Lamadrid's "Tool for Stalling: Mapping" documents use of grassroots mapping in an international context.

del Carmen Lamadrid's article begins with a conditional phrase and an interrogative: "If the official world of maps has mutated into an insane apparatus of surveillance and control, why should communities use maps to make land tenure claims?" The use of "insane" toward dominant mapping platforms is a strong evaluation. del Carmen Lamadrid demonstrates an equally strong commitment to countermapping, and writes that through countermapping, communities "hijack cartography to make themselves visible and more difficult to dismiss." This non-modalized statement's use of "hijack" proves just as direct.

To show the worth of countermapping, del Carmen Lamadrid discusses her work with a Ugandan craft market. The market and its community were central to the area's tourism industry in "selling Ugandan culture and arts to international tourists." They sought to "build a map . . . to stall eviction by the state. The end goal was to gain time so the community could organize their next steps, while creating a dialogue around urban planning and the displacement of communities."[79] del Carmen Lamadrid confronts issues with Google Maps imagery in discussing this example:

> Google Maps oozes an aura of authenticity and credibility that makes it hard to question the information it displays. Partly because the photographic elements seem to be miniature pieces of reality anyone can make (Sontag) and partly because of the companies' emphasis on data collection.
>
> Researchers [sic] at Google continue looking into ways of providing all the world's information to people seeking answers; they are working hard to consistently incorporate information that was not readily accessible before. But when your core interests are companies, what information becomes important and how does it get prioritized?[80]

The beginning non-modalized statement weaves in the work of cultural critic Susan Sontag to justify how Google images are often "hard to question." del Carmen Lamadrid ends with a conjunctive interrogative to embellish Google's corporate partnerships. The argument mirrors Lyndon's points on how biased platforms displayed information during the spill. They again prompt questioning of whether "public" use of data is really public if its application carries biased interests.

Habermas is also concerned with corporate control of both government and media in his notion of refeudalization, an ongoing process from the late 19th century that leaves less and less distinction between what is private and what is public. The result, in Kellner's words, is that "citizens became consumers, dedicating themselves more to passive consumption and private concerns than to issues of the common good and democratic participation."[81]

Through grassroots mapping, del Carmen Lamadrid and the workers of the market strove to "question both the state claims on The Craft Market's importance while subverting the Google Maps representation of the space." The additive clause marked by "while" ties the state to Google Maps as detrimental actors in a non-modalized manner, validating grassroots mapping practices as capable of working against both. del Carmen Lamadrid's endorsement is clear in the following:

> If Google thrives to make information accessible and Google Maps is a kind of 'macroscope' that helps consult places in a space, then what happens to the places and people that are not business? How can mapping be free from the tyranny of the state and from big corporations to bring visibility to . . . communities that do not fall in line with the macro scale?[82]

del Carmen Lamadrid argues the answer to these wh- interrogatives lies in indigenous mapping and "community satellites."[83] del Carmen Lamadrid outlines the design of community satellites as featuring everyday items "in order to achieve high-resolution aerial photography. By lowering the access cost of aerial photography, 'community satellites' can be used by communities [to] question . . . mapping as a medium of state control." What is quoted starts with a clause that conveys purpose (marked by "in order to") associating the high resolution of grassroots mapping with better articulated claims.[84] del Carmen Lamadrid returns to this point, saying the higher resolution makes claims "more sound."[85] But the modal "can" signals maps do not inherently question and prompt action. How communities utilize and employ them in dialogue gives them power, a Latourian take on maps.

del Carmen Lamadrid equally highlights OSM as "more public":

> Users of Google Maps are not able to actively shape the maps displayed. Instead, we release the photographic map to the public domain through an open-source GIS, OpenStreetMaps [sic]. Google Maps sometimes takes information from OpenStreetMaps [sic] of areas they are not able to constantly update. This way The Craft Market and I were hoping to affect Google Maps while shaping their online presence in a method that was relevant to them.[86]

The negative non-modalized statement purporting what users cannot do in the first sentence, the conjunctive "instead" to start the second sentence and the inclusive "we" stressing the community-oriented nature of grassroots mapping reflects del Carmen Lamadrid's commitment to how Google passivates users.[87] The mention of Google extracting from OSM is equally notable, making it a platform for intervention. Simultaneously, this logic also shows how Google once again co-opts public labor within its visual field.

del Carmen Lamadrid deems that the resulting map did not incorporate the community's touch as much as it should have due to this approach: "By being a polished and finished photographic map, it used a representational value that the state can acknowledge, but left no space

to present their own hand drawn map or a systematic investigation." The tension between legibility and trust is thus once again in play here. del Carmen Lamadrid reveals that "[i]n the end, the community was evicted on February 25, 2013."[88] The use of the passive here erases what actors were ultimately behind the eviction, and thus carries the political implications of the passive voice typical in conveying such corporate and government actions.[89]

del Carmen Lamadrid punctuates Google's power as a "force looking in":

> Google, as a foreign global institution, is shaping our perception of the actual size and impact of the market. Google is making claims on the geographic boundaries of the space by naming buildings and marking roads. The ideas behind the credibility of photographic representations and the prestige of the institution render this map as the most important source to what was physically in the space.[90]

The first sentence, a non-modalized statement, directly confronts Google's cognitive effect on users. The tensions inherent in its power of "making claims" is one of different space-times: one of the global that Google accords to and one of the local, which experiences and knows the space in contention much differently. In the article, Google Maps is a point of friction: both the site of power that suppresses community motives and the site of resistance for their contentions. Warren's Master's thesis further explores such power struggles.

Jeff Warren, "Grassroots Mapping: Tools for Participatory and Activist Cartography," (Master's thesis, MIT, 2010)

Warren sees grassroots mapping as an attempt "to make mapping easier for lay users, in order to broaden participation in cartography." While Warren acknowledges maps "as a tool of the state," he claims he designed grassroots tactics "to further democratize cartography." He lists various applications for such tactics, including "environmental monitoring, tenure rights, journalism,

commercial use . . . , community planning . . . , asset mapping in low-income or developing areas, and local-level urban planning." These, to Warren, are more personal applications than those envisioned under a model of "remote sensing," wherein users are treated as data and thus dehumanized. Grassroots mapping, as mentioned previously, reacts against these formations.[91]

Warren also frames grassroots mapping as reacting against the lack of criticality in data consumption, the lack of trust in "official" data, and frustrating licensing restrictions for geospatial data. These concerns resonate in his discussion of the neogeography movement:

> One identifying theme in the neogeography movement is the shift of users from consumers to producers of maps . . . . Neogeographers prefer 'crowdsourced' data, contributed by collaboration and volunteerism, to proprietary data, which they have come to distrust due to copyright, access, and format and quality limitations. Data produced by the public and liberally licensed for public use may be translated, republished, remixed, and repurposed without parasitic dependence upon large and often uninterested organizations and governments.[92]

Warren passivates both neogeographers and actors involved in proprietary data alike. Corporations and governments, in turn, are impersonalized here; Warren sees the relation between the public and these "often uninterested organizations" as "parasitic."[93]

If this relationship is so vexed, why does it persist? Neogeography found its base in Google opening up its API, preceding open source approaches. But this has not diminished the power of more closed approaches, seen in the following conjunctive construction: "However, some services such as Google's geocoding API, Yahoo's Placemaker API, and a variety of commercial satellite imagery sources, are still relied upon — generally because they outperform open source alternatives."[94] Quality is thus the bottom line.

While the focus is largely on the public, Warren acknowledges grassroots mapping's ties to Google and how its data gets licensed for Google. To Warren, when a community supplies data to Google rather than the traditional model, it flips "the licensing bottleneck" that typically hinders

participation in such disasters.[95] He thus hopes the emergence of grassroots mapping will "inspire others" to deploy its mapping tactics "in new and interesting ways" toward confronting the problem.[96] It thus encourages innovation and unintended use of its technologies and practices as a transformational experience for Public Labbers.

Exclusive barriers in corporate platforms operate at the level of code itself. Proprietary maps have a tile-based structure of image files cropped together to create continuity. It allows corporations like Google to better control their imagery. Warren deems the tiles "immutable — they contain no information about authorship, no hyperlinks, and in order not to crowd a given tile, each one displays only a selection of available data for that corresponding area of the world." This renders the approach "a form of exclusion" countering "the common rhetoric that the Google Maps API has enabled a more open, participatory cartography."[97] The expansion of the body of potential contributors may ultimately matter little if they encounter such restrictions and closed structures, a facet of this work that can even creep into OSM's approach.

While Warren notes that OSM contributors are "overwhelmingly" Western and of upper-class stature, given the need for capital and free time to have internet access and afford the time and money for GPS-enabled devices to contribute, he recognizes that projects like OSM differ from Google Maps. Even with a similar tile-based structure, needed information for use of the data is much more available All data is available with coordinate, authorial, and temporal information.[98]

One might read into the struggle advocates like Warren identify as constituting them as part of Pierre Bourdieu's dominated fraction of the dominant class. While the dominant fraction are the holders of money, the dominated fraction – including academic and artists – are the holders of cultural capital. They align themselves with the dominated class, which lacks both forms of capital. While the dominated fraction speaks of the alienation of the dominant class as an ideological

struggle, one must follow how capital is constituted materially in different contexts, and how different actors compete with one another to create structures of dominance in the first place.[99]

Warren's stance accentuates a need for data by publics and for publics, rather than to find further unethical use of public data. Warren emphasizes that "[i]n a time when many in the crisis community were struggling to get large organizations such as Google, the United Nations, etc. to release satellite imagery, the Louisiana Bucket Brigade actually licensed map data to Google — data gathered using Grassroots Mapping tools and techniques."[100] Warren relays this to show mapping can prove tactical in resistance efforts, and that "[t]he assembly of a public domain archive of data on the disaster . . . is a valuable goal in itself."[101] The invocation of assembly here echoes Latour. In tracing assemblies across his work, Latour does not speak in terms of truth, but propositions – specifically, which are well-articulated and which are poorly articulated.[102] Those in the assembly must assemble objects and construct spaces in which dialogue can be fostered to judge what their politics are and what conclusions to reach.[103] Warren similarly stresses expanding the field of participants – both human (communities) and nonhuman (data and everyday objects) – to disrupt top-down assertions through better articulated claims.

Warren drew inspiration from subversive mapping projects like those of the Institute for Applied Autonomy in devising grassroots mapping. Warren's discussion of the Institute establishes relations of equivalence and difference separating matters of rhetoric from matters of action:

> It is precisely the rhetorical qualities of mapping which the Institute for Applied Autonomy explores in 'Tactical cartographies' — but as that name suggests, the Institute goes beyond rhetoric to incite action. Defining tactical cartography as 'the creation, distribution, and use of spatial data to intervene in systems of control affecting spatial meaning and practice', they are not only fighting a war of words (or pictures) in highlighting issues of concern. Their maps act as tools in the direct intervention in problematic situations, transitioning from the (still important) discursive products of maps-as-information to their use as informational weapons in a direct engagement in 'politics and power'. In this vein, the Institute authored a pocket map in 2002 depicting all surveillance cameras in Manhattan, so that users might not only learn about the increasing prevalence of a surveillance society, but actively avoid zones under surveillance in their daily life. This movement beyond a symbolic role for mapping —

> to legal, activist, and primarily action-based outcomes, is what I have attempted to achieve in the Grassroots Mapping project.[104]

These relations associate mapping as a matter of rhetoric with the discursive and the symbolic while associating mapping under a frame of action as a tool and an informational weapon capable of facilitating direct engagement and realizing legal or activist outcomes. Warren clearly strives for a tactical cartography in Kluitenberg's vision in establishing these ties, which he sets up in his use of a contrastive and elaborative phrase following the dash in the first sentence.

Warren, like Kurgan and Parks, further discusses the dangers in seeing the map as simply rhetorical through the Bush administration's use of satellite imagery to justify war. He states that "[w]hat is most alarming about this kind of rhetorical use of map imagery is that it represents a means for those in a position of power to assert or manipulate truths about places they have never been, without the involvement of human testimony from those who have."[105] A grassroots perspective, in contrast, clearly invests in the need for local testimony.

Warren also tackles the misconception that platforms like Google have championed a "complete mapping." Warren employs the contrastive and outside sources to qualify notions of a "complete" map through phrases like "[y]et the premise of mapping the entire planet should remain an obvious fantasy." He incorporates an email on the OSM mailing list indicating UK motorways on the interface being 100% complete and Borges' previously discussed "On Exactitude in Science" to justify his high commitment to the belief that a complete map is impossible.[106]

Warren provides rational legitimation with the following considerations: that regions deemed less developed are less mapped; that maps are more than archives of aerial photographs as these platforms present; that more feasible map production for more groups means more diverse models of space being mapped, eschewing any possibility of a "full gaze" in spatial representation; and that a total map, if possible, would come with obvious privacy implications, rendering it undesirable.[107] He

sums that "[b]eyond the technical impossibility of total mapping lies the trend towards increasingly individualistic, subjective, and divergent models of the world, which inevitably occur as maps become more ubiquitous and more detailed."[108] Hence, technological developments that were supposed to ensure a complete mapping of the world on the same terms have actually led to different ways of seeing and understanding space, as communication scholars from Carey on have long recognized.

OSM's 'on the ground' policy and edit wars substantiate this by revealing tensions that occur amid spatial visions. Warren describes the policy below:

> The 'on the ground' policy, as it is known, places any editorial decision in the hands of 'the people on the ground at that location'. The policy, whose definition was led by Mikel Maron, was originally proposed in response to an 'edit war' in 2007 between Turkish-speaking mappers from northern Cyprus and Greek-speaking mappers from southern Cyprus.[109]

Be it through proprietary restrictions, sociolinguistic nuances, or state policies, the ideal of the complete map thus runs into different local tensions that both render that ideal impossible and fuel its pursuit by promoting dialogue – the dynamics of a friction worthy of fuller recognition to better orient mapping pursuits. Tensions that arise through OSM's policy serve as case in point on how a map is bound in contention, never complete.

While Warren incorporates relevant theory on media and democracy from Evgeny Morozov, Clay Shirky, and Patrick Meier, he faults its focus on the universal. He does not guarantee that mapping tactics will favor community needs over the interests of power, but claims techniques can be developed toward facilitating an inversion of its data gathering capacities away from the state in specific contexts where the elements to catalyze it are in play.[110] This underscores the point of not investing a "truth" to universals, but seeing how concepts transform in different locations.

Warren highlights HOT's work for being more similar to grassroots mapping than other OSM projects.[111] Aside from the early Gaza mapping efforts, Warren also mentions HOT projects in

a Kenyan slum and the Haitian earthquake of 2010. For his discussion of the former, Warren includes a Maron quote on how most HOT Haitian sessions, spanning over 400 different sessions of mapping Haiti in support of hurricane relief, depended on Yahoo data and "old CIA maps."[112] State and corporate data aggregation via mapping thus still enters in OSM's process.

Warren is critical of this use. To him, it circumvents the necessary tension of communities learning to map as a means of advocacy and continues investment in what he deems a "bottleneck," the hindrance to both the speed and the flow of needed community information in disaster situations from proprietary licensing:

> This reliance on satellite imagery for crisis mapping demonstrates its ability to rapidly produce maps, but neglects the importance of building local mapmaking capacity and infrastructure. The initial Haiti maps were made entirely without the participation of local residents, due to the urgency of the situation, not to mention internet access issues and the overwhelming willingness of foreign volunteers to help produce maps. . . . . [I]n the weeks and months following the initial disaster, access to satellite data would prove to be a bottleneck not only for local control of mapmaking efforts, but for everyone involved in the crisis mapping response.[113]

Warren constructs relations of equivalence and difference here contrasting the space-time of rapid production associated with OSM (which comes across as more of a hackathon model) to the slower pace of cultivation grassroots mapping seeks (one tied to the "local" and "participation").[114] Public Labber essays often highlight the BP Oil Spill to exemplify this cultivation.

OSM, meanwhile, still relies a great deal on state aggregation. Warren explains that "existing municipal and public domain databases make up an enormous part of the available [OSM] data; the TIGER database produced by the US Census increased the size of OSM by a factor of twenty." This data gets coupled with pre-existing satellite data and mapper data. OSM holds the latter with high esteem for how it affords "clear legal ownership of the data" and how it reflects "the implicit belief among many OSM participants that better maps are made 'on the ground'."[115]

In the Evaluation chapter of the thesis, Warren presents several interrogatives for evaluating

grassroots mapping's efficacy. Warren heralds the imagery, use, and affordability of grassroots mapping (though he does not include the criteria for the former claim). However, he deems it too soon at the time of writing to reach conclusions about its efficacy, in spite of the practitioners' passions.[116] Though Public Lab rightfully now promotes various success stories, judging from overall community output, it may still perhaps remain to be seen. Warren reiterates his hope that further developments in grassroots mapping techniques "will inspire individuals and communities," repeating the focus on inspiration from the Public Lab community description.[117] Wylie et al's article equally highlights these issues of efficacy and social infrastructure.

Sara Ann Wylie, Kirk Jalbert, Shannon Dosemagen, and Matt Ratto, "Institutions for Civic Technoscience," *The Information Society* 30 (2014)

The article begins by recognizing IP considerations as an obstacle toward pursuits of grassroots mapping and highlighting grassroots tactics as a novel approach. The article's abstract and opening sentences identify a public-academic divide restricting public tactical interventions. While the authors incorporate the work of tactical biopolitics, Michel de Certeau, and the Critical Art Ensemble, by employing the conjunctive, the authors distinguish their efforts from these prior projects. They claim that "these interventions have purposefully been short-lived, designed as one-time experiments." Through their article, they think through how to create institutions inciting unconventional (yet just as rigorous) scientific research. They thus seek "a presence external to the traditional academy."[118] Community conversations that Chapter 7 recounts mirror these concerns for workarounds for the typical IP obstacles that come with academy-initiated community work.

Two causal clauses conveying purpose mirror this focus. The first establishes that "traditional practices for conducting science in [academic] spaces must be altered significantly in

order to be of greater service to science conducted in the public domain." The second brings back the reference to de Certeau: "In order to operate within this climate, researchers sympathetic to civic technoscience must enact different tactics like those de Certeau ascribed to the weak."[119]

de Certeau cites the transitory nature of effective tactics (as opposed to the more cemented, ordered, and statistical strategies of the empowered). Tactics are bound by time, being necessarily temporary, whereas strategies suture time from space in an attempt to transcend it.[120] The authors then distinguish Public Lab's work thusly: "Rather than being short-lived, these communities that blend citizen science with critical making are attempting to establish a formal and lasting presence within domains of scientific research and interface with formal experts."[121] Though the correlative conjunction "rather than" cements the contrast, the addition of "attempting to" affirms how ambitious these aims are.

Further, the article embraces historical critiques of cartography that D. Graham Burnett, J.B Harley, Trevor Paglen, Latour, Helmreich, and Jason Farman pose. The authors include these sources to exemplify that though such issues have received scholarly attention, they have not adequately informed practice as they have within grassroots mapping, referencing Warren's thesis in contending so.[122] The authors also echo Warren and Dosemagen in thinking through how citizen science efforts fashion citizens largely as data points and not active agents:

> Citizen science, with the exception of initiatives like the Bucket Brigades, often turns citizens into data harvesters who assist scientists in acquiring data, such as with the century-long Audubon Christmas bird count. They rarely engage participants in shaping the research agenda. Fortun and Fortun (2005), troubled by the distinction between "citizen" and "scientists" suggested by citizen science, invoke the term "civic science" and call for an investigative relationship that "questions the state of things, rather than a science that simply serves the state" (50).[123]

In such initiatives, participants have little say in the implemented research design, largely instrumentalized as a means to an end rather than being recognized as active agents in ways Public Lab communities are in this sample of texts.

Accordingly, Wylie et al's call for a transformation of material, literary, and social technologies behind scientific knowledge production borrows from Shapin and Schaffer's identified conditions of contemporary experimental science.[124] The authors claim Public Lab achieves this. In discussing how state and corporate ownership of data from the material technology involved – that of GPS – can often close off the communities being mapped from having a voice in aerial imaging, they extend previously analyzed points.[125] Rather than thriving off disconnection like satellites, grassroots mapping connects mappers, mapping tools and environments. Rather than making its practices invisible, grassroots mapping claims to be transparent to bystanders. This contrasts STS findings (such as those of Robert E. Kholer) on laboratory science, which pits spaces of research in a vacuum, separate from human intervention. The authors' reference of Kholer, which they situate as posing if "whether, through critical making, this dynamic can be reversed," legitimates the inversion of power Warren invokes.[126]

Conclusion

Each text in this sample (be it, in terms of genre, a forum article, academic article, or thesis) encompasses a complex chain of social events. The grammatical mood is mostly declarative and interrogative, with semantic relations of contrast constructing difference between grassroots mapping and the perspectives it defines itself against – platforms using proprietary spatial data, government spatial perspectives, and citizen science models – on moral grounds.[127] This complements the ethical stances grassroots mapping initiatives take in favor of the working class, an

association (as the introduction establishes) the grassroots has long had. These patterns help construct opposing pairings of space-times: between rapid map production from satellite imagery associated with the global and grassroots cultivation associated with the local.

The arrangement of these events varies by text; it can at times be chronological and at others ordered however best serves the argument at hand or the contrasts being forged. The texts layer in different acts of mapping, legal implications, and bodies of scholarly work, thus presenting and attributing diverse sets of voices. They can thus demonstrate a dialogism that mirrors the design of grassroots mapping techniques and practices and reflects how, as the preface covers, maps serve as artifacts and modes of dialogue. These texts also feature knowledge exchanges which contain primarily statements of fact and moral evaluations, though its online presence is prone more toward activity-based exchanges, prescribed demands, and interrogatives as calls to action.

These moral evaluations and activity exchanges are often framed against what are perceived as "forces looking in" – government agencies, corporate platforms, citizen science models, IP stipulations, and surveillance systems – established in the prior chapter. Each diminish citizens' and communities' abilities to voice their concerns in both local matters affecting them and global procedures within information capitalism that exploit them – all in the name of "completeness." Grassroots mapping demonstrates how local tensions disrupt the former, and implicates subjects into the latter. It thus reveals frictions that occur with platforms and projects striving for "complete" maps.

In terms of modality, these texts exhibit high commitment to the detriments of information capitalism and dominant spatial platforms' often unquestioned authority. They present consumers and governments alike as complicit within it. Another prime contention is the need to lessen opportunities for surveillance in the design of sociotechnical systems, allowing citizens to opt-out or opt-in to dominant representations. In exploring these debates, a moderate commitment emerges to

how grassroots mapping safeguards against such concerns in its ethical and dialogic nature as an antithesis to the modes of capture and production platforms like Google Maps manifest.

Though the events portrayed enlist various actors, mappers are activated in these texts, with other actors often passivated or excluded. The texts often do not include the voices of those community members on the ground that are actually impacted, which furthers the passivation of publics (at least discursively) that Public Lab identifies as a problem. They embellish grassroots mapping's vision of the mapper as an active critic of the proprietary nature of data in transnational information capitalism. The texts thus portray grassroots mapping as much about the production of a more critical consumer within information capitalism as it is about a mapper.

The so-called democratization of mapping is just as much an issue of "new capitalism" (the point of focus in CDA) as it is about the historically closed nature of map production. With more and more aspects of social life becoming commodified with the shift to a knowledge economy, much of the recent advances in mapping are allied with state and corporate interests.[128] Though these are often situated within a global space-time, Public Lab's particular slant on grassroots mapping puts frictions in information capitalism and mapping front and center, which distinguishes it from other projects examined previously. Those projects were not situating the tools employed overtly as modes of dialogue with discourses surrounding the use of the technology.

Warren and Dosemegan set up a strong contrast between grassroots mapping and corporate or government entities. In constructing this "us versus them" distinction through inclusive pronouns when discussing the Public Lab community and passivations when discussing other actors, they give less overt consideration to other structures of difference that may be in play, such as those of race, class, and gender, in who gets represented or gets access to spatial data toward advocacy. These are critical facets to the participatory frames of government imaginaries and the mapping communities this dissertation highlights that often do not receive their proper due.

This chapter establishes the concerns and discursive framings of grassroots mapping from a philosophical sense. The chapter, like components of the previous one, borrows from precepts of critical ethnography by building a sample of relevant documents in a bottom-up manner spanning from journalistic features to community-authored posts.[129] This comes before dedicated chapters on the online communities of concern – HOT, OSM, and Public Lab – to establish concerns and imaginaries for public orientations of GPS in state, corporate, and community perspectives. The remaining body chapters extend this work in exploring the everyday work in which these perspectives prove collaborative, rather than opposed. I begin this sequence of chapters with my experiences contributing to HOT projects in both official and unofficial capacities, revealing the interfaces, practices, and partnerships involved in both local-community-led and state and NGO-driven mapping projects that HOT facilitates.

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[1] "Punk Science: Do-it-yourself Science is Taking Off," *The Economist,* Dec 19, 2017, https://www.economist.com/news/christmas-specials/21732703-growing-movement-seeks-make-tools-science-available-everyone-including.
[2] See Andy Bodle, "A Chemical Attraction; It's Not All About Test Tubes and Tripods. Andy Bodle Meets the Geeks who are Putting the Social into Science," The Times (London), August 13, 2012.
[3] Dick Hebdige, "Subculture: The Meaning of Style," London (Routledge), 1979.
[4] Christiaan Adams, "Balloon and kite imagery in Google Earth," *Google Maps blog*, April 17, 2012, https://maps.googleblog.com/2012/04/balloon-and-kite-imagery-in-google.html.
[5] For more on affective evaluation, see Fairclough, *Analysing Discourse,* 173.
[6] Adams, "Balloon and kite imagery in Google Earth.
[7] One can find more on personalization in Fairclough, *Analysing Discourse,* 146.
[8] "Balloon Mapping Kit," *Public Lab Store,* https://publiclab.myshopify.com/products/balloon-mapping-kit?variant=7028822724.
[9] Fairclough explicates prescribed demands as strong commitments to what is necessary. See *Analysing Discourse*, 168.
[10] See ibid, 89 for a description of elaboration.
[11] Adams, "Balloon and kite imagery in Google Earth."
[12] Fairclough, *Analysing Discourse,* 123.
[13] See Bethwyn Evans, "Synchronic and Diachronic Explanation," March 13, 2008, http://www.humanities.manchester.ac.uk/medialibrary/llc/files/PhD%20training/theory_seminar_13Mar2008_BE.pdf.
[14] Since the scope of these articles extends beyond internal communications within the community itself, author's identities and names of figures mentioned in the articles are included. Pseudonyms

replace names and usernames in following chapters, which document internal, not overtly public exchanges.
[15] See "Public Lab Store," accessed April 18, 2018, https://publiclab.org/wiki/how-we-are-funded and "How Public Lab is Funded," accessed April 18, 2018, https://publiclab.org/wiki/how-we-are-funded.
[16] "How Public Lab is Funded."
[17] Fairclough, 218-219.
[18] Shannon Dosemagen, "Public Lab Five Year Retrospective."
[19] Ibid.
[20] Dosemagen, "Public Lab Five Year Retrospective." For more on the distinctions between actors being activated and passivated in texts, see Fairclough, *Analysing Discourse,* 145.
[21] Dosemagen, "Public Lab Five Year Retrospective."
[22] Fairclough, *Analysing Discourse*, 47-49.
[23] Ibid.
[24] Fairclough explicates that contrastive phrases are marked by the use of the conjunction "but" in ibid*,* 89.
[25] Ibid*,* 98.
[26] Dosemagen, "Public Lab Five Year Retrospective."
[27] See Gulf Restoration Network, "About Us," accessed April 19, 2018, http://healthygulf.org/who-we-are/about-us, and "History," accessed April 19, 2018, http://healthygulf.org/who-we-are/about-us/history.
[28] Dosemagen, "Public Lab Five Year Retrospective."
[29] See "Mikel Maron," accessed July 25, 2017, https://www.mapbox.com/about/team/mikel-maron/.
[30] Dosemagen, "Public Lab Five Year Retrospective."
[31] Ibid.
[32] Ibid.
[33] Fred Turner, "Where the Counterculture Met the New Economy: The WELL and the Origins of Virtual Community," *Technology and Culture* 46 (2005), 489.
[34] Ibid, 499.
[35] Ibid, 488.
[36] Ibid, 495.
[37] Dosemagen, "Public Lab Five Year Retrospective."
[38] See the conclusion of Adams, "Balloon and kite imagery in Google Earth."
[39] Jeff Warren and Shannon Dosemegan, "Reimagining the Data Lifecycle," *Grassroots Mapping Forum* 1, accessed June 3, 2017, https://publiclab.org/notes/warren/07-01-2014/reimagining-the-data-lifecycle.
[40] The wh-interrogative is a question starting with one of the five Ws. See Fairclough, *Analysing Discourse*, 116.
[41] See Fairclough's distinctions between different types of modality in ibid, 167.
[42] Warren and Dosemegan, "Reimagining the Data Lifecycle."
[43] Ibid.
[44] Ibid.
[45] Ibid.
[46] Ibid.
[47] Recalling Harvey's findings on neoliberalism in *A Brief History of Neoliberalism*, Melissa Gregg finds that, within her conception of presence bleed, such behaviors and uses of digital media platforms

"accords with ideas of neoliberal governance in which workers take responsibility for their actions and enjoy this as a form of freedom." This presence bleed equally ties into Foucault's theorizations of the care of the self. With emerging technologies, "people learn about their environment and the other people with whom they share their lives" as a means of creating a more sustainable environment and a more sustainable self. For more, see David Harvey, *A Brief History of Neoliberalism* (Oxford: Oxford University Press, 2007), 64, 67; Melissa Gregg, *Work's Intimacy* (Polity, 2011), and Deborah Lupton, *Digital Sociology*, 28.

[48] Jerald L. Schnoor, "Citizen Science," *Environmental Science & Technology* 41.17 (2007), 5923.

[49] Trisha Gura, "Citizen Science: Amateur Experts," *Nature* 496 (2013), 259-261.

[50] Greg Newman, Don Zimmerman, Alycia Crall, Melinda Laituri, Jim Graham, and Linda Stapel, "User-friendly Web Mapping: Lessons from a Citizen Science Website," *International Journal of Geographical Information Science* 24.12 (2010), 1851.

[51] Lupton, *Digital Sociology,* 24, 163.

[52] Warren and Dosemagen, "Reimagining the Data Lifecycle."

[53] Ibid.

[54] Scott, *Seeing Like a State*, 2-3.

[55] See "Unmanned Aircraft Systems (UAS) Frequently Asked Questions," *Federal Aviation Administration*, accessed April 19, 2018, https://www.faa.gov/uas/faqs/; "Unmanned Aircraft Systems FAQs," U.S. Forest Service, accessed April 19, 2018, https://www.fs.fed.us/science-technology/fire/unmanned-aircraft-systems/faqs; and "Unmanned Aircraft Systems (UAS)," *International Civil Aviation Organization*, accessed April 19, 2018, https://www.icao.int/Meetings/UAS/Documents/Circular%20328_en.pdf.

[56] Jay Stanley, "'Drones' v. 'UAVs' – What's Behind a Name?" *ACLU*, accessed April 19, 2018, https://www.aclu.org/blog/national-security/drones-vs-uavs-whats-behind-name.

[57] Matthew Lippincott, "Unpiloted Aerial Systems Ethics," *Grassroots Mapping Forum* 2, https://publiclab.org/wiki/unpiloted-aerial-systems-ethics.

[58] Ibid.

[59] Kellner, "Habermas, the Public Sphere, and Democracy."

[60] Lippincott, "Unpiloted Aerial Systems Ethics."

[61] Additive phrases are semantic clauses marked by the word "and." See Fairclough, *Analysing Discourse*, 89.

[62] Lippincott, "Unpiloted Aerial Systems Ethics."

[63] Fairclough deems causal phrases as marked by the word "because." See Fairclough, *Analysing Discourse,* 89.

[64] Lippincott, "Unpiloted Aerial Systems Ethics."

[65] See Latour, "Where Are the Missing Masses?"

[66] Lippincott, "Unpiloted Aerial Systems Ethics."

[67] The use of verbs like "should" in representing different exchanges (an activity exchange on citizen's actions, in this case) does not carry the same commitment as, say, the word "must" would in its place. Fairclough thus refers to the use of such verbs as demonstrating a middling commitment to what is being argued or described. See Fairclough, *Analysing Discourse*, 168 and 170.

[68] Lippincott, "Unpiloted Aerial Systems Ethics."

[69] Yes/no interrogatives are ones that imply either "yes" or "no" in response. See Fairclough, *Analysing Discourse,* 115.

[70] Lippincott, "Unpiloted Aerial Systems Ethics."

[71] Ibid.

[72] For further discussion of these relations, see Fairclough, *Analysing Discourse,* 88-89.

[73] For an example of a street art project that critiques Google capture in such ways, see Cirio, "Street Ghosts."
[74] Lippincott, "Unpiloted Aerial Systems Ethics."
[75] Though Fairclough largely treats "if" as a marker of a conditional statement, I find it more appropriate to reference such instances in this sample of texts as hypotheticals instead. See Fairclough, *Analyzing Discourse,* 89.
[76] Lippincott, "Unpiloted Aerial Systems Ethics."
[77] Ibid.
[78] See Fairclough, *Analysing Discourse,* 98 for more on this mode of legitimation.
[79] María del Carmen Lamadrid, "Tool for Stalling: Mapping," *Grassroots Mapping Forum* 5, https://publiclab.org/notes/mlamadrid/05-15-2013/tool-for-stalling-mapping.
[80] Ibid.
[81] Kellner, "Habermas, the Public Sphere, and Democracy."
[82] del Carmen Lamadrid, "Tool for Stalling: Mapping."
[83] For related and rightful critiques of the geospatial being "based on Western perspectives of land use" and the history of systematic spatial representation and its associated technologies in fueling colonial exploits and capitalism's exploitation of land for further value creation, see Melinda Laituri, "Indigenous Peoples' Issues and Indigenous Uses of GIS," in *The SAGE Handbook of GIS and Society*, ed. Timothy N. Nyerges, Helen Couclelis, and Robert Brainerd McMaster (Los Angeles: SAGE, 2011), 202, 209; Unger, *Ships on Maps,* 17; and Jodi Byrd, *Transit of Empire*, University of Minnesota Press, 2011, xx-xxi.
[84] See Fairclough, *Analysing Discourse,* 89.
[85] del Carmen Lamadrid, "Tool for Stalling: Mapping."
[86] Ibid.
[87] See Fairclough's example of negative statements in *Analysing Discourse*, 89.
[88] del Carmen Lamadrid, "Tool for Stalling: Mapping."
[89] Fairclough, *Analysing Discourse*, 149.
[90] del Carmen Lamadrid, "Tool for Stalling: Mapping."
[91] Ibid, 11.
[92] Ibid, 19.
[93] For a discussion of how actors are impersonalized, see Fairclough, *Analysing Discourse,* 146.
[94] Warren, "Grassroots Mapping: Tools for Participatory and Activist Cartography," 18.
[95] Ibid, 80.
[96] Ibid, 80-82.
[97] Ibid, 35.
[98] Ibid, 36.
[99] "Pierre Bourdieu," in *The Johns Hopkins Guide to Literary Theory and Criticism*, ed. Michael Groden, Martin Kreiswirth, and Imre Szeman.
[100] Ibid, 24.
[101] Ibid, 80.
[102] See Latour, *Politics of Nature* and *Reassembling the Social.*
[103] See Bruno Latour, "From Realpolitik to Dingpolitik."
[104] Ibid, 27.
[105] Ibid, 26.
[106] Ibid, 21.
[107] Ibid 20-22. See also Fairclough's discussion of legitimation in *Analyzing Discourse*, 98.
[108] Ibid, 21.

[109] Ibid, 22.
[110] Warren, "Grassroots Mapping: Tools for Participatory and Activist Cartography," 24.
[111] Ibid, 38.
[112] Ibid, 38.
[113] Ibid, 39.
[114] Lilly Irani. "Hackathons and the Making of Entrepreneurial Citizenship," *Science, Technology, & Human Values* (2015), 1.
[115] Ibid, 36.
[116] Ibid, 83.
[117] Ibid, 95-96.
[118] Wylie et al, "Institutions for Civic Technoscience," 116, 117.
[119] Ibid, 121.
[120] de Certeau, *The Practice of Everyday Life*.
[121] Wylie et al, "Institutions of Civic Technoscience," 117.
[122] Wylie et al, "Institutions of Civic Technoscience," 118.
[123] Ibid, 118.
[124] Ibid, 117.
[125] Ibid, 118.
[126] Ibid, 119.
[127] See ibid, 104 for a succinct description of these semantic relations.
[128] See Fairclough's discussion of new capitalism in *Analyzing Discourse*, 98.
[129] Madison, *Critical Ethnography: Method, Ethics, and Performance* (Thousand Oaks: SAGE Publications, 2005).

CHAPTER 5

HUMANITARIAN OPENSTREETMAP (HOT)

Introduction

As I read my final check-in email from HOT while interning toward its Eliminate Malaria Mapping campaign, I noted the impact with which HOT credits its community mappers in one of the final sentences: "you are part of an effort to map 4.5+ million buildings across 600,000 square kilometers in 9 countries (Guatemala, Honduras, Botswana, Zambia, Zimbabwe, Cambodia, Laos, Mali and Rwanda) in hopes to end the disease malaria." Just a few days prior, HOT contacted interns for testimonials on the positive experience of mapping to post to the organization's Twitter profile for their #whywemapwednesday hashtag. One testimonial I saw follows:

> Mapping for HOT during my internship, I learned so much, more than I could ever expect. I will always map, [sic] I felt a glow of optimism when I saw the final task for our project go up. In a world where so many things cause sorrow, this brings relief and sympathy to forgotten parts of the world. I will always support our mission to map the world, for a better tomorrow.

This framing of contributing via mapping as a means of optimism and helping to combat complex obstacles the non-Western world faces falls within the disaffection that, as this dissertation outlines, permeates across the projects of focus.

The same day I received that email, however, I also saw a Users Diary entry entitled "Does anyone even check what HOT contributors leave behind?" Users weighed in over the course of several days in the entry's comments section on whether or not it was fair implying these problems were exclusive to HOT and not simply on par with the mistakes of new mappers on OSM overall.

One comment recognized that while beginner users are prone to mistakes on both OSM and HOT, HOT uses "armchair mapping" methods without sufficient on the ground surveying or local knowledge to aid beginners. This exacerbates the mistake-prone nature of novice contribution. The commenter equates the mapping that results to "vandalism" and "complete incompetence." The contrast of armchair approaches from the standards endorsed in the writing the prior chapter examined is obvious; though HOT works hard to build local capacity for mapping, it is often outsiders contributing to its campaigns. As this episode conveys, this can pose major problems in data quality, and falls squarely within the ethical critiques projects like Public Lab pose against "forces looking in."

The perceptions of OSM contributors to HOT contributions can thus be quite mixed. The following changeset comment critiquing a HOT user's mapping during Japanese flooding (a project I contributed to as a new mapper myself) further exemplifies the critique: "Remove animal tracks and incorrectly tagged buildings. what [sic] was marked as a compound was in fact a cattle enclosure a [sic] lot of the tracks are cattle tracks. PEOPLE ARE MAPPING HERE THAT HAVE NO IDEA OF WHAT THEY ARE LOOKING AT." The issue is not simply that the data new mappers add remotely during these crises is of poor quality, but also that quality data previously gathered on the ground gets deleted by new crisis mappers limited in experience with remote aerial imagery work. As a safeguard, HOT was insistent with interns that they never delete previously mapped data, and instead edit it for accuracy.

HOT is very aware of such critiques. One of my supervisors while interning with HOT (who I will refer to in this chapter as Addison) says HOT's justification is that with the rise of online media and the needs of the requesting organizations, a large number of OSM contributors would still map in response to disaster on a large scale with or without their oversight, and that the

alternative would likely prove much worse. OSM US must also facilitate a request first to initiate a disaster mapping project, providing organization in real time that would be lacking otherwise.

In cases where there is already quality OSM data for an impacted area or an active local mapping community, the process can safeguard against needless campaigns that could prove harmful. Addison recounted in HOT's San Juan efforts, for instance, that large imports of data were already occurring on OSM for the area, leading him to ask mappers on the ground if they wanted him to, in his words, "unleash the hoard" by having them work in the area remotely. He was told no. These oversights help prevent deletion or editing of quality data in rapid disaster responses.

HOT's managerial capacity is extensive and vital to policy formation around such spatial data in moments of crisis. Addison must explain copyright issues constantly to requesting organizations and FEMA, and insist to requesting organizations that they defer to local knowledge as much as possible rather than remote work. The communities know what features and appropriate designations merit priority in mapping. Requesting agencies equally want a structure to this work, rather than rogue mappers working independently.

To better understand this guidance as well as the practices, technologies, and interactions of HOT contributors, I contributed to projects that include, but are not limited to, malaria mapping tasks in Cambodia, Senegal, Rwanda, Angola, and Laos and disaster mapping projects addressing flooding in Japan, wildfires in South Africa, and areas affected by Hurricanes Harvey, Irma, and Maria. While interning, I added the most to the Laos project and a Uganda refugee mapping project. The internship involved required weekly meetings and seminars, which served as check-ins on questions and issues interns encountered and opportunities for interns to learn new skills such as validation, road mapping, and exporting OSM data.

This chapter draws from the knowledge I gained in these experiences. I situate this work as a product of globalization, a program of politics and economics that "alters basic modes of cultural

organization and international exchange in many parts of the world" toward the pursuit of a "global," largely unregulated market economy that can supposedly – with the critiques from critically minded geographers like Doreen Massey and Harvey in mind – affect disparate areas similarly. As the preface establishes, analytic frameworks often "do not sufficiently address material exclusions resulting from economic forces" and how globalization shapes notions of agency, which this chapter extends in matters of crisis and disaster response.[1] As Harvey finds within globalization, the rise of just-in-time production as well as electronically mediated financial transactions and information flows generates expectations of ever more rapid information delivery.

Discourses of globalization, like those identified in prior chapters, reduce such complexities and often reflect the drive to make space abstract through rationalization as Adorno and Horkheimer identify. But spatial fixities and the particularities of a given place inherently factor in. Different elements of structure such as regulations and time differences can shape how much can be accomplished if a rapid pace becomes expected. Within this context, what is at stake in crowdsourced disaster responses is the ability of the citizenry to contribute in space-times of crisis and create meaning in ways deemed more significant and direct than state action, especially in the aftermath of inefficient disaster response to Hurricanes Katrina and Maria. In the "shock" state endemic of the contemporary Naomi Klein identifies, the moment of devastation becomes a justification of drastic action on corporate and governmental levels –in this case, large-scale tracing (in the Deleuzian sense) to augment the standing spatial order as encompassed in OSM data.[2]

Chapter 4 outlines discursive constructions embedded in grassroots mapping. This chapter especially picks up on a particular concern that surfaces within them – the need to build local mapping capacity for communities of impact. HOT's work is bent toward such a goal in theory, but in practice, the remote and rapid nature of its campaigns can at times seem antithetical to such a pursuit.

HOT tactics can additionally gamify global development work and disaster management response. They encourage efficiency, and HOT invites contributors to experience their labor as modes of leisure and self-entrepreneurship toward a political system of counting buildings and environmental actors that resist easy categorization. Despite this, it can borrow from a similar frame and goal as grassroots mapping: to give communities the ability to map on their own toward needs they themselves define. While its approach differs in various dimensions that I cover in this chapter, HOT still inherits similar problems in the possibilities for co-opting that the punk and the grassroots carry.

Aside from projects I contributed to, I also detail HOT partners, communities and community use of tools, and practices from both those communities and my own experiences to situate its work critically. I begin this exploration with how disaster mapping projects may be described as ecologies (extending the attempts of this dissertation to reclaim the power of this term as a clarifying precept in spite of its vexed history within the study of communication and media) before addressing the extent to which the term grassroots mapping applies to such work and framing it as a more efficient and cost-effective mode of governance aligning with political and economic transformations previously examined.

Ecologies of Disaster Mapping

HOT is but one node in a humanitarian network putting contemporary platform innovations to use. HOT's partners listed on its website include the American Red Cross; The Bill and Melinda Gates Foundation; the Digital Humanitarian Network; the Global Facility for Disaster Reduction and Recover (GFDRR); the Knight Foundation (which has also supported Public Lab); the Humanitarian Innovation Fund; the Peace Corps; the World Bank; and the US Department of State.

The latter is involved both through its Bureau of Population, Refugees, and Migration that assists in HOT Uganda and Turkey refugee mapping projects and through its aforementioned MapGive training program for volunteer mappers.[3] HOT has trained refugees in Uganda fleeing from Southern Sudan violence at a rate of two to three thousand a day to survey and evaluate WASH (water, sanitation, and hygiene) facilities, creating a more accurate map of area road networks in doing so. This work helps develop algorithms for the United Nations High Commissioner for Refugees toward analyzing the spatial distribution of such facilities. HOT in Uganda also organizes mapathons to provide further data to NGOs and refugees on the ground.[4] Other partners this chapter mentions include the Humanitarian Data Exchange (HDX), the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), Mapbox, DigitalGlobe, and RadiantEarth.

Much of what I learned about HOT at the onset of this research was from a series of crisis informatics webinars the HOT Twitter page encouraged joining. One webinar I participated in centered on links between humanitarian satellite imagery efforts, and included figures from DigitalGlobe (the leading satellite image provider), RadiantEarth (which "offers solutions to fully realizing the potential of earth observation for positive, even life-changing global impact") and HOT.[5] The DigitalGlobe presentation featured its partnership with HOT, referencing actions of "volunteers around the world constantly contributing" and arguing its efforts with HOT exemplifies its belief in "no monopoly on place."

Toward this, DigitalGlobe works through its Open Data program to provide before and after crisis imagery under a CC BY-SA 4.0 open license. The goal, similar to Public Lab's, is to "create a community of practice around the open imagery." While these organizations make closed imagery available in moments of crisis to serve the public good, this does not put the production of aerial imagery in the hands of users themselves as actively as grassroots approaches do. Such is the critique Warren conveys of HOT's work in his Master's thesis, as the last chapter analyzed.

Despite such programs as that of DigitalGlobe, there remains ample reason for fostering local mapping capacities in disaster contexts. While DigitalGlobe sponsors a First Look team that monitors for disaster-prone areas around the clock to prop these efforts, the political economy behind these image sets (and for crisis informatics in general) is not so simple as to allow for any crisis event to merit open imagery under this procedure. A crisis earning activation of this license not only mandates an organization's request, but also often must be a sudden event of extensive impact that affects the developing world rather than the West.

DigitalGlobe heralds HOT's crowdsourced model toward building enumeration in rapid contexts. It cites a statistic of 4 million buildings mapped in four months by the HOT community in its Eliminate Malaria Mapping campaign as a testament to its efficacy. Like HOT, DigitalGlobe partners with nonprofits, communities of mapping enthusiasts and the US government on various fronts. DigitalGlobe highlights its help in an Ebola campaign in Liberia that sought to pair human geography data layers with demographic findings, socioeconomic data, and road infrastructure with elevation data to pinpoint where helicopters could land in aiding the eradication campaign.

Though these strides speak for themselves, there are plenty of extensions in disaster mapping work that organizations involved with crowdsourced disaster mapping are exploring. While a representative from DigitalGlobe referenced machine learning efforts in using crisis data, the representative deemed such efforts "not ready for primetime yet." HOT has also worked with research centers like the Stanford Urban Resilience Initiative to improve how a crowdsourced approach can determine different levels of damage assessment for buildings from aerial imagery.[6] Though DigitalGlobe's own work with Facebook may seem confounding considering Facebook is not considered a global humanitarian data actor, Facebook has helped DigitalGlobe produce population density mapping of high resolution (at 5 meters). Initially used to organize drone and ground-based efforts for supplying internet access to the tenth of the world populations whose areas

lack connectivity, these Facebook mapping efforts that can locate hamlets and even trace buildings using AI aerial imagery analysis also aid Missing Maps in enhancing navigation for relief efforts.[7]

HOT community members have scolded Facebook edits that changed a large amount of data at once. Some of the more well-documented errors occurred in Thailand and Egypt. In both cases, Facebook representatives were transparent. They cooperated with the OSM Data Working Group to improve their methods and revert the erroneous automated changes. Community members abhor such moves for the difficulty of reverting so many wrong changes at once made in one changeset and the lack of consult with mapped communities.[8]

Though Facebook's interventions ended in controversy, as Addison puts it, "This field is moving with or without us – it's here." Such partnerships and their associated projects can distance HOT campaigns from grassroots projects. The former sponsors rapid production of base maps, harnessing the power of a global community that maps non-Western areas often ignored in conceptions of "completeness" within contemporary mapping. The model is the opposite within grassroots projects, even if HOT and the projects it assists can still champion themselves as grassroots. The grassroots as a sociotechnical project employs a global community *to speak back to the global* and how it positions subjects, rather than further it. But in both grassroots mapping and HOT mapping, there is significant emphasis on creating aerial images and maps of action by whatever available means achieve impact, rather than maps as mere rhetoric, as Warren equally desires. The next section evaluates HOT's model of disaster mapping based on the tendencies of grassroots mapping that the last chapter presented.

Disaster Mapping as Grassroots Mapping?

RadiantEarth, an imagery provider for both DigitalGlobe and HOT, fittingly voiced concern in the aforementioned webinar not so much with the quality of imagery available, but how "actionable" it is. This includes how it might be disseminated, physically kept (particularly a problem with drone-gathered imagery sets), and delivered to those in power in ways that are charismatic. This recognizes data as having a lifecycle that merits responsible treatment, rather than viewing data as static or passive. Additionally, the representative discussed licensing as an obvious problem, but cautioned against seeing satellite imagery as the end-all-be-all means for capture. In the representative's words, "data is what matters – if it comes from balloons, we're happy to see if that moves the needle." This mention of grassroots techniques demonstrates an attempt to shift powerful global interests toward impactful results, embracing techniques that circumvent the licensing bottleneck Warren identifies.

Like RadiantEarth, HOT also emphasizes the variety of means of data capture it develops, not just via satellite imagery. OpenAerialMap (OAM) has partners spanning from HOT and Development SEED (an interdisciplinary open source development team that, like Warren and RadiantEarth, emphasizes the actionable through collaborative open source design) to the Australian Government and even Amazon. It is a platform for contributing, finding, and employing open license UAV imagery.[9] HOT credits such image sources for their ability to visualize change over time. HOT highlights case studies such as Philippines community planning and Dar es Salaam flood mapping that it claims demonstrates the efficacy of UAV imagery toward development and humanitarian pursuits. In contrast, working with satellite imagery sets in remote mapping can prove difficult, especially depending on the frequency of flyovers pre-disaster and post-disaster and the degree to which cloud cover distorts what is available out of that imagery.

Above all else, Addison thinks HOT's priority in the next decade should be moving from a management role to a supporting role – one that provides its infrastructure when necessary and raises funds for communities to map on their own, without its guidance or warranting organizational requests. Instead of organizing "a hoard response" every time a base map was needed (which, in cases like Puerto Rico, meant corralling an estimated 4000 mappers in a few weeks' time), Missing Maps would have the capacity to build off pre-existing data. This would include using on-the-ground kite and UAV imaging uploaded to OpenAerialMap to generate crowd support from there.

HOT underlines remote mapping as a basis of dialogue with on the ground mappers to then add more detailed and locally salient attribute data that would be difficult to determine otherwise. The knowledge of community leaders informs boundaries that enter into the map. They are taught through HOT's interventions how to map for themselves, in ways that can inform the specific attribute designations employed in the act of mapping based on the crisis itself. In Jakarta, for instance, flooding made the mapping of pumping stations and more detailed designations of their characteristics than one might usually include key. Similar educational initiatives include mapping efforts in Turkey and Uganda.

One HOT representative on a webinar I participated in demonstrated "the power of crowdsourced data" through a timelapse of community mapping in Guinea resulting in about 20,000 buildings mapped in just over a day. HOT supplied this data to Doctors Without Borders toward first response navigation. The cultural work here is thus one of creating a more just world through more equitable structures of data collection, use, and continued circulation. The representative particularly mentioned an emphasis on the involvement of women as well as accessibility mapping, extending archival imaginings from Chapter 3.

HOT seeks to support affected communities as they learn to map and to generate community among remote mappers. As a callback to Steve Coast's original vision for the OSM

community circulating around "mapping party" events, HOT often self-organizes through volunteers mingling around pizza and beer in mapathon events buttressing the work of the Missing Maps projects. Supported by global humanitarian efforts and perhaps most notably by the Red Cross, Missing Maps is dedicated to "putting the world's vulnerable people on the map," and sponsors a great deal of mapathons across the world.[10] While contributing to HOT projects, I came across mapathons from the US and the UK to Uganda and Tanzania.

HOT's webinar presentation defines its community in terms of a "common space, common attitudes, [and] common ownership." It is a unifying principle, rather than one that works off difference as the starting point. But HOT added in its contributions to the "ecosystem" of technologies in OSM development, and the RadiantEarth representative equally invoked the notion of an "ecosystem" at play in their role within these crisis informatics partnerships. The representative highlighted the HOT Task Manager, Open Map Kit, Field Papers, OSM Analytics, and OSM export tool as key technologies for the community's work within the OSM ecology.

HDX, another HOT partner in this ecology, assists 288 registered organizations sharing almost 5000 datasets that over 5000 registered users are free to search through, employ, and analyze. The goal is to simplify data sharing while ensuring privacy – no personally identifiable information is included to ensure protection for populations affected and workers aiding them. In this description, the representative personalized the Red Cross as "friends" and highlighted the seamless integration between OSM data and its platform.

The Missing Maps project, an outgrowth of the Red Cross, brings organizations like the Red Cross, Doctors Without Borders, and HOT together. Red Cross organizations have regularly held mapathons in support of HOT efforts to health crises, swift disasters, and long-term planning projects. Posts for Missing Maps mapathons often included a line about a laptop, a mouse, and enthusiasm being the only prerequisites for participation. Missing Maps also supports field mapping

by local residents, especially youth, to contribute to its range of projects, including "measles vaccination monitoring in Malawi, the construction of a water pipeline in Zimbabwe, the identification of vulnerable border communities as part of Ebola recovery in West Africa, and the installation of fire sensors in an informal settlement South Africa… to name a few." The Red Cross also sees its efforts toward map-making as critical to fostering data literacy skills across the organization.[11]

The draw of mapping in this work is clear. In a grassroots fold, amid climate change and the failings of increasingly specialized technological systems, digital mapping and the modes of self-organization it can facilitate constitutes a means of effecting change and building social infrastructures to both rebuild and to imagine more equitable environmental and social practices. The following quotation highlighted on a blog post on the International Federation of Red Cross and Red Crescent Societies website helps encapsulate the spirit behind the investment in maps:

> ***"Building Maps is building trust,"*** via Jemilah Mahmood, Under Secretary General for Partnerships at the IFRC. Engaging local communities and volunteers with Missing Maps provides an opportunity to link our work to more volunteers, including youth and as well as technical audiences.[12]

The map as an artifact that builds trust echoes more grassroots philosophies on mapping, even as such projects enroll large government and corporate partners. These ambitions thus harbor a relationship with the state and must be seen as augmenting statecraft.

HOT finds itself in the middle of a similar critique on ownership of data as grassroots projects. One of the biggest steps forward within this ecology has emerged via HDX. Since mid-2014, HDX has enabled users to search through and use humanitarian data sets. For HDX, run by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) and launched in 1998, humanitarian data encompasses data about residents in crisis, be it in terms of aiding damage

assessment or organizational responses to said crises. This fits OCHA's overall mission to facilitate collaboration between humanitarian agencies toward efficient emergency response.[13]

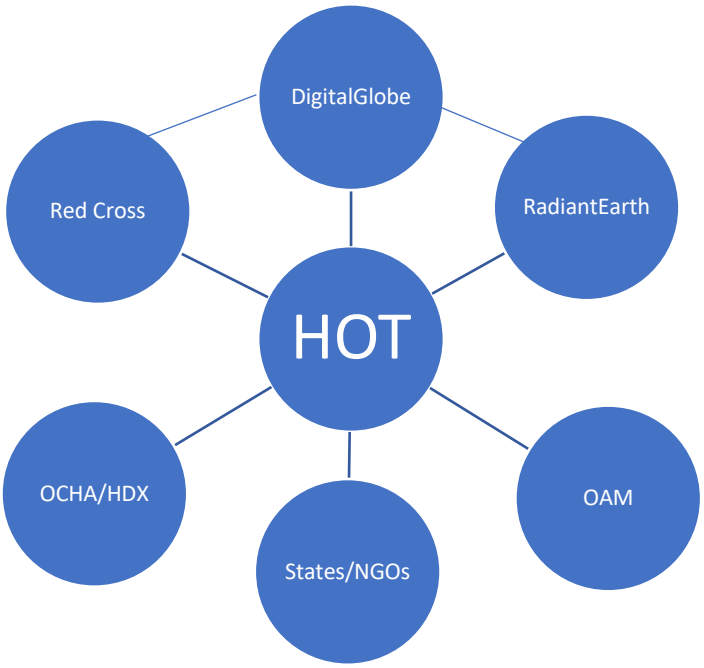

Figure 5.1: A rendering of the HOT disaster mapping network as covered in this chapter. In the top half of this rendering, DigitalGlobe provides imagery to HOT and linked organizations like the Red Cross and RadiantEarth as state and NGO requests are generated to create mapping campaigns. The work of these, as demonstrated in the bottom half of the diagram, both augments standing open data sets in the event of future disasters (notably, OCHA's HDX platform) and is aided by bottom-up hobbyist efforts in mapping (as is the case within OAM contributions providing disaster imagery).

OCHA's Chief of Data Services, Sarah Telford, describes that prior to HDX, humanitarian projects lacked a streamlined platform for data that would allow for more analytic rather than narrative perspectives via maps and graphs. Data projects at OCHA were one-off projects for crises. Data maintenance was neglected and unable to find or use later. The ambition was thus to aggregate data on a single platform toward better maintenance, more efficient use, and enhanced data accessibility via a standard file format (.hdx). What counts as humanitarian data in HDX is relevant pre-existing data like poverty rates, crisis data that locates areas of impact for emergency response, and data on the response itself – who was involved, what they contributed, and how it helped.[14]

HDX highlights various successful case studies that gained traction in popular media coverage, notably in the 2015 Nepal Earthquake, one of the most highlighted use cases.[15] The Nepal data was important during the event, as groups like MapAction were able to produce a few shapefiles rapidly that steered state and NGO efforts and could guide on the ground volunteers who lacked internet access and electricity offline. The Red Cross, in turn, layered poverty statistics on top of these shapefiles to reach the areas that would reasonably need the most help in such a crisis. Due to such potential and the simplicity of the HDX interface, one Red Cross employee has called HDX "the Candy Crush of disaster information sharing."[16] The comparison of this humanitarian outreach with a viral Facebook puzzle game signals that what was once likely seen as a form of labor has transcended into the broader field of civil society as a hobby of concerned citizens who assist in the causes to which HOT and requesting NGOs direct them. This mode of labor being compared to a game also begins to show how gamification around humanitarian and environmental data is afoot.

HOT campaigns play a large role within this data ecology, one that can align with grassroots tactics. The sense of global community brought about in part through online communities and pervasive technologies like GPS set the stage for this kind of work. In a presentation to the State Department, Maron credits three trends as part of HOT's ascension. They are as follows: the willingness of users to mobilize to help those in crisis, the spread of globalization and the proliferation of social media in creating an immediacy to these humanitarian campaigns, and the broader access to information these forces have enabled. Maron declares to US government officials that as a result of these trends, "HOT stands to bridge the grassroots OSM community to traditional responders by filling in the missing gaps of information."[17]

HOT not only invokes the term "grassroots" here, but also distinguishes it from the "traditional." This steeps its approach not only in tactics toward online political mobilization through mapping on similar terms as Public Lab, but also imbricates its distinct approach toward

humanitarian data within discourses of the "new."[18] Disaster mapping also demonstrates a shared association with civic hacking. A mapathon event occurred as part of a National Day of Civic Hacking in 2017 that aided HOT projects among others as a proof of concept for crowdsourced crisis efforts to FEMA.

One of the main figures behind the event, which evolved on relatively short notice as a response to the surge of hurricanes at the time and changed locations on short notice, would retweet the growing coverage of HOT mapathons in the weeks to come, including via *The New York Times* and PBS NewsHour. The user added, "Don't donate food or water or even money, [sic] Donate your time and skills to mapping Puerto Rico and help responders after #MariaPR." Such contributions, whether through mapathons or individuals, are seen as constituting human capital, one which some believe outweighs more conventional means of contributing to humanitarian crises such as donations. Especially in light of US government inefficiencies in disaster management best seen in responses to Hurricane Katrina and more recently Hurricane Maria, many are beginning to see such activities as a growingly effective means of aid.[19]

HOT Microgrant Case Studies: Crowd2Map Tanzania and Map Lesotho

In turn, HOT Microgrant projects show how communities can take up HOT mapping in locally salient ways resonant with a grassroots mapping framework. Through its microgrants program, HOT provides $2000-$5000 to cover internet access, technology expenses, and training to community-based mapping projects in the Global South.[20] Crowd2Map Tanzania, as one example, uses HOT to combat female genital mutilation in the country's rural, less mapped areas. The project measures success in both its lack of economic support (championing operating off no budget) and reduction of lives lost. Toward the latter, the group cites that deaths occurring during the region's

"cutting season" went down from 12 deaths to four from one year to the next under their watch. They equally contend that "[h]aving better maps" as a result of their work "helped prevent 2257 girls from being cut."[21]

I first heard of Crowd2Map Tanzania through their attempt to host the largest mapathon to date for remote contribution. Crowd2Map Tanzania emerged out of a meetup during Mozilla's 2015 festival as proof of how crowdsourced approaches could yield data that benefits map-making. The group points out that the rural regions are especially poorly mapped in relation to the urban areas of Tanzania, and deems it "blank in Google Maps." The group soon learned that due to the community's refugee mapping efforts worldwide, this was not the case on OSM, but that there was still a lot of data left to be desired. It sought to bring open data available through the Tanzanian government to the OSM interface, and developed training materials to do so, in spite of great odds during these training sessions due to a lack of access to enough laptops. A picture from a Crowd2Map Tanzania slide presentation illustrates a mapping training session where a large group of people is witnessing a training on the only laptop accessible for the session.[22]

Offline smartphone applications like MAPS.ME, one of many the broader OSM community employs on the ground, proved useful. But it required developing a more tailored interface to avoid confusion for mappers. Many of the categories for designating nodes and ways (which the next chapter defines with more depth) that are applicable in a Western context were not for the contexts of on-the-ground mapping being faced. Eventually this tailored version was translated into Swahili, as it had remained in English in an initial version. Though OSM and maps in general present a largely Western perspective, such work (as well as the multilingual nature of the user diaries) evidence the language buildout that goes on in the OSM community. While the contentious nature of Mapillary in the OSM community is covered in the next chapter, the Crowd2Map Tanzania group finds it "useful to show road conditions in the rainy season."[23]

There were monthly competitions among users for doing the most mapping as well as a means of incentivizing contribution to the project. Communication seems to have occurred in part over a group Facebook page as well as via WhatsApp to determine what the names of different villages were, estimates for resident counts, and roads or bridges connecting one area to another. The group trained local volunteers as well as the girls occupying the safe house how to map for this campaign, building local mapping capacity in doing so. This has led to the safe house not only discovering more impacted communities, but also reaching them with improved knowledge of the limited roads networks connecting them, better knowledge of how much fuel they will need to reach said communities, and a more independent means of mapping toward these tasks.[24] As of August 2017, the group had mapped 130,608 kilometers of road networks, 1,827,920 buildings, 1737 schools, and 389 medical facilities: all the labor of a total of 3465 volunteers.[25]

Among this volunteer group, Crowd2Map Tanzania cites notable differences between subjectivities of remote mappers and community mappers. Remote mappers are often highly educated, have seen maps all around them and used them from a young age, and are equally tech-savvy as a result of exposure to different technologies and platforms since childhood. Community mappers' experiences lie on the other side of the spectrum; many do not complete any education past primary schooling, never get exposed to a map of their home, and have never used internet-enabled technologies.[26] Remote mapping can exacerbate the dearth of cartographic practice and its representational output in unmapped areas, rather than enable subjects to map whatever affects their spaces most.

Further, remote mapping can carry colonial discourses. Various user diary entries that I came across throughout this research exemplify this. Whether it is a diary entry title like "When The Hunting is Poor, Change Your Hunting Ground" or another diary entry about OSM work occurring

in mapping Iraq that compares the region to an open frontier, the colonial history of mapping can and does enter into OSM community work. Here is a noteworthy excerpt from the latter:

> Wouldn't you prefer to be the first person to put entire villages and towns on the map . . . , never before touched by OSM? . . . If only there was somewhere where life, pardon me, mapping, was still simple, honest, and true. Well, fear not! Such a place does exist. Come join us . . .and claim your place among the pioneers.

Such statements problematically fashion OSM blank spots as "virgin land" and its mappers as "pioneers." They resonate with colonial ambitions that maps historically perpetuate.[27] The gendering of space is an equally important dynamic in play within OSM and HOT. While the introduction and Chapter 6 respectively think through silencing based on gender in OSM and the need to create spaces specifically geared toward the inclusion of women, the next section covers how the HOT Microgrant program helps promote gender-based advocacy within the OSM community.

Gender and HOT Projects

While the HOT Microgrant program has provided funding toward recruiting local female mappers, Crowd2Map Tanzania's female mappers have faced significant harassment, ranging from sexist remarks centered on how their responsibilities lie in the domestic sphere rather than the field, unwanted physical contact from male colleagues, and premeditated attempts by men to draw them to remote areas to map with the intent to rape them. Not only must Crowd2Map Tanzania face the need to convince locals that maps and map literacy can be transformative for the area, but also a need to educate men on gender equality and to collaborate with local law enforcement to keep mappers safe.[28]

Crowd2Map Tanzania thus carries a legacy of feminist critique in relation to space and spatial policies. Historically speaking, development policies have failed when they have been

inattentive to women's cultural practices and their role in shaping the environment. In these cases, "women were subjects for research which was aimed at creating more 'efficient' and 'effective' development policies."[29] Given the emphasis on efficiency without sufficient focus on particular local contexts, the specific ways space is produced (often in gendered and class-based ways, as identity-based mapping projects help show) is blurred.

Ecofeminism, for instance, explores the nuanced expertise women have with their local environment, one often ignored on the level of policy, and applies feminism's concern over any and all modes of domination to modes of domination that involve nature. It equally analyzes the gendered nature of technological practice, notable in cartography. Spatial ignorance and illiteracy refract in gendered, racial, and class-based tones as a tool of oppression. Crowd2Map Tanzania has called for HOT and OSM to be reflexive about how their training caters implicitly to male subjects as opposed to female mappers, how the community is a male-dominated space to prompt the creation of women-exclusive advocacy and advisory groups; and how more funding and participation is needed to map rural features affecting women's rights.[30]

Map Lesotho, a similar project, emerged out of a need for openly licensed mapping of the area. Proprietary licenses local mappers had previously used for mapping had expired and there were no funds for renewing them. Through partnerships with both local government and Irish government organizations (culminating in a memorandum of understanding between Lesotho and the Fingal County Council in Ireland), the community began creating tasks through HOT. It set up local surveying as well as mapathons in Irish schools and universities.[31] A similar approach of working via government councils, both local and abroad, is also occurring in Zambia.

Local surveying employed tools like Mapillary for accurate street-level details as well as Field Papers (further discussed in the next chapter); OSMTracker (also discussed later for its utility in bus route tracking); Osmosis (for command-line processing of OSM data); OSMInspector (which

highlights bugs in different map layers present for a given area); and Keepright (which can correct errors in prior mapping, such as overlapping roads).[32] The mapathons pit students against each other as motivation and award the top mappers prizes. The top mappers would often be determined on a monthly basis, and many institutions held several events a month.

Missing Maps member profiles, with stats on buildings, roads and waterways mapped and where a user's mapping occurs, as well as badges that a given user has earned, attempt to motivate mappers in similar ways. Through my aforementioned internship experience, I was promoted from a "basic mapper" to a "pro mapper" in a little over a month, earning badges for tracing buildings; tracing roads' participating in mapathons; learning JOSM (Java OpenStreetMap); and for consecutive days spent mapping.

This gamification through badges and "leveling up" on each badge, which mirrors how Crowd2Map Tanzania and Map Lesotho motivates mappers, exemplifies how HOT can seeks to motivate through competition. Overall, since Missing Maps began in 2014, it lists over 75,000 contributors, over 45 million total edits, over 38 million buildings mapped, and almost 1 million kilometers of roads mapped.[33] Before exploring my own contributions to this work, including as a HOT intern, it is worth discussing the use of remote mapping and US government programs toward malaria eradication.

Malaria and Remote Mapping

Sub-Saharan Africa suffers nine out of every 10 malaria deaths. As campaigns toward ridding the disease become more successful, many see surveillance as more important in tracking and monitoring sites of contact. Organizations like the World Health Organization (WHO) and the National Malaria Program consider maps that can be both complex and rapidly updated in countries

with lower case rates necessary. One such country is Botswana, where the Peace Corps put HOT techniques to use in a crowdsourced approach for training locals, thus reducing costs without sacrificing accuracy. Using GPS devices, volunteers surveyed which buildings had or had not been sprayed, and collected reasons why some had not as an added data layer. In most cases, the reason was that the buildings simply had no one around during initial spray visits, with refusal being the second-most cited. Volunteers then rendered results on QGIS to show how small investments in terms of support and training could make a bigger difference in fighting the disease than larger scale initiatives given the nature of malaria once case incidents decline.[34]

HOT supports on the ground mapping in the region and recognizes why data based on satellite imagery alone is insufficient. But for cases such as the malaria campaign wherein the data is being used at an aggregate level, HOT and CHAI seek to convince local governments that crowdsourced remote mapping can be not just accurate but transformative. Citing recent work in Botswana, CHAI figures I spoke with found persuading the government of this was not difficult when framed in terms of how cost-effective such efforts can be, an argument mirroring the rationale of efficiency that played a part in arguments toward public GPS from Chapter 3. They do, however, recognize challenges ahead in convincing more governments to encourage citizens to take on more of this work and see their data as representative, given how recent humanitarian crowdsourcing efforts are.

While remote mapping is critiqued for dissociating environmental factors in lacking an on the ground perspective, these considerations can enter into remote mapping tasks. Elements of the natural environment can "speak" in remote mapping toward the historical, economic, and social aspects of a given terrain. While my recollections from my internship in a later section and my writing on bus route mapping in the next chapter speak further to this, one story I heard while interning pertains to HOT's efforts in mapping Fiji in the aftermath of a recent typhoon. The story

arose in response to interns' questions on whether white squares in the available imagery appearing flatter than a building should be mapped as buildings or not. One sign that a structure is a building is whether or not it casts a shadow. This avoids mapping, say, tents and tarps for drying tobacco or for crop cover as buildings.

But the Fiji story pertains to a thin railway line appearing as HOT mappers worked in the northern area of the country, a rail line that would disappear into the road networks being mapped. Addison shared this story as "part of the fun of mapping." Research amongst himself and other mappers found this rail line was a "cane train" that played an integral role in the area's economy. This knowledge led to more accurate tagging within OSM to better reflect the status of this rail line accordingly. This implies that part of mapping's worth is to learn from spatial entanglements that then feed back into the designations the representation uses.

Aside from weekly calls and webinars on Zoom from which I heard such stories, interns and supervisors communicated through a dedicated Slack channel. HOT also employs Slack channels to facilitate workflow and address mappers' questions on specific mapping projects and imagery issues. On the first call I participated in with the intern team, Addison explained that the HOT Eliminate Malaria Mapping campaign had been ongoing since mid-2016. It was a project developed alongside CHAI, who was the requesting organization for the data being produced, as well as with DigitalGlobe-donated imagery. Addison notably personalized DigitalGlobe as a "friend" in assisting HOT projects for some time, mirroring how HOT refers to its partners.

HOT has also had previous collaboration with the Bush-era President's Malaria Initiative (PMI) as well as with USAID. When one looks at available archival materials from the Bush administration, one notices the original stated aims of the President's Malaria Initiative do not mention mapping as a tactic for malaria prevention.[35] This is notable given the safety of life framing

of a public use for GPS applications initially, but is unsurprising considering how little imagined uses gave credence to the productivity and challenges of community campaigns relying on GPS.

Taken from a Foucauldian perspective, the visuality and detailed spatial management that emerged from the modern hospital, a distinct entity considering hospitals' functions prior to modernity, seemingly falls into the hands of NGOs and citizens via crowdsourced campaigns, at least in terms of predicting and managing the symbiosis between human and nonhuman within the broader environment.[36] It is precisely this symbiosis Foucault attends to that scholars like Latour and Mitchell pick up in attesting that to trace the complexity of taken-for-granted abstractions like capitalism merits recognizing a span of political agencies and standards that construct space and either extend or disrupt visons of power over space.[37] Such is the foundation of new materialist critiques of the work of Marxist geographers like Harvey.[38]

What PMI does underscore within archived materials, however, is "The Power of Public-Private Partnerships" in malaria elimination, as well as a need for "Growing the Grassroots." While not in reference to mapping, a White House Summit on Malaria features both as themes, indicating that "[p]owerful grassroots movements can raise awareness of malaria, and highlight ways that organizations can get involved in combating this preventable disease in Africa."[39] Though originally set as a five-year program, PMI continues to this day, engaging in efforts surrounding insecticide, spraying, women's preventative care, children's treatments, and diagnostic training.[40] The emphasis on public-private partnerships echoes how governance has sublimated into everyday media.

Within the Clinton Foundation's work, the CHAI mission statement reflects the drive toward this mode of governance, with stated interests to "strengthen the capacity of people in the United States and throughout the world to meet the challenges of global interdependence."[41] Figures from CHAI we spoke to as interns conveyed that remote mapping "has been a huge help" to the project, given that GPS data collection efforts on the ground, in their experience, proves costly and

time-intensive. They also expressed potential applications of this data in targeting mosquito breeding sites based on rates of occurrence in different areas with different population densities, which would further help proofing efforts, bed net distribution, and estimates on how much personnel and spray to send to particular areas. Further, they expressed this data could be used as a check on population estimates based on census data in indigenous communities.

Early Mapping Experiences and the Eliminate Malaria Mapping Campaign

This section shares further findings specific to the campaign I contributed to toward my internship. Prior to interning with HOT, I followed its Twitter page while getting more acquainted with OSM mapping. HOT has an active Twitter presence, encouraging followers to "make your mark" through contributions. Such language can be common among nonprofit media campaigns, and, as discussed with civic hacking, attempts to appeal to those who feel disaffected with expert and government response. I noted particularly the following tweets for their suggestions that users dedicate time for HOT around work or leisure time:

- "It's been another week of #mappingagainstmalaria! Help us finish out strong by swiping through #Mapswipe on your evening commute."
- "Recuperating from a busy weekend? Relax and swipe a task on #mapswipe! Not swiping yet? Check out: mapswipe.org."
- "We used some of our extra time this morning to map Mali and make a difference. What about you? Get started."

Tweets encouraging HOT contribution such as "Explore the world from the comfort of your own home" and "Need a summer vacation? Mapping allows you to see other countries without leaving your own city! Take a look" further reflect the historical ambition to view the world as an observer somehow outside of it as one does on digital mapping interfaces. Particularly given the largely Western perspective on largely underdeveloped areas in which HOT efforts intervene, these notions of exploration again carry a colonial and voyeuristic tone.

To encourage remote contribution, HOT frames contribution as exploration. As another tweet submits, "It's never been so easy to help! You can make a difference without leaving your house." This aligns with a spatial visuality akin to that of Google Earth, which "valorizes external spectatorship on the totality of the earth, the pleasures of flying, and the instantaneity of seamless, hassle-free travel without leaving the safety of a home computer."[42] But by invoking contribution as an activity that occurs around the work day of mappers, these tweets also reinforce the continual imposition of such responsibilities for the ideal citizen upon one's leisure time. They are deemed leisurely – a hobby, not an imposition.

Considering such work demands for mappers, HOT designed the internship program to cater to the work-life balances of interns. The Eliminate Malaria Mapping Campaign consists largely of remote contributions. It maps seven countries in projects scaling up to work with governments to decrease contact with malaria through vaccination and mosquito fumigation. There was a weekly quota of 2000 buildings to map per week for interns. This could vary if an intern was placed on validation for a project, or put on a project involving road mapping. Regardless, the expectation was that mappers would devote 12 hours a week to the assigned project in meeting this quota.

I spent far over 12 hours a week reaching the quota initially as I adjusted to JOSM. JOSM is an interface wherein one can edit and publish data, alongside other editors like iD and Potlatch.[43] Efficiency is of utmost concern, and ultimately informs decisions in what platforms and tools to use

in disaster mapping projects. The editor typically used by beginners, iD, is a platform that is easier to map with but harder to square as accurately or as quickly as JOSM. On the iD editor, widely perceived as better for beginner mappers to use, the denser a tile is in terms of buildings, the less and more selectively it decides to display them when zooming out to try to see building differences better. Many mapathon Eventbrite pages I have seen underscore learning JOSM considering that it helps get more mapping accomplished in such settings, a priority for a project that seeks to have impact on a global scale and space-time.

JOSM carries various different preset tools that enable quicker mapping. One for buildings, for instance, allows a mapper to draw a line on one side of the building and then drag their mouse to the opposite side of the building to create a square, automatically tagged as a building. On iD and JOSM, a mapper can map quickly by copying and pasting a building shape to superimpose on similar building shapes. But on iD, when tiles present buildings of myriad sizes, one needs to first place nodes connected by lines for the four corners of the building, then additionally scroll to the Edit Features menu to tag it as a building manually. The JOSM buildings preset does so automatically.

As I continued relying on the iD editor in mapping buildings for the campaign at first, I kept finding the boundary tasks would not load correctly. This meant I could not tell what the area I should be working on was and could risk obstructing other mappers' work in adjacent tiles. Usually if I tried loading the boundaries again, the boundary box would load the second time around. As Addison later described when a fellow mapper asked about, it is a matter of the editor not "communicating" effectively with the Tasking Manager. Nonhuman interactions within the OSM ecology obviously imprint on the act of mapping, but such personifications of the technical components can show that the ecology at hand is both social and technical.

On the technological side, I often wondered how much these actions qualify as "mapping" as conventionally described. This was not so much a refusal of this work being mapping, but a

consideration of what constitutes mapping in the present moment. I often think of Addison encouraging interns to see OSM "as a georeferenced database," and that "what you're really doing is adding points and lines to a database." Referring to "points" and "lines" correlates to OSM's emphasis on nodes, which include building corners and meaningful sites, and ways, which include lines connecting nodes, as one does to generate a building, respectively.

In Addison's endorsement of QGIS plug-ins like InaSAFE that help with hazard analysis and routing, he conveys that a lot of HOT's current work with FEMA deals with routing, as was equally a concern in archival materials Chapter 3 examined. Returning to the example of Puerto Rico, Addison pointed out that with ground-initiated UAV imagery, imaging obstructing trees at the island's center for improved routing may have been easier. But improved road designations for hazard analysis are also key moving forward. Addison cited the contentious surface=impassable OSM tag as an attempt at this, but one largely critiqued as highly subjective and as failing "to identify the usability of ways at different weather conditions."[44]

Addison is well-versed in the utility of such data. Addison started as a volunteer with the Red Cross with expertise in spatial management, expertise he claims was sorely needed to realize the full potential of its GIS investments. He became more enmeshed in OSM work through meetup events and through his work on a proprietary platform called Depiction that used OSM as its base layer toward emergency routing services for disaster preparedness.[45] The area in which he lived and worked was one which Steve Coast lived in at the time, whom Addison got to interact with and refers to as the "godfather" of OSM. The area would also go on to host a State of the Map convention, where he presented on Depiction and engaged in a series of organizing meetings that would provide the starting ground for HOT. It was a journey that would take him from OSM work in Mongolia to serving as a voting member and chairperson within OSM to working on one of

HOT's most highlighted case studies – mapping Kathmandu Valley as part of its 2015 Nepal earthquake response.

Addison thus has a broad perspective on OSM. When speaking of his experience as a voting member, he relays a point he assumed I would be aware of as well: that "governance and open source don't mix." This signals an erasure of politics within the precarity and fast pace of the global, an attitude I had certainly come across before in other maker circles.[46]

It was Addison's idea to start the intern program in spite of it being largely unprecedented. HOT had individualized internship experiences such as in social media outreach in the past, but never an "army of interns" as he was after, in his own words. While the Eliminate Malaria Mapping internships started from HOT being off track on their mapping goals for the South Asia region, they were simply unable to take in all of the 160 applications they received – far more than they predicted. Though HOT mulled accepting only 20 of the applicants for a more tailored experience, the program took in 60 and without daily mapping check-ins in favor of weekly ones via email.

There was a balance within the internship group between users who were new to OSM and YouthMappers chapter presidents who were African students. I was told during the interview that part of the appeal of the internship for these students was that they would need to compete in a market in which students were expected to have a large range and number of internships. Part of the impetus for interns, then, is the need to acquire experiences and skills to help them compete in a global data economy. The interviewer that I spoke with said that the expectation for many of the African students would be to have served in as many as eight different internship opportunities before being seen as qualified for many of the job opportunities they would seek.

Overall, interns ranged in their OSM experience. The YouthMappers had several years of experience mapping on the ground with OSM. Other interns were North American students (many

women) studying GIS but with limited OSM experience. One notable intern was a middle-aged worker looking for a career change and seeking to gain experience with humanitarian data projects.

Addison stressed that unlike other Missing Maps projects, where the data might also be for purposes of navigation, this was a strict building count so that workers on the ground could know how much spray and how many bed nets should be packed in visiting a given area. The imagery being used (usually from DigitalGlobe or Bing) complicates the task of building enumeration. While tracing building footprints as accurately as possible is ideal to estimate the location, shape, and size of the building for a number of occupants, what mappers ultimately have to trace through the aerial view is instead the "roofprint." Thus, while accuracy was still paramount, small indents were less concerning. Squaring one's work does help alleviate having to work off of roofprints to have building traces mimic footprints more closely.

In assessing damage, these prints can be misleading. An otherwise normal standing building could lack a roof, and more importantly, a building that has a roof could very well be otherwise dilapidated. Another challenge to accurate mapping in disaster mapping and Missing Maps projects is the recency of the available aerial imagery. In making judgment calls about which imagery set to use, one relies on aspects of the environment – such as trees and roads – to "speak" to its recency. If trees are larger, more numerous, or absent, or if roads appear wider or straighter, those changes (often man-made) in the landscape can point out if one imagery set should be used over another.

Roads, in turn, can distinguish between trees and huts, which can look similar in aerial images. If a road ends and a circle of such shapes appears, the road likely ends in the middle of a hamlet, indicating that what is shown are huts rather than trees. If such a shape appears in the middle of the road, it is unlikely that a building would be placed there. What is pictured is likely tree cover over a road. In spite of the grand nature that aerial imagery often invokes, it is the mundane yet important objects tied to different spaces that often factor in most meaningfully.

To further help distinguish huts from forestry, HOT encourages imagery offsets. Typically, one could check imagery alignments with GPS traces; if a trace of one walking down a road strays from the aerial image of the road, that indicates a mapper must reposition the aerial image at hand to match how data is being drawn by dragging the background on iD or JOSM. For the areas HOT projects focus on, these differences can prove significant. A difference of a few years between one imagery set and another can mean a great deal when mapping areas that are often susceptible to flooding, for instance.

The trouble, again, is that this is not an exact science. The changes I spoke of before can aid mappers, but there is often no means during the act of mapping to tell when a given image provider captured the imagery at hand. At times, task instructions stipulate which imagery set to use out of recency. With many tasks, it is a judgement call, as Addison, invoking a common saying in deeming mapping as an art and a science, confirmed. The archive of available images, then, and the subjective calls mappers must rely on resist notions of the complete map as much as natural disasters do.

Though often deemed objective and complete, maps are always subjective and contentious.[47] The god's eye view of maps can blur what is on the ground. This is what Fortun is after when distinguishing an aerial view from a sensorial perspective; representing the regional penetration of a pollutant (the macro-scale) is different from mapping the symbiosis between pollutant and body (the micro-scale).[48] Maps can thus both extend and fragment vision in accordance with Helmreich's insights from the preface. They construct the temporality of a catastrophe, which refuse easy definition.[49]

Within HOT tasks, there is a difference between "complete" and finished. A task can be deemed complete without being validated yet. Tasks demand interaction. At least two mappers are necessary in order for a block on the map to be finished: one to map and mark a tile as complete, another to validate that the work on the block has been done correctly.

As one maps, communication with mappers working on the same task are the changesets and the Task Manager comments. HOT incorporates numbers within changesets to convey how many mappers have contributed to a given campaign. Mappers are then encouraged to add what they actually did ("added buildings," "modified highways," etc.) and to save their work often, so that if work must be reverted for any reason it is far easier and faster to accomplish. I was called out rightfully for not saving my work often enough – a bad habit exacerbated by my switch to JOSM and the more rapid pace of mapping it affords. While the Task Manager comments are more for comments between mapper and validator, changesets are more global to the rest of the OSM community. In the event of a future project in the area, they can signal why features may have been traced when they may not show up in a given imagery set being used for the current initiative.

As Addison demonstrated mapping on the HOT Task Manager, he explained the work of algorithms in designing task tiles. These are sometimes square tiles but are irregularly shaped at other times. Their design accounts for the crowdsourced nature of the work involved. Early on in my work with the campaign, I was unsurprised that I was familiar with the nature of the aerial imagery and what the general terrain looked like, given that I participated in the MapSwipe campaign that helped generate the task boundaries.

MapSwipe is a mobile app HOT developed to determine which areas should be included on a given project map. Users swipe through images from the general area and indicate if there are, are not, or may be buildings in the images shown. Whereas other approaches have led to small squares with little, if not nothing, to map, Addison claimed that the "funky" algorithm helps create more irregular shapes that would make mappers feel like they were contributing by including a decent amount to map. It also does not overwhelm them with so much that they would move on from that particular tile. The aim was to strike this balance so mappers would feel inclined to map more than

one task each time they logged on. HOT knows if tiles take 10-20 minutes to complete, this is much more likely than if they take half an hour or more.

HOT, therefore, recognizes psychological dimensions with the mode of production in play, with technical practices forged toward efficiency. The MapSwipe campaigns for these projects were so proficient that project leaders overestimated the number of projects for interns to work on by about a factor of two. This led to some interns being switched over to validation for those projects or interns being assigned to other projects, as I was with the Ugandan refugee mapping project.

An internship webinar on validation particularly stressed the import of validation in HOT mapping, which HOT attempts to encourage via its #ValidationFriday campaign. A Red Cross contact (whom I will refer to as Mick) who frequently uses data from HOT campaigns to aid first responders and runs mapathons ran the session. In applying a lesson Mick has carried with him from his time as a Boy Scout, Mick modifies a common scout adage that one should "leave your campsite better than you found it" to apply to mapping on HOT tasks: "leave the task better than you found it." Complementing this ethic, one from a male-dominated community, Mick places the cultivation of community via validation as a foremost concern. He encouraged always leaving a comment following validation thanking the mapper for their assistance regardless of its quality. Mick underscores that acknowledgement of a mapper's time is key, and that any contribution can be productive. This can help generate the "constructive," "positive" environment HOT seeks.

This ideal, however, is not always the reality. For one, tiles can be invalidated somewhat needlessly with no explanation from the validator. As one fellow intern put it in a webinar text comment, which I present unedited, "I think we have to adress the conditons underwhich a cell is invalidated. I get suprised when a cell is invalidated simply because there is a 1 or 2 missings buildings or there some little error which could easily be corrected." While HOT can guide its

enthusiastic community through previously mentioned means, such a moment demonstrates matters that can be somewhat out of their control given their reliance on the crowd.

My earliest experiences mapping with HOT, contrasting values Mick espoused, reflected HOT's reputation for fostering a fairly terse environment, rather than Mick's vision. For one Cambodia task I worked on, I received a message through the site entitled "Task #836 invalidated," with the curt message, "Missing buildings." The user left a similar message on another tile shortly thereafter, without any real suggestions for further resources to refine my skills going through the imagery or any constructive feedback.

Two months later, I revisited that tile. It had to go through another invalidation by the same user a month later – this time, with a slightly more elaborate response: "Missing and misshapen buildings." After another round of edits and a positive validation by a different user, the task was at last complete. Task completion can thus take quite some time depending on the project at hand.

I had another task invalidated by a user with the following comment: "buildings still missing, changed roads to surface=unpaved," followed by various user names that worked on that tile. Road classifications, as I would learn via the Users Diaries throughout this research, are contentious. I had simply extended and connected roads from outside the tiles I had worked on for this particular project and kept the classifications as they were before. It is possible I and others had not read the instructions for the task carefully enough, which often narrow down the potential road classifications one is likely to come across in a given task to two or three potential types of roads.

Early on, I would often have to look up tiles I mapped on my own, which proved time-intensive, to learn how my work fared. One often only gets direct messages over work when it is invalidated and a comment mentions the user directly. On an adjacent task to one mentioned previously that was invalidated, the validator left a comment I would not have seen had I not searched back through: "Great team effort on this one - I've made a couple of minor amendments."

Though encouraging and in line with the collegial feedback OSM strives for, most mappers would not see such a comment, with no mappers being tagged.

To compare what HOT encourages to validators' responses, here is an example of a comment I received from a fellow intern on my early mapping work while interning: "@cugrassroots Thanks for your contribution! Make sure to square the edges of your buildings. If you are using iD editor press "S" or if using JOSM press "Q" Thanks again!" Soon afterward, once I gained more experience mapping on JOSM, most comments I received would simply convey I had done a good job and express gratitude. The divide between the collegiality that HOT imparted on interns and what happens in the community in real time is stark when considering insights from my prior HOT experiences.

During the validation webinar, Mick told us that those in charge of HOT tasks are very aware that it is easier for mappers to enter into a task with the knowledge that they are only mapping roads or only mapping buildings, rather than both. This was the case in the Uganda tasks. The recognition of the cognitive load involved further signals how HOT accounts for these considerations in crowdsourcing as much as possible.

HOT interns spoke with a Ugandan HOT worker to know the correct road designations to use and how they would appear on aerial images. Though contributing may have been more difficult for a community member without this opportunity, task instructions still delimited two types of road designations appearing in the task. Tracing huts within the Uganda tasks was easier than tracing buildings in other tasks. To map a round building, one simply makes a triangle of three points at its border, hits a keyboard shortcut that renders it a circle, and from there copy and pastes over others, provided that the surrounding huts are roughly the same size as they usually were in my experience. These functionalities, again, are clearly in service of efficient mapping and mindful of the nature of crowdsourced labor.

This was also the first task I worked on in which I had to consent to an agreement over the use of project imagery. The NextView license agreement I signed, which would also come up in post-hurricane imagery I would later work with, stated I would not use the imagery outside of "digitizing OpenStreetMap data for humanitarian purposes." The copyright for the imagery, in turn, constantly turned up in the imagery itself as I was mapping, a constant reminder of the political economy of these imagery sets. It was reminiscent of the agreements one must consent to in signing up for an OSM account, a process I explore in the next chapter. Before that, I close with a discussion of the ethical considerations at hand in such remote mapping projects.

Conclusion

During the aforementioned CHAI Zoom call, a fellow intern unmuted his microphone to inquire whether these communities want to be mapped in such a way that persists after a campaign is over. CHAI's response was that being mapped brings more good than harm, and could be used, for instance, to assert ownership of one's home. The representatives equally attested that in asking communities whether or not it would be permissible to map them in such a way, they had not once been told no, and would often be received with enthusiasm by these communities, which they claimed wanted "world recognition" through these efforts. To be mapped is to be recognized, and HOT's argument is that subjects in developing contexts thus welcome being mapped out of wanting what comes from that political recognition. The intern who asked the original question spoke of how in a Western context, when one chooses to live in a less developed area or in the "wilderness," it is often assumed as an act of opting out. The consensus was that since the decision to evade such work was not an active choice for residents in these contexts, HOT does not face such attitudes.

The stakes for development strategies within HOT's output are clear. To HOT and CHAI, which referenced a recent conference call they were on concerning global development projects, many of the generally agreed upon markers of development are geospatial. Examples these figures gave were access to clean water and being a certain number of miles away from a school. Such characteristics have simply not been aggregated or examined in many less developed contexts that have not been properly mapped. The figures additionally cited regions like Mesoamerica as ones where no spatial reference is available. This leads their work in this region to consist largely of identifying building networks to then take back to communities for community names and other significant or distinctive markers. Community input is focal to this model, but again, the model is not oriented toward building local capacities for mapping work. Rather, campaigns are arguably bent toward the strategic as often as they are toward the tactical. The interface at hand can support the latter for communities to map in innovative ways toward problems they themselves define. While the possibilities for such innovations were precipitated in a broad sense within visions of GPS from Chapter 3, the campaigns demonstrate the caliber of complex entanglements imaginaries from Chapter 3 and discursive constructions from Chapter 4 do not fully give due justice.

Given Lippincott's critiques and how they clearly resonate throughout Public Lab, this points out a difference between Public Lab and OSM that I deem key. Both communities borrow technologies of capture, but only one seems overtly critical and reflexive about how they are used in practice – Public Lab. Likewise, while a crowdsourced approach, which HOT and OSM clearly embody, adopts a rapid pace of production to address urgent problems where time is not a luxury, the frame of grassroots approaches desires to slow down spatial practices – to reconsider meanings ascribed to space and to cultivate dialogue around social issues. While there is some critique of the political economy of aerial imagery within the ecology of humanitarian data among HOT and its partners, there is not the same urgency in making members more critical consumers of data within

information capitalism as there is in Public Lab. Both organizations ultimately hope to have subjects map for themselves even if remote work can preclude building local mapping capacities.

The internship model, one such avenue of rapid production for HOT, is one HOT has conveyed it may follow in the future as a means of meeting mapping goals, but it is not without obstacles. The expectation in developing contexts that there will be a stipend provided for mobile data is one such concern. For YouthMappers chapters, HOT can provide up to $3 a day stipends for this work, but it is far more difficult for a global internship program. Other issues that have occurred in these projects include differences in time zones of mappers and impacted areas as well as the high turnover rate of mappers annually within HOT's crowd. Addison points out that the "career volunteer" for these efforts is rare, and that only recently was this work more than a hobby for him.

Overall, HOT campaigns have a diverse base of contributors: some disaffected citizens rallying around the efficacy of civic hacking as opposed to trusting appropriate government response; non-Western subjects competing for a place on the map and in a globalized market requiring a technical skillset; GIS enthusiasts; and humanitarian NGO employees. The line between labor and leisure within such communities that Addison's quote on the "career volunteer" speaks to can be quite blurry. It is one that, when considering the diffusion of governmental oversight taking place, shows how "growing the grassroots" can become a matter of cultivating a more productive citizenry in line with initiatives like Reinventing Government and E-Government. These considerations continue into the next chapter, which focuses more broadly on OSM through its Users Diaries, mapathons, and conferences.

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[26] Janet Chapman, "Empowering Female Mappers in Rural Tanzania HOT Summit 2017 Crowd2 map," presentation slides, Sept 10, 2017, https://www.slideshare.net/jachapman82/empowering-female-mappers-in-rural-tanzania-hot-summit-2017-crowd2-map.
[27] Fusco, "Questioning the Frame" and Mitchell, *Colonising Egypt*, 177.
[28] Chapman, "Empowering Female Mappers in Rural Tanzania HOT Summit 2017 Crowd2 map."
[29] Noel Sturgeon, "Ecofeminist Natures and Transnational Environmental Politics," in *Ecofeminism and Globalization: Exploring Culture, Context, and Religion*, edited by Heather Eaton and Lois Ann Lorentzen (Lanham: Rowman and Littlefield, 2003), 97.
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[31] More on Mapping Lesotho and its partnerships is available through joecorr, "Fingal County Council Sign Historic Agreement with Lesotho Government," *Joseph Corr,* http://www.corr.ie/blog/4567078398/Fingal-County-Council-sign-historic-agreement-with-Lesotho-Government/7628289 and https://wiki.openstreetmap.org/wiki/MapLesotho.
[32] Though some of these tools will be covered with more depth later, more information is available on the OSM wiki via the following links: "OSMInspector," *OSM Wiki*, http://wiki.openstreetmap.org/wiki/OSM_Inspector; "OSMTracker," *OSM Wiki*, http://learnosm.org/en/mobile-mapping/osmtracker/; "Osmosis," *OSM Wiki*, http://wiki.openstreetmap.org/wiki/Osmosis; and "KeepRight," *OSM Wiki*, http://wiki.openstreetmap.org/wiki/Keep_Right.
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[41] See "Clinton Foundation HIV/AIDS Initiative," *WHO,* accessed May 23, 2018, http://www.who.int/workforcealliance/members_partners/member_list/clinton/en/
[42] Presner et al, *HyperCities,* 86.
[43] HOT's export tool is the opposite – one requests data from the OSM database to produce a particular map isolating specified attributes. The latest version of the export tool, version 3.0, features a more expansive set of file formats and regions for export, as well as improved search functionalities for areas of interest (AOI) and features to highlight via the export. See "Export Tool 3.0," *Humanitarian OpenStreetMap*, accessed October 20, 2017, https://www.HOT.org/projects/export_tool_30.
[44] See http://wiki.openstreetmap.org/wiki/Proposed_features/smoothness; https://help.openstreetmap.org/questions/6237/how-to-tag-that-a-path-is-impassable-for-bikes
[45] See "Frequently Asked Questions (FAQ)," *Depiction*, Accessed January 1, 2018, http://www.depiction.com/faqs.
[46] Irani, "Hackathons and the Making of Entrepreneurial Citizenship."
[47] See Burnett, *Masters of All They Surveyed*, 99; Lorraine Daston and Peter Galison, *Objectivity* (Cambridge: MIT Press, 2007), 9, 10, 17; Naomi Oreskes, *The Rejection of Continental Drift: Theory and Method in American Earth Science* (New York: Oxford University Press, 1999), 315-316.
[48] Fortun, "Afterword," 253.
[49] Such is what Kim Fortun finds in work on the Bhopal catastrophe. See Fortun, *Advocacy after Bhopal*, 353.

CHAPTER 6

OPENSTREETMAP (OSM)

Introduction

In a Google Hangouts Virtual Mappy Hour held well before the bus route mapathons this chapter covers, OSM members heard a user present work on one of OSM's best mapped public bus networks. Prior to mapping the network, the user took issue with the system's bus maps in their city; they were individual to each line and did not display the variety of routes available at a certain street or stop. They also excluded highway intersections to better orient readers.

Bus route mapping on JOSM requires advanced knowledge of three basic OSM classifications: nodes, ways, and relations. A node signifies a point on the map, with a way being a line connecting different nodes (as in drawing a building). A relation signals a given way falls under a higher order classification – in this case, a bus route. Ways can be part of multiple relations. When a bus route follows along a highway, the way must be "split" on JOSM to indicate it is part of a highway *and* part of a bus route. To chart a bus route, then, one must select nodes on each way; split the way; continue to split ways at every turn of the route; mark them as part of the same relation in the JOSM relationship editor; and then tag the new relation as a bus route via a Public Transport JOSM preset before uploading changes. The presenting mapper explained the process as "making a relation out of the street data that's already in OSM."

The mapper used aerial imagery at times in similar ways as documented in the previous chapter to find oil tracks of buses that could indicate where lines began:

> Presenter: If you look at the right shoulder of this road, it's very dark, and that's because buses tend to drip oil like a sieve and wherever they stop at the beginning and end of the lines they're usually idle there for a while and it leaves this big oil slick –
>
> Voice on the call: That's fantastic
>
> Presenter: Yeah [chuckles], and that's how I know where the bus starts.

But to map the system, the mapper relied on the network's maps, which is technically copying data the mapper does not own or have permission to use.

The audience's questions made the community stance on the IP ramifications of what the mapper was doing clear. The discussion left the mapper with two options: ask the public transportation network for permission to use their data and thus make it publicly available for further use under OSM's licensing parameters, or survey by hand – be it by self-tracking on a bus route or taking notes on each bus stop on the line. "Having done that, it draws some strange looks, and it's not actually ideal for getting the stop locations," the mapper asserted on the latter.

This mapper is fairly known on OSM. I was already familiar with him for work that, while only amounting to a few edits, reverberated in the community far more than most small changesets. As several local governments removed Confederate statues following 2017's Unite the Right rally, he deleted them from OSM accordingly, including one local to where he resides. "OpenStreetMap is a database of physical features," the mapper wrote in a Users Diary entry. "Since the . . . monuments are no longer *physically* present, I have removed them from OpenStreetMap." Community members applauded him on entry comments and social media posts.

This encapsulates OSM's on the ground stance at its best – that members who live in areas affected by such swift changes can add data making OSM's representation of their local community the most up to date representation available. The mapper's explanation for the edits reminded me of Addison's response to an intern question on discrepancies between what might appear in aerial

imagery and what appears on OSM's representation of the area in question. "If they've been removed in reality, we want them removed from OSM," Addison insisted.

Addison then brought up vandalism occurring due to Pokémon Go's popularity to exemplify community stances on OSM reflecting "reality." When the mobile augmented reality game debuted, players were joining OSM in droves to add gym locations. The trend frustrated community members, as it did not reflect how places were named on the ground. "Add actual stuff and it works just as well," Addison contended. Accordingly, many diary entries issue truth claims on what constitutes a place in the mapped environment.

Chapter 5 addressed how the increasingly remote, "off the ground" nature of OSM contribution tends to conflict with these founding precepts. This chapter continues that emphasis and specifically delves into IP complexities as well as further government and corporate interventions with OSM data and its community. While this can speak to notions of co-opting the grassroots that discussions within other chapters address, it also reveals differences in mappers' opinions on what constitutes freedom and free choice in determining the parameters of free use based on their contributions.

To pick up a point from the last chapter on OSM contribution at its core being about "adding points and lines to a database" (one that mirrors the aforementioned description of OSM being a database of physical features, and not a map as it is more conventionally understood), these truth claims stem from the Deleuzian trace in the authority they take from the aerial photograph and/or self-tracking. While nonhuman interactions captured within these means can and do inform OSM edits, the level of those entanglements are not nearly at the same degree as more experimental approaches in public-produced digital maps. This restricts the spatial complexities OSM is able to document – often by choice. The on the ground principle also helps quell political debates on OSM, such as in border disputes. When the news broke on Catalonia's independence referendum from

Spain in 2017, one user published a diary entry to highlight the issue as an "early warning flare." As community members debated the most appropriate approach, one community member replied:

> I would say ground truth, [sic] whoever is physically controlling the landmass [sic] gets the border. If Catalonia runs things and Spain only politically disputes it it spins off as it's [sic] country. If Spain sends in troops / replacement police and occupies Catalonia then it remains as part of Spain's borders.[1]

The endorsed utility of the on the ground philosophy in this example demonstrates how different political and spatial realities are eschewed to avoid contention. An aversion to contention over the ownership of the data mappers publish also informs the Virtual Mappy Hour response.

Following the Deleuzian tradition, space is so tied to the situation of its capture that we must resist notions of "knowing" a space. Rather, we must recognize the need for different occasions of mapping by different means in order to arrive at a sense of the different interactions that constitute a space and speak to different dimensions of space. Accordingly, Deleuze highlights the transfer of pollen from an orchid via a wasp to think more relationally about how rhizomatic relations generate space.[2]

Adhering to the absolute, by contrast, reduces, but makes a singular spatial image possible. Through the on the ground stance, the way places are named on the ground – through street signs, building placards, or the like – is how OSM prompts mappers to name them. Like most maps preceding it, the platform does not recognize multiplicities of spatial understandings. As maps did in the colonial tradition, OSM asserts claims of what is "there" inevitably inscribed with the largely Western, white and male perspective of its mappers. It does not imagine otherwise, as might be the case in, say, mapping indigenous land claims, or the spatial understandings of minority groups.[3]

Perkins thus questions whether "the wikification of mapping might facilitate a more mutable politics."[4] The digital nature of maps, in accordance with points the preface makes, has changed maps' production and permanence, with the form becoming increasingly personalized and

situational within data economies. While some would say this makes maps more mutable, Latour contends its immutability remains unchanged, even while admitting mapping is now far more accelerated as a process and in its effects. But post-constructivist voices in critical cartography, including Perkins, claim it is (im)mutable practice – in some ways mutable, in others not. The mix varies with the context at hand. Immutable elements of OSM include code, hardware, and bounded interfaces. Mutable elements include use, crowdsourced content, and the range of interests and motivations among mappers.[5]

Due to this situational specificity, maps can be far more fluid in the messages they convey than Latour claims. Perkins notes that work in STS and critical communications theory anticipates seeing maps this way (as the preface explores) in the post-constructivist mold.[6] The contribution of open source mapping communities like OSM could thus be to dissolve a dominant sense of space, inviting contention and diverse cultural models of collaboration into producing maps.

Outside work from prominent members can display how OSM contributors engage in experimentation and further research on the political legacies of mapping. OSM work cannot be divorced from the situated contexts of its mappers and chapters. In his spare time, the OSM chapter leader for the particular chapter I worked with closely (whom I will refer to as Tom) has experimented with using k-means clustering to imagine new districts for his fairly gerrymandered state. K-means clustering is a well-known clustering algorithm that calculates k centroids and assigns points to clusters through the centroid a given point is closest to.[7] Tom also experimented similarly with school districts in his area, which led him to realize myriad considerations, including race and distance from public transportation, are at work in both cases.

Likewise, after news of Senator Doug Jones' victory over Roy Moore for Jeff Sessions' vacant seat after his appointment to Attorney General, one Maptime chapter retweeted a comparison of the map of Jones' electoral victory to a map entitled "Map Showing the Distribution

of the Slave Populations of the Southern States of the United States Compiled from the Census of 1860," one President Abraham Lincoln relied on for Civil War strategizing. Areas in Alabama the latter map charts as those with the highest concentration of slave populations aligned with districts voting for Doug Jones in the former map. The tweet contended the correlation embodies lasting effects of slavery – that black voters still predominate in areas where their ancestors were disenfranchised and drove support for Jones after Trump's election.

Thus far, I have introduced some of OSM's political and social dimensions through the work of leading figures and notable political events. Overall, this chapter continues the participant observation work from the previous chapter. I focus specifically on OSM US community-wide events (including mapathons, mappy hours, and State of the Map US conferences) and relevant OSM Users Diaries entries.

Many of these events show OSM is evolving in large part through its associated projects to address more and more complex problems like mapping bus routes, accessibility levels, and indigenous land rights claims. These more complex initiatives depend on collaborative frameworks that merit changes in the social, technical, and even legal frameworks OSM-based mapping typically employs. It encounters structures of data governance that ultimately shape and constrain its potential, revealing frictions IP policies and automated modes of mapping pose. OSM philosophies once considered foundational are changing accordingly and being exposed as constructions based on the largely Western values and philosophies that have conventionally defined the community. OSM work is evolving, recognized as more "off-the-ground" and accepting of changes that machine learning applications in digital mapping have on ecologies underpinning OSM. I reflect here on my earliest surveying experiences before detailing my involvement with bus route mapping and OSM US to trace – as the prior chapter did with humanitarian mapping – these changing ecologies with maps and their digitization.

Local Level OSM Activities

After signing up for an OSM account, I was immediately led to tutorials on editing OSM through iD. After learning the basics, I started making updates that seemed in line with my beginner status, updating local restaurant names for buildings where new venues had taken over and adding building area designations where they were missing. Going through the tutorials, I was amazed how much OSM highlights, more than one is accustomed to with a Google representation: park benches, fire hydrants, picnic tables, even markers for toilets, condom vending machines, and excrement bags for pets in parks. This reflects the level of detail in which OSM invests.

These diverse designations can manifest in interesting trends. The leader of one OSM chapter presenting at State of the Map US 2017, for instance, cross-referenced the number of businesses mapped in his city to the number listed in the Yellow Pages. This user, who started mapping events in his local chapter by setting up a National Day of Civic Hacking event to encourage more than armchair mapping in the area, found that while OSM was relatively on pace with retail services more so than "professional services," OSM was especially good at mapping local cannabis dispensaries. The Yellow Pages had none listed. "We like cannabis better than taxes apparently," he quipped.[8]

The variety of places one can add to OSM can make mappers more aware of what surrounds them. Surveying made me pay attention to the buildings around where I lived. Whether it was a building being a law office or learning the particular denomination of a nearby church, there was a great deal I noticed that had escaped my attention in my everyday experience of my neighborhood.

In these initial acts of surveying, I could not help but compare and contrast the experience to the values espoused and experiences recounted in Public Lab's Grassroots Mapping Forum articles. More and more of OSM surveying involves apps, including several mapathons this chapter

describes, as OSM moves to map increasingly complex formations. Even in surveying with Field Papers, atlases for mappers to jot down and upload new data with the atlas image as the overlay, one is not as entangled with natural elements as one is with Public Lab's mapping. The only way that wind, for instance, seemed to factor in was in folding my Field Papers every which way as I attempted clumsily filling them with more and more details OSM's standing representation excluded.

I also sought to contribute through Maptime when I first joined OSM. Maptime, the product of OSM community conversations stemming from that year's State of the Map event, launched in 2013 as a series of weekly gatherings around pizza of local mappers encouraging those with diverse backgrounds and minimal experience.[9] But many of the nearby chapters (including a Champaign-Urbana chapter) were long inactive. The Virtual Mappy Hour presenter previously mentioned was one of several leaders for his local Maptime chapter, but the chapter disbanded formally in 2016.

Out of the scores of US chapters Maptime lists on its website, only a small portion have maintained an active Twitter presence and slate of local events. In a mappy hour conversation I had with Tom, he too conveyed that Maptime-sponsored events and turnout was declining. Thus, my contributions to the OSM community (aside from my HOT internship) came by participating in events in the chapter Tom runs. This includes its bus route mapathons that took place during the summer of 2017 as part of a series of nationwide mapathons.

"You can always tell the mappers," Tom laughed the morning of the mapathon. With a folder of bus survey sheets, several of which he gave me when we first met that morning, he shuffled toward an approaching man. None of us, save for Tom, wore anything with an OSM logo to indicate we were mappers. Nor was there a clear meeting place in the city bus bay Tom selected for the mapathon. But, as Tom jested, one could spot the geeks, who stood out from the few city residents catching buses at 9 am on a rainy Saturday morning flooding the city subway stations.

Judging from how quickly Tom noticed me as I paced through the bus bay searching for mappers, I must have passed for a mapper. This would prove a signifier for the mostly white and male mapping hobbyists who would arrive over the next hour. Of the 13 mappers that originally said they would attend, only four (myself included) were at the bus bay, and only one was not white.[10]

Participant observation research relevant to communication and media studies has long noted issues of race in digital environments. danah boyd's research on the movement of white teens from MySpace to Facebook contends that "[j]ust as physical spaces and tastes are organized around and shaped by race and class, so too are digital environments."[11] In Boellstorff's dialectical reading of the digital through work on Second Life, the digital is likewise entangled with the dynamics of race and class that constitute any other space.[12] In urban areas like the one this local OSM chapter inhabits, the makeup of mappers from the OSM online community and the demographics of the mapped community can contrast in telling ways. This juxtaposition between the racial makeup of the area being mapped and that of those mapping is a collision between a physical space (the mapped area) and a virtual space (the OSM community) that reveals a great deal about the habitus and cultural entanglement of the latter.

The Western male dominance of OSM is one the community often acknowledges in its online exchanges. One academic study a prestigious UK university highlighted in a Users Diary entry on participation biases in OSM and how an unequal gender distribution of contributors affects OSM data reflects the import of these disparities. One obvious factor is that of leisure time; advanced contribution is largest among men in retirement.[13]

The Users Diaries, as the introduction tables, can document how structures of identity play out in local level OSM participation. Accordingly, the page can serve as a reflective space about practices and practitioners of mapping on OSM. One notable example regarding class identity was from after the Grenfell Tower tragedy. An OSM contributor wrote about a mapping party years ago

in the area. The mapper expressed remorse over the mapper's previously posted classist comments that the area was "horrible" and nothing more than "a dodgy concrete jungle," calling the original post "harsh and insensitive in retrospect."

The contributor also identified a perceived failure of OSM mapping projects – that those who need to map the most to highlight their particular spatialities and temporalities are not just unable, but uninterested. This aligns with Warren's points on community oversights to build local mapping capacity for mapping to serve as a medium for local perspectives, not "forces looking in." Though there were broader pitfalls surrounding the tragedy, which the mapper expressed "feels like a failure of London to bridge the wealth divide," the entry cites research on OSM to substantiate the absence. These citations justify the author's claims that beliefs on mapping being "democratized" through platforms like OSM merit qualification, as Perkins likewise finds.

The OSM chapter I have worked with often maps areas of the city community members feel are far less mapped as a result of structures of difference. As a local academic who helps in organizing events for the chapter put it, "east of the river don't get no love" in their city. The previous mapathon before the bus routing mapathon that I learned about when I first signed up on the chapter's MeetUp page was specifically oriented to one such area of the city.

The mapathon model OSM adopts for part of its work is necessarily amorphous. Prior seasonal mapathon themes the chapter had organized events toward and highlighted on its page include "The Great Outdoors" and National Geographic's Geography Awareness Week, which seeks to galvanize the citizenry around geography through events like mapathons. A Presidential proclamation began the annual series of events, which have been running since 1989.[14] As one of the more regular recurring OSM mapathon themes, it begins to show how OSM work can, like HOT's, support broader government initiatives.

Maptime US chapters host similar events and aforementioned ones like HOT mapathons and National Day of Civic Hacking events. But Maptime US chapter activities encompass a range of different events. These include demonstrations on geospatial data in 3D modeling and mapping with the JavaScript library D3; discussions on government use of open data and civic data and how to read maps critically; explorations on the utility of open data in transit maps; workshops on creating hand-drawn maps, historical online walking tour maps, "emoji" maps, and origami using scrap maps; and even a grassroots mapping workshop with Public Lab. The next section chronicles recent themed OSM US mapathons on bus route mapping to explore local activities further.

OSM Bus Route Mapping

Mapping bus routes as a mapathon theme was Tom's idea, inspired by the aforementioned virtual mappy hour**.** Three other OSM chapters ran similar mapathons in major cities. OSM encouraged member participation even if their particular city was not holding an event.

The mappers in attendance were mainly workers in GIS, many in government. One who described his work in urban planning with immigration data remarked these events typically mark something different to him than his vocational life, particularly with the self-tracking these events involve in mind. The barriers for entry in the expertise and technologies involved in such events can still prove steep for GIS professionals, never mind those with limited technical expertise. Despite Tom's guidelines indicating the only experience needed was that of riding a bus, Tom admitted editing the traces on JOSM was complicated. "They should make this easy to figure out," one mapper sighed as we were both figuring out the tracking apps ideal for bus route tracking on our phones. I explained I had to get a new phone just to be able to run such a tracking app.

The collaboratively authored bus mapping mapathon guide endorsed using the Mapillary app to capture street-level data through automated, geotagged smartphone camera capture. I first heard of Mapillary via the vouching of various OSM users in their diary entries. One such application I learned of for Mapillary was the HailHydra(nt)! initiative. It references a mantra among members of Hydra, a longtime Marvel universe terrorist contingent. The initiative uses Mapillary and apps like OSMHydrant and OSMAnd to render fire hydrant networks on OSM. It holds mapathons in conjunction with fire departments and mirrors an exact imagined application of GPS-enabled mapping discussed in Chapter 3 in relation to locating fire hydrants. OSM can thus align with early governmental imaginings for public GPS.

One of Mapillary's affordances in on the ground surveying is that it alleviates the awkwardness of filling in a printed atlas as one walks around – a common practice with mapathons via Field Papers. In my local surveying, however, I have found holding a smartphone in landscape position and keeping it at head-level to capture needed details remains awkward and obvious to bystanders as one walks the streets, much as the Virtual Mappy Hour presenter did for similar tactics in bus route surveying. Mapillary capture may be *legal*, as its software automatically blurs captured faces, license plates, and the like.[15] But since none of these users have the option to opt-in or out of having themselves or their property captured, the *ethics* of the capture are another matter entirely, as Lippincott contrasts with the ethical orientation behind grassroots mapping.

When I asked Tom about his impressions of Mapillary, he too seemed reluctant. "I feel like we're just working for a company," he lamented. Mapillary's corporate partnerships are comprised predominantly of companies involved in developing driverless vehicles and in need of the details Mapillary can extract from user submissions.[16] OSM's work in propping up corporate initiatives via corporate use of the platform and its data, be it on the part of Mapillary or Facebook, means that

participation can often mean "working for a company," just as much of users' participation in digital platforms is equally a performance of labor.

As we spoke more about the awkward position it puts the mapper in and the secrecy it brings into the act of surveying, Tom recalled having the idea of OSM providing vests for people who are surveying to make the act more transparent. "We have enough money," Tom pointed out. Later, at State of the Map US 2017, I would hear Tom talk about using a chapter banner at mapping events to make activities more visible. When asked about OSM, one can then explain the project and invite bystanders to map.

While a concern with community dialogue is not built into technologies of capture nearly to the degree as they are within Public Lab, the events themselves can build some of this work in through such means. In turn, though many could fault Mapillary's capture tactics and policies, communities in developing contexts (as the previous chapter explored) garner street view data through it that aids advocacy efforts. Likewise, as the last chapter noted, geospatial technologies and practices one could consider invasive in a Western context can be reworked in less developed contexts to enable vital activism. Whereas observation is in one case surreptitious and dangerous, it carries liberating and affirming potential in the other. These twin realities of mapping practices within the observational work of open source mapping communities, their associated discourses, and their associated technological practices can reshape, rather than immobilize, mapping efforts and the pursuit – even if misguided – of the "complete" map.

For the bus routing mapathon, mappers tracked their chosen bus routes using OSMTracker, an app that facilitates offline geospatial tracking. It allows mappers to mark points onto a .gpx track that, once uploaded onto OSM and overlaid on JOSM, they can use to mark the bus route. Users can upload these traces onto the GPS Traces section of the OSM website to then download onto JOSM. The survey sheets Tom distributed were to record additional designations for bus stops:

whether or not bus stops had shelters, benches, a nearby street lamp, or a bike rack, and whether the stop served other routes or bus networks. While noting this information, mappers also needed to create points on their GPS tracks to indicate where they passed bus stops. By designating each stop from a number in chronological order as the route went along, mappers would see where stops were on JOSM and would have a number that corresponded with the stops on the survey sheet.

The exercise is fast-paced and complex. "Wow!! Those stop [sic] fly fast. You really need to keep an eye out for the bus stop signs," Tom later cautioned on the event MeetUp page. Using information from the city's public transportation website would have proved far easier, though not always permissible from an IP standpoint. Mounting one's phone to the front bus window with the bus driver's permission for automated Mapillary capture, as many users online had suggested, may also have been easier to verify bus stop locations and features afterward.

At a Mappy Hour Tom held for the OSM chapter months later, we discussed our experiences at the mapathon further and how to improve the workflow behind it. Ideally, with a better turnout, pairs would survey each bus line – one using a GPS mobile app to record the stops, the other to note intersections and stop features. Community members could also meet afterward and have more experienced mappers demonstrate how to overlay the .gpx tracks and create bus routes on JOSM. Not even the mapper from the Virtual Mappy Hour presentation worked alone.

Having enough community members attend to split the labor would be an obstacle. A mapathon between the bus route mapathon and our mappy hour conversation that occurred at a local bookstore reflects this challenge. Held to support Geography Awareness Week, the event had members work on tasks of their choosing, including HOT tasks. Only four members attended, though the MeetUp page indicates far more came, as with the mappy hour. The event itself had participants contribute to HOT campaigns of their choosing, reflecting the growing popularity of

HOT contribution over the MapTime workshop model, and receive guidance or feedback when warranted.

Tom expressed hopes of building a new website for local chapter members that did not rely on MeetUp. It would show the blank spots of the city on OSM to galvanize members around specific mapping events that would address those gaps. The website would also serve as a repository for documents like the bus survey sheets, so that those with the most expertise could create routes on JOSM. Though I was able to outline the process step-by-step from the recorded virtual mappy hour, it proved complicated in practice, even with an intermediate skillset by then in JOSM.

At the mappy hour, Tom indicated the city's public transport data is open, so I instead contributed my data via the app JungleBus using information available on the network's website. While it does not designate relations for bus routes, it does allow a mapper to map a bus stop as a point and indicate what route or routes it serves. Nonetheless, as OSM moves to map more complex features with many of the areas where mapping occurs most frequently being fairly well-mapped already, the more social and collaborative it must be to ensure it is comprehensive. Proponents of the on the ground stance might argue the use of JungleBus is insufficient. It assumes the network's open information is up to date. The philosophy remains prominent as one searches on OSM forums for information on bus route mapping.

Prior to the bus route mapathon, I found a forum discussion before the mapathon that spoke to the IP complexities at play. In the forum discussion, a user inquiring how to map bus routes posited three different ways the user imagined for doing so: copying off other maps, surveying bus stop signs, or riding the bus itself. The user admits the first two approaches might prove more accurate, but acknowledges potential setbacks in terms of IP. After the user asks which method would be most acceptable to the community, the most popular response conveys a clear stance on copying from other maps, one that reflects OSM's position:

> Approach number 1 (copying) is really no different from copying anything else to put on the map. All of the reasons for not doing that still apply to bus routes I think.
>
> we [sic] have that same discussion of "Not creative thus not protected by copyright" (in which jurisdiction??) with any and all types of map data, and ultimately the killer reason for not copying is always this: OpenStreetMap is not a project where we experiment with testing legal theories and pushing copyright legalities to their limits. That's not what we do. We go out and we create maps from scratch to avoid all of that.

The comment asserts OSM is not an experimental space for copyright or IP considerations, and presents the community as agnostic to such concerns. Indeed, Gabriella Coleman's ethnographic work on open source communities concurs that open source groups espouse they are more about inclusiveness, open to the participation of anyone eager and engaged, than about a particular political orientation.[17] The challenge within OSM, as the introduction explored, lies in when the "open" in open source is taken as ensuring participation in and of itself. This excludes the social, political, economic, and material exclusions that are always in play when considering open mapping platforms as ecologies rather than givens.

Nevertheless, this user's response, as well as others that follow said user's response, acknowledge other methods also pose their own obstacles. Dialogue follows on whether different structures toward such data in different countries matter, with France and Germany's policies being cited as specific examples. Anything uploaded to OSM needs to conform with the most stringent of IP structures since it is available globally; local differences do not factor into its policy.

The copyright considerations at hand in OSM work signals evolving relations to maps and their production. How one reads and forms maps as texts, as documents, and as pieces of property whose data may or may not be proprietary is an increasingly complicated venture in today's data economies. One specific facet of this discussed at length in OSM forum threads is the "Easter egg." While typically invoked to describe an unexpected facet of a piece of media (be it an added scene following the credits of a movie or video game or a change in an image as one hovers over different

objects or sections), the Easter egg in mapping refers to an inaccurate feature in a proprietary map that, if one is caught copying it, can be used against a mapper in a legal dispute. Map proportions and even image offsets can also serve as proprietary marks that companies can use in court as part of the style of their maps.[18] The proprietary map thus denies trust on two levels: one being its lack of attunement to spatial transformations in real time, the other being different proprietary markers that convey ownership but sacrifice accuracy.

These IP considerations start as soon as a mapper joins OSM. On signing up, members agree not to input data without proper permission or that they have not gathered themselves. Members receive an explanation that all contributions are published within an open database license that can only be changed with "a 2/3 majority vote of active OSM contributors." In signing up, contributors and OSM disavow liability from consequences in cases where its data is erroneous.[19]

Though it does not change how their data is handled or distributed, users must also choose on signing up to state whether they want their contributions considered as public domain (PD). Unlike OSM's share-alike structure, which stipulates that any developing off OSM gets incorporated back under the share-alike license to keep OSM open and improving, situating work as PD asserts authorship but not ownership, enabling anything to be done with it outside OSM. According to the OpenStreetMap Foundation (OSMF), some see PD as simpler. It does not vary from country to country, as bus routing illustrates. As Harvey lays out in the case of capital, OSM community pursuits attempt to undercut particularities of space, specifically national techno-legal frameworks, to fuel the global project through workarounds like PD. This can ultimately mean more information about the particularities of different spaces can be made available via the platform.

Warren's Master's thesis also discusses issues surrounding PD. Grassroots mapping is almost exclusively in PD. Warren considers the ability to archive PD material for disaster response key to the assemblies and collaborations that can come from DIY mapping. While an individual's biometric

data, for instance, should be justly considered as owned by the individual, and not a medical system or corporation, one can often find access to one's own records and data difficult. Individual contributions within such grassroots campaigns toward public good must have the ability to be built from. It is a matter of citizen data allowing broader grassroots ambitions to take root, rather than be "harvested" in the aggregate and the absolute, as subjects have grown accustomed to under corporate and proprietary data ecologies.

Declaring work as PD is seen as an "opt out of the 'intellectual property' game," a major point of discussion among community members.[20] One State of the Map US presenter I heard speak, upon discussing licensing, even joked, "I just said license, which means someone just won OSM bingo." Another consideration specific to OSM US is how ODBL, the Open Database License OSM data is made available for use under, discourages government collaboration:

> PD would remove a significant barrier to direct contribution to OSM by US Government organizations, like the US Geological Survey and the US Census. Right now, OSM can import data produced by these organizations and occasionally get a little guidance. These organizations are hesitant to invest significant effort in developing OSM because they can't use the data themselves. From the perspective of the US Government, OSM is another place where data goes to die. PD would remove the restrictions, allowing US Government organizations to explore direct data interoperability with OSM.[21]

As explored in the last chapter via HOT, licensing can shape OSM's relation to governance. More specifically, this quote elucidates the effect licensing strictures can have on the "lifecycle" of OSM data in relation to government use. Local IP differences can thus reinvigorate calls for geospatial data to be considered public domain, showing how the particular and the universal are remade alongside each other in the pursuit of a "complete" map, one that can enroll involvement for diverse reasons and toward diverse applications.

Mapathons and their Motivations

"You never know where these volunteers are going to take their skills to spread the OSM gospel," one HOT representative expounded in a State of the Map 2017 presentation on the growth of mapathons. She described them as "growing like wildfire," being used for high school volunteer credits, corporate outreach events, and campus collaborations. OSM's membership and press coverage often heralds it as a crowdsourcing success story, and it remains a growing movement gathering users toward mapping for various different campaigns, rather than a single unified goal.

One can thus see OSM as a platform for lay cartographic intervention in a broad sense. The aforementioned presentation featured, fittingly, a textbook image with John Snow's descendent at a Missing Maps mapathon. Like Public Lab, OSM contrasts more typical knowledge exchange models. One State of the Map US 2017 keynote speaker's reference to Susan Cain's *Quiet* underscored that OSM's model differs from corporate cultures – in which, to him, the loudest voices win out. Instead, he deemed the OSM model a "grassroots" approach that exhibited a collaborative model of leadership preceding this corporate culture and meriting a revival. In turn, OSM's mapathon model celebrates collaboration and local knowledge as a means of developing a more robust resource.

As explored previously, however, the model does come with its challenges, both in terms of communicating aims, garnering local interest, and organizing members. In his State of the Map US 2017 presentation, Tom discussed the irony of OSM mapathons at times being referred to as "mapping parties." He joked that those one encounters on the street and invites to join in are "not thinking about the party that you're thinking about." He did, though, mention one chapter's meetup as a wine tasting event, noting, "I mean, who wouldn't want to go to that?"

The "party" label to these events can conflate labor and leisure. When discussing the low turnout at chapter events with me at the mappy hour, Tom underscored that users often do not

appreciate how much work can go into contributing at a mapping event, which can result in high turnover within the community. Mapathons gather hobbyists around shared interests, but also require a great deal of technological proficiency and encompass hard work – some of which, as this chapter argues, ultimately aids modes of post-governmental organization as HOT does.[22]

Tom advised planning events in advance to sustain community. He highlighted a chapter with events booked seven months ahead at the time. These events can include bike rack mapping; mapping along hiking routes; civic hacking projects associated with National Day of Civic Hacking; cemetery mapping for where notable figures are buried; and themed OSM US mapathons. Chapters also schedule events for specific occasions, such as Red Cross Month, Open Data Day, Bike to Work Day, OSM's birthday (August 9), GIS Day, and Geographic Awareness Week.

Tom lists several motivations among those who participate: gaining technological proficiency; meeting people in one's community; learning more about one's community; contributing to a free and global resource; and exercising through surveying. This variety of motivations aligns with scholarship on critical making communities more broadly.[23]

Tom's exercise point shows OSM participation gets framed as making users more productive and healthier. Even remote mapping projects can boast health benefits. A HOT tweet I once saw linked to *The Guardian* discussing a Harvard School of Public Health longitudinal study contending Americans who volunteer end up in hospitals less often than non-volunteering peers. This coincides with prior findings that volunteers exhibit decreased mortality rates.[24] The tweet read: "Some volunteer time a day keeps the doctor away?? Yet, [sic] another reason to get mapping today!" Though one's socioeconomic status, race, and work and family obligations are other obvious factors in seeking preventative health measures, associating mapping (whether on the ground or remote) with better health regularly occurs.[25]

A notable example of this link in on the ground mapping is mapping bike routes. Through emerging apps like Strava, bikers use GPS to track themselves while biking to map routes. OSM designations can then convey whether bike paths are separate from or part of the road. Following State of the Map US 2017, Strava made headlines for publishing a heat map including, inadvertently, tracks of soldiers' exercise routes near military bases. This enabled identification of US bases across the globe. DoD is conducting an extensive investigation to see whether policy enactments to try to curb these occurrences may be necessary.[26]

This furthers aforementioned security concerns involved in opening up GPS use from the start. But tracking is also advantageous to fostering bottom-up community knowledge production within OSM work to support governmental initiatives. Tom discussed one example:

> Here is an event . . . where we partnered with a local group . . . . It is about kids that want to build up their resume, learn what it is like to have a job, and what we did on this event was walk up and down the streets . . . and look at the storefronts, and we were saying, we were also partnering at the same time with . . the government . . . because they are providing capital funding for sprucing up your storefronts. So while we were doing mapping, we were giving the storefronts an A, B, or C record, and the kids really helped out with that.

Tom's talk also showed mapathons can demonstrate awareness of how popular cartographic initiatives must address gender. Tom brings up a need to welcome women and lessen the "mansplaining" often surrounding such work through more dedicated "GeoLadies" events. An OSM member later voiced at a conference wrap-up session that OSM's work with gender parity was positive, but that the conversation still needed to continue.

While HOT and OSM are both plagued with the same problems of white male domination that afflict digital cartography as a whole, the former's female constituency is growing far faster than the latter's. Thanks in part to HOT Microgrant projects like Crowd2Map Tanzania, the gender breakdown approaches a 50-50 split.[27] Such a trend holds in my experiences with HOT interns, and more broadly in enrollment within study abroad programs and MOOCs.[28] In the case of the

particular topic at hand, it exacerbates the contrast between masculine associations of GPS with militarism and spatial control that pervades governmental imaginaries of GPS and growing feminist associations of public GPS to an ethics of care via grassroots mapping and environmental monitoring more broadly.

Following Tom's talk, the biggest focus within the audience questions pertained to another concern of grassroots mapping – accessibility. He was first asked if he had heard of mapping events focused on accessibility standards such as ADA compliant door width. Tom praised the idea, and noted the University of Maryland's efforts spearheading accessible routing on OSM. Another audience member jumped in to add efforts in mapping curb cuts, but conveyed, as is the case with bus route mapping, that such specific instantiations of sidewalk mapping are quite advanced. As Tom often suggests himself, this audience member mentioned that separating data logging from coding is helpful – that is, to have some in the group document curb cuts and others focus on editing through a dedicated Tasking Manager project. But, like bus route mapping, accessibility mapping exemplifies how OSM's worthy ambitions in mapping are becoming growingly complex in both the social and the technical dimensions of digital mapping.

One simplified platform for wheelchair accessibility mapping I learned of at the State of the Map US 2017 was wheelmap.org, cited as one of several positive projects generated from OSM and one that I first learned of through coverage of the MapAbility project from Chapter 3. The platform coincides with the notion of nonexpert mapping platforms serving as crowdsourcing success stories that show how technology can intervene tactically in a stratified world. A nonprofit named SOZIALHELDEN e.V runs Wheelmap. To mark public spaces for how accessible they are, the map borrows from the semiotics of a stoplight. A green flag indicates full accessibility, while a yellow one signifies partial accessibility and a red one indicates no accessibility.

Full accessibility requires an entrance without steps and the ability to reach each room in the building without them. Partial accessibility means some rooms cannot be reached, but important ones can, and that the entrance has "no more than one step which is not higher than . . . one hand width." A building lacking accessibility has a number of rooms that require steps to get to, with an entrance that either has multiple steps or one that exceeds this width. Wheelmap also demarcates the accessibility of bathrooms, with a green flag indicating that a building's accessible toilet matches specific dimensions that it describes on its website.[29] This mirrors the Erasmus project from Chapter 3 and shows how OSM can tackle similar concerns through its associated projects. Wheelmap runs off OSM and thus carries OSM's open license. All data collected can be used freely with attribution and with an extension of that right to further creative use. Wheelmap requires an OSM log-in, as do most apps that facilitate OSM contribution. After providing the log-in, one needs simply to go to the Wheelmap website, click on the building the user wants to edit, and indicate its accessibility.[30]

Wheelmap encourages users to get involved by holding mapping events toward contributions, or to sign up on the website to become a Wheelchair Ambassador. It thus stresses mapping as a social engagement. Overall, one State of the Map US 2017 presentation declared there have been more than a thousand mapathons in 65 countries – some supporting Wheelmap.

As some bus route mapathons had with Mapillary, some mapathons center on specific apps, tools or practices. A closing workshop to State of the Map 2017, for instance, highlighted OpenStreetCam, a tool similar to Mapillary that collects street images to "detect salient features . . . , such as signs, lanes, and road curvature to improve OpenStreetMap."[31] Participants split into groups with ridesharing services waiting for them to tour Boulder while employing OpenStreetCam toward photomapping different areas. The groups then all met up at a local bar afterward to upload and analyze the data, as accords with the conventional mapping party model.

This workshop is typical of State of the Map mapathons and its spirit of collegiality. Happy hours sponsored by OSM partners, including MapBox and Development SEED, were frequent. Conference-hosted mapathon events ranged from local street surveying using Field Papers to teach grade school teachers OSM; a validation workshop by MapBox specifically talking about the tools and approaches they use for validation; and a trail mapping party.[32] The next section gives more background on the event itself and overviews common threads in the proceedings.

State of the Map US 2017

National State of the Map events occur around the world annually. A broader State of the Map event for the community at large is also held annually at a different international site each year. For State of the Map US 2017, Folsom Field, the University of Colorado Boulder football stadium, was the conference site. Organizers called it the best view of any conference they had attended. There was a shroud of mountains in the distance beneath clear skies and sunlight, and the stands outside of an elongated suite within the stadium were available for community members to sit, eat, and converse on projects. The conference also made use of the stadium's JumboTron to present user-generated maps for attendees to admire.

On the first morning of the conference, I was at the back of a large registration line. Others in line wore various t-shirts from prior State of the Map events and corporate sponsors present. One read "Explore the world with us," reminding me of HOT tweets from the last chapter and the sense of belonging that open source mapping communities instill more broadly. Eventually, I would find I had already interacted with many attendees, whether in person or virtually. Tom, for instance, was one of the chapter leaders signing in participants, so I was quick to sign in with him and introduce myself again. Several, like myself, were attending a State of the Map event for the first time.

Aside from standard 20-minute presentations, lightning talks (roughly 5 minutes long) ranged from descriptions of technical projects to quantitative studies based on OSM data and OSM chapter stories. Many presenters were prominent figures in HOT, representatives from partnering organizations, or OSM or Maptime chapter leaders. Though this is a fairly conventional conference structure, organizers framed the event as a different kind of conference – a "no bullshit conference" in which "everything you see here is real." The only "rule," attendees were told, was to "have fun."

Various presentations addressed tensions between OSM's on the ground philosophy and the increased use of machine learning in digital mapping. These discussions reminded me of a Users Diary entry on how calming mapping can be for OSM members. Some commenters saw tracing as more relaxing, and others outdoor surveying and correcting errors in others' mapping. But another took an unexpected turn: "Or teach the computer to recognize traffic signs," with a Mapillary link included for more information. The next comment exclaims, "Computers are taking our relaxing hobbies!" This reflects how these newer techniques – even when still abiding to on the ground precepts – are not universally accepted.

A slide title from State of the Map US 2017 – Preparation for the Robot Takeover – also comes to mind in community conversations on automation. Though tongue-in-cheek, the title reflects real concerns among users. But as Lilly Irani notes, depictions of AI often obscure invisibilized human labor and fail to trace how it is displaced, not supplanted.[33]

In a panel on autonomous vehicles and OSM, one panelist mentioned the stance as informing some reluctance in OSM toward this growth:

> [T]here's a rule in OpenStreetMap we call the on the ground rule. You're supposed to easily observe what you're mapping . . . . [W]ith autonomous vehicles . . . , a lot of the information needed isn't easily observable. But we think it's OK to use a GPS to observe the latitude and longitude. But that's not human observable. You're using a machine. What is OK in the community and what is not? And you won't find one opinion there . . . . We're used to GPS. It's in all of our phones and some of these other autonomous or technical tools will be less strange.

Here, the speaker acknowledges mapping has always required disciplining technologies to make complex formations more legible, ones that render views of mapping being "objective" misguided. These views seem more of a matter of constructions of technologies and, like maps, the level of trust that users have in them to provide faithful and actionable output.

Clearly, views on GPS use overall have evolved since public uses of GPS were first being imagined. It is equally a myth that the community adheres strictly to the on the ground policy. According to an informal poll during a talk at a different State of the Map event highlighted on the Users Diaries, 85% of surveyed OSM members indicated local surveying, armchair mapping, AI interventions, and outside data imports should stand on equal measure in OSM. The results recognize OSM's evolution in its workflow to address more complex problems.

For instance, in a session on human and machine collaboration in mapping, the speaker noted the role OSM's human users play in machine learning in developing areas: "the hardest part of machine learning . . . is getting the training data . . . . And for most of the world, that data doesn't exist. You don't have government entities with 20 years of really clean records. That is coming from OSM . . . . [Y]ou should know that you are all involved in this." As with HOT, OSM contributions can thus respond to government gaps in data, aiding development projects through means that states' top-down structures have historically lacked.

Mapillary's Human in the Loop concept is important to note in connection to human-nonhuman interactions in contemporary crowdsourced mapping initiatives. One lightning talk separate from Mapillary's presentation even discussed treating machines, in an especially Latourian moment, as "novice mappers" within such a loop. In speaking of interactions between human users and machine learning tools as part of a feedback loop, Mapillary and its OSM applications frame an

ecology in which human and nonhuman are not only mutually enforcing, but enhance each other's work. One presenter discussing Mapillary framed affordances of machine learning to OSM thusly:

> [T]here's some things that robots are better at than humans . . . . [T]here are certain sets of data that are hard to map on the ground, or without having some help. Mangroves are another one, [sic] it is hard to go with your GPS and map the extent of a mangrove region. So that is one area.

Machine learning is thus better suited for mapping certain areas than on the ground surveying.

Mapillary contribution not only includes street imagery capture, but also verification of AI detections off that imagery via Mapillary's Verifier tool. Mapillary presents such work as a game more overtly than HOT pits its own mapping activities. Mapillary counts users' verification reviews and provides a tally to give users a "chance to shine in the task leaderboard."[34] Data Mapillary collects from these modes of gamification range from speed limits on roads to traffic signs. As the title of its Human in the Loop concept implies, Mapillary sees human labor as critical to its machine learning training:

> The Verifier tool is part of our Human in the Loop concept, which in short means that we're including human feedback into the learning loop of the machine, thus speeding up the learning process needed for improved data accuracy . . . . Bit by bit, we integrate additional functionality and build new tools to create a comprehensive system to improve our computer vision technology. The way that the back end has been built is different from how it used to be in the old Traffic Sign Game.[35]

Incentivizing users' labor in this way has proven fruitful; contributions have increased exponentially since the platform launched in late 2013. Mapillary hit 200 million user contributions in October 2017, an increase by a factor of two in less than a year.[36] Though inhabiting a grassroots frame, particularly through its partnership with OSM, Mapillary's resonance with a model of data harvesting in this large output and how it is put to work as discussed previously is hard to ignore.

The previous chapter explored how HOT mediates between different government organizations, NGO partners, and communities being mapped to ensure proper procedure with official requests for mapping campaigns and donated aerial imagery that facilitate contribution. What can differ in OSM more broadly is that what gets drawn and worked on is largely (in theory) the result of on the ground surveying for campaigns either with local community organizations or that interest a given mapper to fill what the mapper considers a need in the standing representation of the area on OSM. This is either done through data a mapper collects on the ground (not by looking at other maps or closed data sets) or creates through tracks like in the bus route mapathons.

Though originally steeped in this vision of on the ground contributions, OSM work is increasingly manifesting through collaboration with AI detection tools like Mapillary. The rise of automated mapping tools within the OSM community, as intimated previously, can often mirror what workers' rights advocate Joseph Thomas Phelon illuminates within Forlano and Halpern's research as "'the robots are coming' argument," one which carries "both the promise and peril" of automation.[37]

On top of Mapillary's efforts in automation and gamified community mapping and Missing Maps' own resonance with gaming platforms discussed in the previous chapter, other OSM-relevant apps and platforms like MapRoulette and StreetComplete also adopt gaming principles. MapRoulette maps "challenges" for users to complete who are willing to help with suggested projects. Challenges range from fixing incorrect road designations consistently found over a large area to missing features like crosswalks.[38]

In turn, I learned about StreetComplete at State of the Map 2017 through Tom, who invoked it during his talk on mapping parties and at a wrap-up session for the conference. StreetComplete is an app that poses questions, or "quests," indicating what is missing from the OSM representation of the area where one is at the time. Once a question has been answered – be it

over the speed limit on a given road, the surface of the road, the number of a given building, or what style of food a restaurant serves – it automatically updates OSM.

It is important to distinguish the level of gamification here to those of other platforms engaging in crowdsourced mapping, which can go further. FourSquare, for instance, has long had a problem of users creating false data or copying preexisting data to become "superusers" or mayors of their town. OSM does not have such an exaggerated reputation system for users, nor does it rely nearly as much from third-party bulk edits as a platform like FourSquare. In contrast to Wikipedia, OSM's lack of moderation, in spite of the ability for edits to be reverted, also enables the fast pace of production needed in disaster mapping as explored previously.

Such a lack of moderation leads to characterizations that Perkins notes of OSM not only sponsoring a mutable politics of mapping seen in the aforementioned Confederate statues example, but also adopting a more democratic community structure than other crowdsourcing sites. Despite what this structure enables, outsiders can also see OSM as "democratic to a fault." Different levels of status among community members could lead toward more authority over perceived "never-ending" conversations OSM hosts that some argue stymie its progress. Williams' reminder that debate surrounding the degree of members' involvement in democracies has been constant in attempts to define democracy is relevant here.[39]

The utility of machine learning within approaches like Mapillary's equally lies in the psychology of the crowdsourced labor involved. As one presenter framed, "There's boring stuff that is good for computers to do that tires people easily. If you can take the cognitive load off and allow humans to do the parts they are good at, that is another way . . . to be more effective . . . and to help them work faster." This is thus not a matter of automation replacing human labor. Again, it is about increasing the efficiency of human labor, which Addison elucidated within HOT campaigns.[40]

Facebook, for one, relies on machine learning for its mapping. Facebook uses iD and the HOT Tasking Manager to track edits. Its algorithms get trained by a "training set" comprised of human-curated images that have tagged roads in the imagery correctly so that algorithms can learn better from human labor. As the model improves, less training sets are needed for the algorithm to hone a "confidence factor" for roads that can then be verified through human validation. A Facebook representative presenting at State of the Map US 2017 even recognized that if efforts mapping Indonesia were to rely solely on machine learning, it would not be complete until 2025.

To add to the potential of remote contributions in developing contexts, on the ground surveying can be considered illegal or carry dangers in various non-Western contexts, as Perkins also notes and Crowd2Map Tanzania's work from the last chapter demonstrates.[41] Given these challenges, the rationale among many of corporate representatives at State of the Map for their interventions is twofold. It is one of all being deserving of inclusion on a map and one of enhancing the resiliency of cities – be it for disaster preparation for developing areas or better transit data in developed areas.

Development discourses pertaining to post-disaster nations re-brand disasters, as Bush did following Katrina for New Orleans in a nationally televised address, as opportunities to reinvigorate nations' socioeconomic dimensions. With OSM and HOT implying traditional knowledge production models around place and disaster are insufficient, it is a perceived lack in state knowledge production such labor seeks to fill.[42] Accordingly, various State of the Map US speakers not only underscored such contexts as meriting cartographic proficiencies by the wider citizenry, but that citizen investment in doing so would instill them with valuable technological proficiencies in the globalized economy.

One main challenge Facebook's mapping work faces is that in areas where there is no clear local community engaged in mapping to dialogue with, it is difficult to gain approval of what is being

mapped based on locally informed mapping practices. Silicon Valley giants like Facebook are notorious for lacking criticality and tact with such work, as evidenced in the preceding chapter.[43] Mapping initiatives can thus overlook matters of identity inscribed in the local that the on the ground stance affords, inscribing them asymmetrically.

Despite these global ambitions and aforementioned criticisms, Facebook contends its work is attuned to the local. Its workforce represents 22 different languages to understand the local nuances of the physical environment as well as local community's editing styles in mapping. Through its use of the Tasking Manager, it builds in dialogue and social interaction between mappers so that changes face community scrutiny. It enrolls local mappers for street names and uses similar apps for quality assurance as described in Map Lesotho's and Crowd2Map Tanzania's work.

Areas lacking infrastructure (like Lesotho and Tanzania) or experiencing significant effects from climate change equally pose challenges toward mapping. On the latter front, in the case of open mapping in Alaska, projects respond to growingly precarious environments as a result of a crisis that, as scholars like William I. Robinson point out, is as much one of capitalism as it is ecological.[44] As a State of the Map US 2017 presentation on open mapping attempts in Alaska indicated, symptoms of climate change in the region like vanishing permafrost damage prospects of building infrastructure in areas that already lack infrastructure for running water or access to mail. This equally affects emergency routing. Due to a lack of sufficient infrastructure, residents convey many locations in a relative way – by other nearby landmarks. These descriptions may work for community members due to their common understandings, but are unhelpful for first responders.

Indigenous communities in Alaska are reluctant to consent to mapping projects in spite of their benefits. They have a history of being "over-researched," and mapping has thwarted their land claims. Rather than taking the damage-based perspective where researchers frame mapping projects as a "solution" to a lack, mapping should be desire-based, inviting these communities to address

self-defined concerns through mapping if they deem it the best method.[45] The Environmental Data and Governance Initiative (EDGI), an offshoot of Public Lab's work, is particularly interested in these issues within environmental data justice, an application that the penultimate chapter details.

This merits unpacking mapping's colonial histories and maps' complexities with indigenous communities. A State of the Map US 2017 talk from Digital Democracy, a nonprofit driven to "empower marginalized communities to use technology to defend their rights," honed in on such conversations.[46] It quoted the Doctrine of Discovery, which justified European conquest of non-Christian lands upon papal approval at multiple moments in the 15th century. The Doctrine remains cited within Supreme Court decisions to legitimate settler control of indigenous land.

Founded in 2008, Digital Democracy envisioned "that new technology . . . could be used to serve grassroots movements in innovative ways."[47] Digital Democracy's Mapeo tool for indigenous mapping projects is an adaptation of OSM that reworks the popular iD editor for offline use. It is not the only such current effort in offline use of OSM; Portable OpenStreetMap (POSM) is a notable example. The Red Cross partnered with OSM to develop POSM, specifically for disaster relief mapping in remote contexts lacking internet connectivity.[48]

With Mapeo, indigenous communities with no internet connectivity can narrate space and advocate for themselves. One Digital Democracy case study involves training a Chapa, Mexico community to map, starting from paper maps to eventually digital maps. The community was one the government was evicting for its presence on a preserve, and one aware of the legacy of damage-based research in potentially having outsiders map on their behalf rather than mapping themselves. Mapeo (which, like Public Lab, receives Knight Foundation support) shares a desire to create contrasting temporalities around such issues via a grassroots approach. These, again, are striking applications that were unforeseen as government agencies were realizing a public GPS.

Digital Democracy teaches Mapeo to indigenous communities that approach them with projects. The resulting representations, its State of the Map speaker conveyed, contrast from official state representations, which present lands as "virgin" land. Mapeo work dialogues with these representations, showing how space is experienced by those who inhabit it. Mapping is always embroiled, as Mapeo's work further shows, in questions of ownership, power and rights, dynamics maps often inscribe asymmetrically.

Digital Democracy extends these values within the Kappa architecture and append-only database structure they adopt for Mapeo. In an append-only database, "new documents are added to the database as they arrive and are never removed." The records kept are cumulative, and data entered in is never destroyed or changed in any way.[49] Each user receives an ID number, while each edit from each user is given a sequence number and is listed within the database in an immutable chronological order.[50] Digital Democracy contrasts this from the conventional server-based flow of digital mapping concentrating authority within a single server. Echoing Scott on state-based maps, this is an ahistorical "snapshot" in time, a representation solely of most recent work.

Part of the drive to have data collected as cumulative with none of it destroyed in the process is to ensure that the way data on Mapeo is maintained does not inadvertently discount any spatial perspectives. As one developer put it, "we want to embrace the subjectivity of the human experience." This is in stark contrast to the historical and illusory investments in objectivity to which cartography and the sciences writ large have adhered.[51] Latour's distinction between civilized (mapped) and "savage" (orated or cognitive) geographies further speaks to what spatial perspectives are seen as legitimate by whom, under what contexts, and within what institutional arrangements. While the renderings of space the native provides (the "savage" geography) is seen as illegitimate, the precise, "scientific" rendering (the civilized geography) gets seen as an avenue by which the territory can finally be "known."[52]

Through the metricization of the natural through maps, nature takes on new dynamics that make them appear separate from these considerations.[53] As Scott surmises, states' statistical mapping pits space and nature solely as absolute space. Instead, Harvey contends absolute, relative, and relational space-times "must be kept in dialectical tension with each other if we are to understand how concepts of space and time condition our possibilities, as Kant would put it, to understand the world around us."[54]

Absolute space is the space of Cartesian coordinates. It freezes space and time. Subjects and objects occupy stable locations from which, by proxy, private property is made possible.[55] The state investment solely in the absolute proves deleterious. Blank spots in an absolute vision of space, as Digital Democracy elucidated, indicate spaces for capital to conquer. Jake Kosek (an STS scholar Trevor Paglen deems an experimental geographer) adds that official maps portray space as "devoid of any social markers or divisions." This erasure is "central to a reimagining of the landscape . . . oriented around production and the authority of the state" and "reproducing ideas of wilderness purity."[56] It presents a "pure nature" that differs substantially from residents' understandings of it, bound in social and material understandings of the landscape.[57]

Relative space, by contrast, encompasses networked relations, such as those involved in economic exchanges - ones impossible to reduce to a location or time.[58] While relational space is similar, it is far more phenomenological. It accounts for what subjects desire based on their subjectivities and aspirations. Whereas relative space conveys relationships between objects (notably, for instance, through money) as constitutive of space, relational space conveys the objects themselves as constitutive of space in how they stand in for such desires.[59] Hence, desire-based modes of mapping that Digital Democracy's Mapeo tool engenders reflects visions of relational space that state and corporate spatial visions historically occlude.

These communities need different means of mapping toward different visions of space not just out of their lack of the usual technological infrastructure underpinning digital map production, but also for social reasons. Most of the important features for these community members – where they hunt, significant bodies of water, or historical and commemorative sites – are not easily placed through aerial imagery, as they are often ensconced in forestry. They contrast with conventionally mapped land features like buildings or road networks. Moreover, knowledge production in these communities is often more collaborative and more participatory. While GPS as a technology can fit with these values, it is less so the case with GIS, being more closed and professionalized.

Mapping, by contrast, is a predominantly Western project of knowledge production and control. But in Deleuze's rhizomatic frame, it may simultaneously afford acts of "disorganizing and obfuscating" when used under more subversive frameworks – as is the case here.[60] Rather than the Kappa architecture of Mapeo instilling social values of collaboration, a technologically deterministic perspective, its peer-to-peer structure responds to pre-existing collaborative practices in these contexts.[61] At State of the Map US 2017, a Mapeo developer noted, "It is funny how technology tends to mirror the society that creates it, and the society's values. I think a peer to peer solution tends to mirror the society and values of the people that it wants to serve."

Digital Democracy's efforts stand out considering Western corporate interest in using AI and OSM's platform to map the world in order to increase internet connectivity. In attempting to reach the tenth of the global population lacking internet connectivity, one Facebook representative claimed those at Facebook "want to understand the world" and "make it more connected." They view mapping as a vital part of these efforts toward navigating these communities. Facebook makes little mention of its self-interest toward profitability in such campaigns, which resonate deeply with techno-utopianism and the trope of the white man's burden. Facebook defines the lack of connectivity in such areas as an absence that must be filled by its solutions. It lies within a Western

legacy of similar colonial ideas in constructing telegraph and railway networks in the name of connectivity, inherently connected to progress in the Western Enlightenment paradigm.[62]

As this chapter shows, OSM's offshoot projects can take a form notorious for its colonial use and employ it toward matters of equity, much like scholarly and artistic interventions in mapping that the preface references. One State of the Map 2017 presentation quoted from Ursula Franklin's *The Real World of Technology*, John Armstrong's *The Philosophy of Voting*, and Indy Johar's *Democratizing Cities* to embroil the production of maps within the project of democratic designs. The presenter defined democracy as a process of reaching decisions wherein participants stand on equal footing within a portion of the overall process.

Doing so would serve as a starting point for absorbing concerns of the lifeworld into the system, and ensure public participation within at least one step of a given deliberation. It is thus "about empowerment and having agency in the decisions that affect our lives." One example the speaker posed was of watershed residents being able to approve construction decisions within it. This also touches on the growing capacities of maps to convey communities' desires, rather than inflict damage through outsider perspectives that do not consider community voices, a stance the next chapter will more fully examine.

Conclusion

OSM rethinks ownership of data through open licensing and calls within the community to make its work public domain – a marker of grassroots work, being evident in Public Lab's work. Though on the ground policies are often seen as fundamental to OSM, community attitudes toward IP and means of surveying have transformed. The fast pace of problems OSM now seeks to map (be they natural disasters or under-mapped public transportation routes) reshapes OSM's tools,

practices and philosophies accordingly, fueling community debate. This speaks to the ecologies at hand in such large-scale crowdsourced mapping initiatives. Technological advancements and users' inventive, often unforeseen use of them transform each other and ultimately the work of open mapping platforms. They can alter the field of participants, as Altheide might put it, as well as who or what gets mapped and to what ends, be they positive or negative.

When one examines the ecologies at hand that produce OSM, there is clearly a concerted effort in OSM to train armchair mappers and algorithms simultaneously as better novice mappers. In the efforts this chapter covers, OSM, taking an additional step from early B.F. Skinner-esque imaginings of computational networks as "the teaching computer" which inspired early online distance education networks like PLATO, becomes about teaching the computer in its machine learning efforts through users' image verifications and training sets based on their data.[63] This increases the efficiency of human labor concurrently in these initiatives, rather than erasing the need for such labor as popular discourses surrounding automation might suggest.

Friction exists in how the community can at times distance itself from the use of off-the-ground, invasive means of geospatial capture, yet is continually made and remade by such applications of technology via GPS applications. I thus see the on-the-ground philosophy as a naturalized community value of "being there" which shaped its early output but is now growingly exposed as but one option from a range of mapping approaches. While this range must be embraced if open community mapping is to contribute to important current problems, it also must be approached with a critical eye toward the ethical and the local.

I situate OSM and its modes of organization, from mapathons and mappy hours to State of the Map events, as a response to growingly precarious environments that public-private partnerships cannot keep up with – a platform, in other words, for grassroots projects. Through grassroots collaboration, they bring out different space-times that state-produced maps have historically erased.

I identify this as a critical component of the cultural work involved in grassroots modes of mapping. As a response to precarity, these formations seem like obvious outgrowths of the lines of reasoning factoring into the positioning of public GPS use within the frameworks of Reinventing Government and E-Government that I address in Chapter 3.

Concurring with Digital Democracy, Public Lab's stance is to train communities to map for themselves, to break the barriers to mapping as a mode of articulating power and setting community agendas. Communities can fully decide for themselves if they want to or should map, and how it is best to do so. Their wariness is well-warranted; state investments in geospatial technologies for security, management, and efficiency have long been encoded into mapping technologies.

In the case of OSM, what can be seen as invasive technological practice can be activating depending on the context of use. Though colonialism originally underpinned mapping and "a select geospatial priesthood" was originally behind encoding and working with geospatial technologies, situated and unintended use is also important in shaping what a technology means.[64] The ways OSM-based projects like Mapeo recognize social, cultural, and political differences at work in specific indigenous mapping projects enables the mapping of different space-times that counter state investments in the absolute. It also reinvigorates the call for mapping as a rhizomatic mode of dialogue with absolute spatial visions that can convey community desires, rather than solely bolstering further exploitation. I have shown in this chapter that on its own, OSM resembles an aggregation of traces rather than the rhizome; with the right tools, social infrastructure, and attention to both difference and different agencies – human and nonhuman – OSM has the potential to support the latter.

Fittingly, scholars like Lucy Suchman demand researchers and practitioners of technologies recognize the context of their use as highly significant to how those technologies and their output are interpreted and acted upon.[65] It is critical to see the use of automated mapping within OSM-

based projects similarly. Suchman even employs maps as a metaphor for these claims: "the questions of how a map is produced for specific purposes, how in any actual instance it is interpreted vis-a-vis the world, and how its use is a resource for traversing the world are both reasonable and productive."[66] This questions the idea of a global or complete map, as action (in this case, the production and use of maps) is always situated to its environments and purposes. Seeing such changes in maps and map-making is paramount. Autonomous vehicles are an example of how maps must now be made legible to machines in signaling three dimensional objects that are part of the physical environment so they can recognize aberrant ones – namely, other cars or roadblocks.

Many of Perkins' findings on OSM's politics hold true here. Despite OSM's mutable elements, it still largely serves as a "flat inscription." It still displays in ways the masses have little say over, and its social hierarchy regulates significantly.[67] For Perkins, these immutable dimensions include its IP regulation and vandalism views. This contributes to the "delusion of democratization" OSM's structure fosters.[68] OSM privileges the West as surveys historically have, claims to represent the "real," and does not recognize other understandings.[69] The ways in which multinational corporations like Facebook deploy OSM are such that, rather than ensuring a free global resource with accurate data, experiments with it as a mode of generating profit and furthering Western values that have long plagued Silicon Valley companies in how they view space. Scholars like Perkins, however, ultimately argue for immersion through textual analysis and participation, while lacking analyses of what participation on relevant interfaces looks like, how they construct work, what they performs, and what campaign or task designers and participants think about. My intervention here adds these considerations into the analysis, specifically in this chapter and the prior chapter, while incorporating the attention to the archival and the textual that such scholarship mandates via Chapters 3 and 4.

Regarding the former, while the scope of OSM's self-organization was not imagined by government actants within Chapter 3's analysis to be an affordance of publicly available GPS, the nature of its work in many ways accords with their desires to increase efficiency and improve citizens' health and safety, even if its associated applications present a threat to the sense of security GPS was imagined to afford. The next chapter focuses far more specifically on environmental monitoring via Public Lab and its associated projects. It will also further connect OSM work to that of Public Lab, already indicated through Maptime kite and balloon mapping workshops.

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[1] As another user pointed toward, OSM keeps a general forum on border disputes, but also one with a particular eye out for the Spanish border. See https://forum.openstreetmap.org/viewtopic.php?pid=602864#p602864 for an example one user linked to on the User Diary.
[2] Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, translated by Brian Massumi (University of Minnesota Press, 1987).
[3] Perkins, "Plotting Practices and Politics," 309.
[4] Ibid, 304.
[5] Ibid, 315.
[6] Ibid, 305.
[7] Chris Piech, "K Means," *Stanford CS221*, 2013, http://stanford.edu/~cpiech/cs221/handouts/kmeans.html.
[8] To ensure accuracy as best as possible, all quotations of State of the Map 2017 come from video footage and transcriptions made publically available by the event.
[9] "What is Maptime?" *Maptime*, accessed March 4, 2018, http://maptime.io/about/.
[10] It is worth qualifying this turnout with the fact that other mappers may have made, uploaded, and edited with their own traces of a bus route without meeting up at the bus bay as was originally laid out. In addressing this confusion the morning of the event online with the group, Tom indicated that mapping on one's own to pick a route closer to their place of residence was acceptable.
[11] danah boyd, "White Flight in Networked Publics: How Race and Class Shaped American Teen Engagement with MySpace and Facebook," in *Race After the Internet*, ed. Lisa Nakamura and Peter Chow-White (Milton Park: Routledge, 2012), 204.
[12] Boellstorff, *Coming of Age in Second Life*.
[13] Sarah Holder, "Who Maps the World?" CityLab, last modified March 14, 2018, https://www.citylab.com/equity/2018/03/who-maps-the-world/555272/.
[14] Derek Alderman, "Making Every Week About Geography Awareness and Advocacy," *American Association of Geographers (AAG)*, November 1, 2017, http://news.aag.org/2017/11/making-every-week-about-geography-awareness-and-advocacy/.
[15] See Mapillary, "What to Capture and Not Capture," *Mapillary*, accessed January 28, 2018, https://help.mapillary.com/hc/en-us/articles/115001463589-What-to-capture-and-not-capture, and

Mapillary, "Blurring Images," *Mapillary*, accessed January 28, 2018, https://help.mapillary.com/hc/en-us/articles/115001663705.
[16] Ingrid Lunden, "Mapillary opens up 25k street-level images to train automotive AI systems," *TechCrunch*, last modified May 3, 2017, https://techcrunch.com/2017/05/03/mapillary-open-sources-25k-street-level-images-to-train-automotive-ai-systems/.
[17] Coleman, *Coding Freedom,* 186.
[18] See OpenStreetMap wiki, "Copyright Easter Eggs," accessed May 14, 2018, https://wiki.openstreetmap.org/wiki/Copyright_Easter_Eggs.
[19] OpenStreetMap Foundation, "Summary of OpenStreetMap Contributor Terms," *OpenStreetMap Foundation*, accessed January 28, 2018, https://wiki.osmfoundation.org/wiki/Licence_and_Legal_FAQ/Contributor_Terms_Summary.
[20] OpenStreetMap Foundation, "Licence and Legal FAQ/Why Would I Want My Contributions to be Public Domain," *OpenStreetMap Foundation*, accessed January 28, 2018, https://wiki.osmfoundation.org/wiki/Licence_and_Legal_FAQ/Why_would_I_want_my_contributions_to_be_public_domain.
[21] Ibid.
[22] See Eric Kluitenberg, "The Post-Governmental Condition," in Kluitenberg, *Delusive Spaces: Essays on Culture, Media and Technology* (Rotterdam: NAi, 2008), 190-213.
[23] See Lindtner. "Making Subjectivities," 153.
[24] Claudia Cahalane, "Is it Time for Doctors to Prescribe Volunteering?" *The Guardian,* January 18, 2016, https://www.theguardian.com/voluntary-sector-network/2016/jan/18/is-it-time-to-prescribe-volunteering.
[25] See "Can Volunteering Lead to Better Health?" *Harvard T.H. Chan School of Public Health*, https://www.hsph.harvard.edu/news/features/can-volunteering-lead-to-better-health/.
[26] Bill Chappell, "Pentagon Reviews GPS Policies After Soldiers' Strava Tracks Are Seemingly Exposed," *NPR,* last modified January 29, 2018, https://www.npr.org/sections/thetwo-way/2018/01/29/581597949/pentagon-reviews-gps-data-after-soldiers-strava-tracks-are-seemingly-exposed.
[27] Holder, "Who Maps the World?"
[28] See News Office, "Study on MOOCs Provides New Insights on an Evolving Space," *MIT News*. Last modified April 1, 2015, http://news.mit.edu/2015/mit-harvard-study-moocs-0401 and Suemedha Sood, "The Statistics of Studying Abroad," *BBC*, last modified September 26, 2012, http://www.bbc.com/travel/story/20120926-the-statistics-of-studying-abroad.
[29] "General Info," *Wheelmap*, accessed December 27, 2018, https://news.wheelmap.org/en/FAQ/.
[30] Ibid.
[31] OpenStreetCam, "Get the OpenStreetCam App!" *OpenStreetCam*, accessed January 29, 2017, http://www.openstreetcam.org/map/.
[32] Though trails can be public, information about them is usually closed off because of that data being owned. Such is the impetus for a range of recent trail mapping mapathons.
[33] Forlano and Halpern, "Reimagining Work," 43.
[34] Jan Erik Solem, "Celebrating 200 Million Images," *The Mapillary Blog*, October 5, 2017, https://blog.mapillary.com/update/2017/10/05/200-million-images.html.
[35] Andrew Mahon, "Anyone Can Teach the Computer: The Mapillary Verifier Tool," *The Mapillary Blog*, October 18 2017, https://blog.mapillary.com/product/2017/10/18/mapillary-verifier-tool.html?t=1&cn=ZmxleGlibGVfcmVjcw%3D%3D&refsrc=email&iid=f30c4dc3cb144599a0e7a7312d9a691f&uid=882256282396262401&nid=244+272699400.
[36] Solem, "Celebrating 200 Million Images."

[37] Forlano and Halpern, "Reimagining Work," 44.
[38] See *MapRoulette*, http://maproulette.org/; Martijn van Exel, "Find your MapRoulette Challenge," July 21, 2017, http://blog.improve-osm.org/en/2017/07/find-your-maproulette-challenge/; and Martijn van Exel, "MapRoulette Popular/New Challenges," September 12, 2017, http://rtijn.org/maproulette/.
[39] Williams, *Keywords*, 94.
[40] This is certainly not exclusive to these mapping communities and is a notable trend in a range of contemporary vocations. See Gregg, *Work's Intimacy*.
[41] See Perkins, "Plotting Practices and Politics," 311.
[42] See Suvi Alt, "Beyond Bricks and Mortar: Peace-Building in a Permanent State of Adaptation," in *The Biopolitics of Development: Reading Michel Foucault in the Postcolonial Present*, ed. Sandro Mezzadra, Julian Reid, and Ranabir Samaddar (New Delhi: Springer, 2013), 91.
[43] Suchman discusses how Silicon Valley often ignores different geographies and temporalities and, as such, fails to see where truly transformative, situated work in technological development is occurring. See Forlano and Halpern, "Reimagining Work," 43, and Anita Chan, *Networking Peripheries: Technological Futures and the Myth of Digital Universalism* (Cambridge: MIT Press, 2013).
[44] See Robinson, *Global Capitalism and the Crisis of Humanity*, 17.
[45] Eve Tuck, "Suspending Damage: A Letter to Communities," *Harvard Educational Review* 79.3 (2009)
[46] Digital Democracy, "Our Approach," *Digital Democracy*, accessed January 29, 2018, https://www.digital-democracy.org/mission/.
[47] Emily Jacobi, "Reflecting on 8 Years of Digital Democracy," *Digital Democracy*, accessed January 29, 2018, https://www.digital-democracy.org/blog/reflecting-on-8-years-of-digital-democracy/.
[48] See "Portable OpenStreetMap," *OpenStreetMap Wiki*, accessed November 29, 2017, https://wiki.openstreetmap.org/wiki/Portable_OpenStreetMap; "Portable OpenStreetMap - offline mapping and field enumeration," *GitHub*, accessed November 29, 2017, https://github.com/posm/posm.
[49] Douglas Terry, David Goldberg, David Nichols, and Brian Oki, "Continuous Queries over Append-Only Databases," *Association for Computing Machinery* (1992), 321-330, http://www.cs.brandeis.edu/%7Ecs227b/papers/pubsub/TGNO92-Continuous.pdf.
[50] Darren Shaw, "Kappa Architexture on Blue Mix," *IBM*, December 21, 2016, https://www.ibm.com/blogs/emerging-technology/kappa-architecture-on-bluemix/.
[51] See Daston and Galison, *Objectivity*, 9, 10, 17, as well as Burnett's application of these points specifically to the use of cartography in colonial exploration in *Masters of All They Surveyed: Exploration, Geography, and a British El Dorado*, 100, 106.
[52] Latour, "Drawing Things Together," 56.
[53] Ibid, 75.
[54] Harvey, *Cosmopolitanism and the Geographies of Freedom*, 134.
[55] Ibid, 134.
[56] Jake Kosek, *Understories,* 165.
[57] Ibid, 169.
[58] Harvey, *Cosmopolitanism and the Geographies of Freedom*, 135.
[59] Ibid, 137.
[60] Presner, Shepard, and Kawano, *HyperCities*, 86.
[61] See Williams, "The Technology and the Society," 11.
[62] Dhanashree Thorat, "Colonial Pasts and Techno-Utopian Futures" (presentation, Global Digital Humanities Symposium, East Lansing, MI, March 22-23, 2018).

[63] See Stuart Umpleby, "Citizen Sampling Simulations: A Method for Involving the Public in Social Planning," Policy Sciences 1 (1970): 361-375.
[64] Timothy Nyerges, Robert McMaster, and Helen Couclelis, "Geographic Information Systems and Society: A Twenty Year Research Perspective," in *The SAGE Handbook of GIS and Society*, ed. Timothy N. Nyerges, Helen Couclelis, and Robert Brainerd McMaster (Los Angeles: SAGE, 2011), 4.
[65] Lucy A. Suchman, *Human Machine Reconfigurations: Plans and Situated Actions* (Cambridge University Press, 2007), 176.
[66] Ibid, 186.
[67] Perkins, "Plotting Practices and Politics," 314.
[68] Ibid, 313.
[69] Ibid, 314.

CHAPTER 7

PUBLIC LAB

Introduction

In speaking about my experiences with HOT during an interview, one Public Lab member would point out what I had long suspected was the shared sentiment of Public Lab figures, especially considering this shared fluency and Warren's foundational stances: that the difference in goals between "authoritative data" for a requesting organization and "community autonomy" result in different community models. The "dream" to this user, though, would have two dedicated groups within a grassroots model working as part of documentation of a large-scale event – one that would survey on the ground, another that would be well-versed in stitching remotely. This is not so different from HOT's model, and is in part due to the difficulties of stitching.

These are nested in tensions surrounding the platform's design, which tries to balance between what aspects of stitching get automated and what gets left in users' control. The more left onto the user in these responsibilities, the more labor is involved, and that can be particularly taxing if one's accumulated images provide a large sample to work with. It is not unusual for thousands of images being captured within a given trip, depending on the project at hand. These considerations mandate thinking through the complexities of the image archives underpinning public-produced digital maps and the means of their production, as the preface advocates.

Public Lab members have diverse backgrounds. Its initial membership included urban issues activists, artists with broad technological literacy, aerial imagery enthusiasts, and academics with interests in public-led environmental mapping. One of these early members noted the one shared

fluency among this early network was a knowledge of how to build – not just in the sense of technological infrastructure, but also community infrastructure.

Despite the community's evolution, interest in mapping persists. One founding member's professional efforts have largely coalesced in constructing a database to "map" fracking impact. This member conveys "thinking about maps for a long time" within their research, specifically "how databases can be used as maps" and thinking through both as modes of argumentation. This member and the member's mother came up with the name PLOTS (The Public Laboratory for Open Technology and Science) for the community in part as a reference to mapping – reflecting the project's original focus and continued resonance with mapping. Beyond thinking about databases as maps, the member also sees wiki comment functionalities on such work and sites like Public Lab as a further mode of mapping – as a mode of dialogism that can be used to trace connections. Extending from the discussions contained in the preface to the work of each of the body chapters, the need to think about maps not just in terms of data, but dialogue mandates looking at myriad facets of the interfaces that underpin such work – comment functionalities, review standards, modes of etiquette, member events, and so on – for the interactions they sponsor. That requires a deep dive into community operations via participant observation that prior studies on digital mapping have lacked.

Public Lab projects can rely on previously mentioned apps, including Mapillary. An example lies in fish pole mapping, wherein the app helps supply high-quality street view imagery as it does for OSM surveying. Others rely on more creative means, like attaching GoPro or GoPro knockoff cameras onto rubber ducks tied onto a line for a "fish eye view" – a nonhuman perspective. As one member put it, "A lot of the data you're looking for is incredibly subtle – the camera you use matters." The use of such apps – in a turn evident from Chapter 3's discussion of the DroneLab app on – manifest a turn on data harvesting implications in contemporary data economies noted in the

introduction and users' app use that help define the alternative nature of grassroots work in relation to such formations and technologies.

The need for Public Lab's grassroots approach, however, is far from universally recognized. Early in my research on Public Lab, the community held an OpenHour on aerial mapping to commemorate its then-recently launch of a Kickstarter Gold campaign for mini-mapping kits. The emphasis of the OpenHour call, though, was on cultivating projects, rather than cementing technical approaches in use of the new kits. One of the questions that arose during the call was how to persuade others that producing and utilizing one's own aerial imagery is a worthwhile civic practice. The need for persuasive arguments is likely due to Google's extensive imagery archive.

Yet the marker of ideally captured grassroots imagery can ultimately be its incorporation into Google's imagery archive, as various retweets from Public Lab indicate. One person on the OpenHour call was quick to clarify that when one critiques Google Maps imagery, they are actually critiquing federal agencies' aerial imagery aggregation rather than solely Google. This begins to show that what is constructed at the level of discourse about the relation such work has to dominant platforms and the work of governance – the focus of Chapter 4 – does not always reflect the realities of how that work translates into use by such forces. This member explicated such imagery is almost exclusively captured in the winter. For that member's restorative work on rivers, this timing misses telling facets of vegetation. The state perspective, in short, fails to capture the richness of nature (as Scott points out), in ways that would speak toward its protection.

Members espoused that there is no such thing as a bad aerial view. It is simply a matter of how it gets layered in, be it over historical data or scaled differently. In this capacity, Google layers get categorized as an "intermediate," not as a polar opposite to grassroots work. But the real-time thrust of grassroots techniques is obviously distinguishing and is well-encapsulated by the Make Gowanus Great Again Project, which I first heard of during the OpenHour call. The title of the

project, an offshoot of Public Lab's work within its New York contingent, parodies Trump's Make America Great Again campaign slogan. The community's balloon mapping efforts on the Gowanus Canal toward ensuring the EPA's Superfund status for the Gowanus canal ended up discovering not only aspects of the area the EPA missed, but also cement cracks that would go on to reveal the location of a burial ground for Revolutionary War veterans. The Gowanus Canal research, which sought environmental protection under the American Battlefield Protection Program, now runs up against areas Trump senior advisor and son-in-law Jared Kushner owned and sought to re-develop. The group's work manifests a notable and well-publicized Public Lab-led aerial mapping project engaging in the politics of the moment.[1]

Public Lab mapping in rural and prairie contexts receive far less coverage. A Public Lab barnraising event had just been held on the Appalachian region at the time of the call. Barnraising sessions focused on collecting oral histories to determine the health of mining families generation by generation, promoting watershed advocacy, logging data, mapping with squid kites, and tracing oversights in environmental management. The stated point of these sessions was to imagine scenarios, goals over time, and elaborate on questions entangled within those goals.

One Appalachian project discussed in the OpenHour seeks specifically to narrate the region's spaces through both on the ground initiatives as well as via drone capture, particularly of local coal mines. This struck me as a documentary application quite similar to that of *Hollow*, examined in Chapter 3. But unlike *Hollow's* continued mantle of grassroots mapping as a descriptor, the presenter cautioned that the project was less about mapping and more so encompassed an analysis of aerial imagery, as could arguably be the case with much of HOT and OSM's work in its resonance with the trace rather than the rhizome.

The project collaborated with SkyTruth, a satellite imaging and monitoring service that touts applications toward mountain region surveying. SkyTruth can trace not only coal mining but also

uranium extraction and tar sand assessment.[2] As the presenter conveyed, part of the reason for this partnership was pragmatic. While on the ground mappers might face imprisonment for trespassing or may be subject to UAV regulations depending on how they map, collaboration with such an aerial remote imaging company sidesteps these issues. Partnerships behind Public Lab projects, like those of HOT and OSM, can feature government and corporate entities prominently, again contrasting from the posited constructions at the core of Chapter 4.

Chapter 6 covers complexities inherent in OSM's crowdsourcing model for public interventions as it becomes increasingly "off the ground." I return to Public Lab's work, previously discussed in Chapter 4 to further demonstrate the discursive ties of grassroots mapping, in this chapter, which reviews the kinds of negotiations embedded within surveying and creating maps on the MapKnitter interface as well as the institutional value such work has. This chapter not only focuses on the technical practices involved in grassroots mapping, but also the spaces (online and offline) and pedagogies such concerns circulate within. I begin this chapter by analyzing MapKnitter submissions and Public Lab notes over a six-month span. I then survey some of the spaces Public Lab has operated within. This includes MIT's Center of Civic Media, where Jeff Warren was a Master's student when he devised grassroots mapping; a makerspace that has run Public Lab workshops from the start; and an EDGI workshop toward drafting a statement of concerns relevant to environmental monitoring.

Through participant observation, this chapter highlights common threads between these spaces and analyzes community activity online over a six-month span. The former namely includes a multidisciplinary and humanistic pedagogy toward technologies and their ramifications. The need for narrating and managing data differently itself involves a different pedagogy for technology and data. Maps, as explored in Chapter 4, can be modes of action and not merely matters of rhetoric within such pedagogical transformations, and I explore how this logic follows in texts seminal members

reference. I dedicate the rest of the chapter to my experiences prototyping the new mini kite kit and experimenting with MapKnitter. I convey how grassroots mapping practices work and how they present a tactical means of aerial imagery capture precisely because of their ecological (as opposed to "parasitic") dependencies. These dependencies open up a variety of rhizomatic capacities.

Community Maps and Research Notes

Submissions I analyzed over a six-month period substantiate Public Lab's claims of being global in scope. Over 52% of its maps were of areas outside of the United States. However, there were more active nodes of mapping in the US than in other countries – meaning there were more US areas repeatedly being mapped over that span than in other areas across the globe, mainly featured in one-off projects. Many were schools and universities, the most prominent arguably being the University of North Carolina at Chapel Hill. Students produced these particular maps as part of a lab for a UNC geography class.

Over 44% of map authors were anonymous. Public Lab takes the right of mappers to publish anonymously seriously. It recognizes that the publishing of maps is always politicized, and the ability to publish anonymously and assuage privacy concerns is necessary. One in five submissions in this period, however, were spam. Almost all submissions including descriptions (only 27% in total), wherein mappers can ideally specify what they are monitoring, important facets of the mapped area, or the particular technologies and approaches employed for the capture, were part of spam maps promoting businesses ranging from home décor, repair, and essay writing services. Ironically, anonymous authorship to protect mappers and communities where mapping could prove dangerous enables unwanted advertisements.

"There sure are a ton of spam maps on mapknitter.org," one concerned member wrote to begin a thread on the grassroots mapping email listserv, another mode of communication for community members to share events, questions, articles, and research results. One prominent member offered reasoning for why authors can publish anonymously without dismissing the identified problem: "We've long allowed anonymous map creation to help people remain anonymous, but I think it may be causing enough trouble that we need to re-evaluate." The author of the original post later responded, "I am in favor of anonymous mapping. I just think maybe moderators can delete the advertisements for Soapy Dog Pet Wash and Better Call Saul Law Firm." Since the six-month span of data collection, Public Lab has updated MapKnitter with a tool for members to mark maps as spam. Still, the prevalence of spam in the data collected is notable given the tactical framing of grassroots mapping and MapKnitter submissions.

The prevalence of incomplete submissions (which I define further later) and maps of developed areas are other issues. Only two maps in a six-month span, for instance, came from Urbana-Champaign or central Illinois in general. The only local map was a self-proclaimed "test map" with the wrongful attribution of "uabana" [sic]. The other map was from Danville, IL. The prairie is vastly under-mapped in such grassroots maps, echoing points about the rural evident from the OpenHour call.

Questions and research notes posted onto the site from this period equally underrepresented the prairie. Only one from this span centered on the region. The author – a foremost figure in championing environmental activism in Champaign-Urbana since the 1960s, one I briefly spoke to at a local event on environmental activism – notes that since local weeds have evolved to resist Roundup applications, companies are back to using more harmful herbicides. While their potential for polluting nearby towns is largely known, there remains no widely accessible means for residents

to test concentrations for themselves. Though the user finished with a plea for help from the community, the user heard no response back.

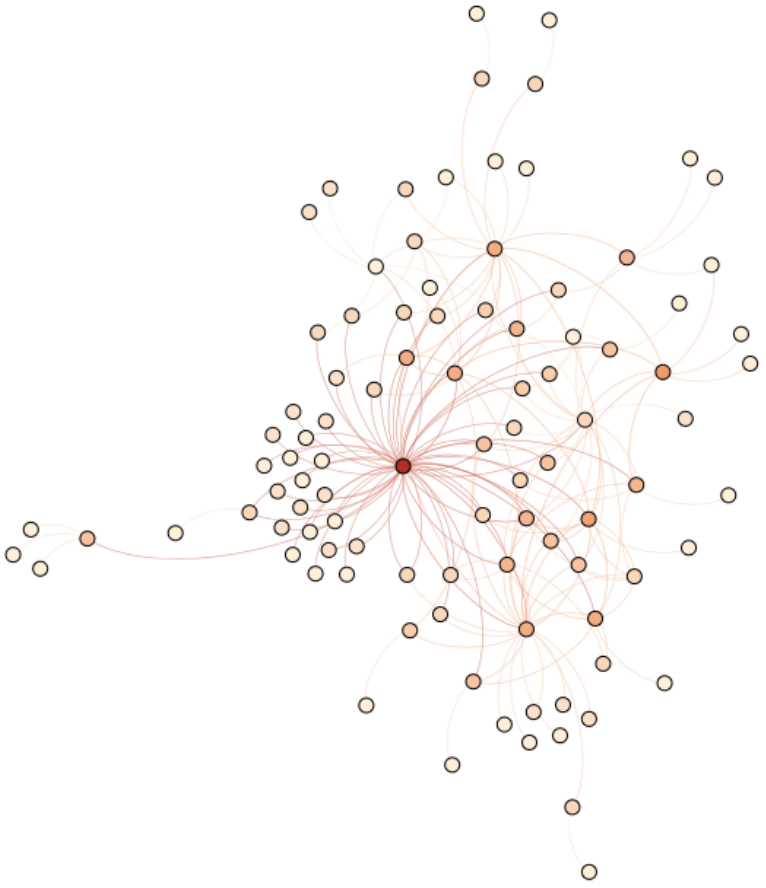

Figure 7.1: A visualization of Public Lab research note contributions over a six-month period. Node colors are deeper depending on the degree of the user's contributions, which can also be seen in how well-connected a given node is to others in the visualization.[3]

When one reviews research notes, the close knit and highly concentrated nature of the community becomes apparent. While about one in three notes receive no comments, in those that receive two or more (about one in five), eight users emerge as key cogs in the site's dialogue. They represent less than a tenth of the total contributors over a six-month span of notes I reviewed. Many of those select users serve in formal roles in Public Lab. In the network, it is clear one user, demarcated in the network visualization below through the node of deepest red, pens or is present

in a great deal of the online interaction.[4] While I review the content of these notes in the next section, I include the visualization in this section to establish the highly concentrated nature of Public Lab work – which, again, accords with that of other popular platforms for nonexpert collaboration.

Community Conversations

Research notes go beyond matters of environmental monitoring. They can reflect on the ethics of community work, on technical matters for the website, and on different barnraisings or workshops. But a common topic in research notes from this period is hydrogen sulfide. One Public Lab page documents related harmful and potentially odorless emissions from oil fields and spills, sewage leaks, car battery leaks, and manhole fumes. Aside from an added reading described as only being available "behind a paywall," the page includes linked news coverage to illustrate such incidents. In such instances, Public Lab work encompasses a gathering of knowledge around matters of concern in a broader environment of information capitalism in which a great deal of the available knowledge is closed and proprietary.[5]

Research notes I gathered on the issue included compilations of state by state regulations and classifications of hydrogen sulfide emissions, but mostly focused on where and how to collect hydrogen sulfide samples best and most safely. These exchanges particularly emphasized different speculative designs for testing hydrogen sulfide that were straightforward in their construction and cost-effective. Various prototypes, for example, used copper plates to test oxidation levels.

A great deal of discussion centered on using acetone (which can dissolve with both water and oil) to prep the copper. Acetone is widely available, being a prime component of various nail polish removers. The interest in acetone reflects the "punk science" resonance Chapter 4 discusses.

Members' interest in commercial options was also high, with several notes on wearable sensors and air testing via SUMMA canisters. Members also noted, though, that LABB's aforementioned methods are comparable and more cost-effective. Community members can at times thus criticize such proprietary methods not only for being more closed off, but less effective.

IP and legal considerations also often crop up in Public Lab research notes. In one research note discussion thread, for instance, a member brought up a recent high-profile lawsuit against ResearchGate. In this lawsuit, five publishing companies comprising The Coalition on Responsible Sharing insist ResearchGate remove published articles for which it is unauthorized to provide access.[6] The note questioned how and if articles posted to ResearchGate can be shared on Public Lab's website.[7] The note also highlights a *Nature* article in which a group of environmental scientists describe their switch to more open methods via R not only to make their approach more legible to affected publics, but also to themselves. This recognizes the need for legibility that means of data collection in which stations of power invests, but places the question of legibility for whom – bodies of management or communities of impact – front and center. To this end, the switch added to the replicability of the researchers' approach and to the efficiency of the project at large, mirroring the benefits in open source methods for scientists and lay publics.[8]

A separate note discussed legal dimensions surrounding the ethical co-ownership of data by researchers and impacted communities within IRB. One member narrated their own struggles in their role with a community organization and a collaborating university claiming ownership of the data garnered through the collaboration. Another prominent member of Public Lab noted the irony of IRB ensuring informed consent in theory but often withholding information and restricting agency to communities within such practices.

Such issues also emerge within Wylie et al's account. Following Public Lab's pattern of forging identity through contrast, the authors repeat how the production of grassroots mapping

images differs from that of satellite imagery and contrast it from a project out of Rensselaer Polytechnic Institute (RPI). They deem IP and disciplinary silos key parts of the lack of public involvement in research efforts. Though it had similar philosophical and technological principles as Public Lab, the RPI project (which goes unnamed) partnered with a lab RPI typically utilizes toward commercial collaboration. The authors purport the lab "quickly locked into a classic pathology of engineering customized platforms," leading to a significant dispute over whether project content should be open or copyrighted.[9] The characterization of closed platforms in the academy as a "pathology" signals a pervasive problem. It mirrors the characterization of the "parasitic dependence" Warren identifies within neogeography on proprietary spatial capture.

Though the open source interests of the collective won out, the struggle strained relations with the lab. It compromised how the project's technology worked due to it being developed all along under two different models. The authors deem the interests "inherently misaligned" while highlighting the "rich diversity" universities have and how they are "severely restricted" by IP policies. They contrast "[w]hat could have been" with "assertions of how science and technology development 'ought' to be done."[10] It exposes assumptions within the academy on the nature of research and evaluates these presumptions as hindering civic projects. This is in large part why such projects are moving away from formal institutions and onto open platforms.

Aside from these issue-based explorations and community conversations, research notes can outline "activities" – sets of guidelines toward kits, tools, and experiments that members are encouraged to replicate and comment upon their own findings. In a note hoping to generate interest in having users edit activities posted to Public Lab, one member notes that activities should have a defined goal; list necessary supplies; present a thorough procedure outlined for how to accomplish the activity; provide multiple checks throughout the procedure for participants to know that their work is where it should be; detail possible outcomes; and posit further questions that may come out

of the activity. Public Lab encouraged members to go through published activities and to offer constructive criticism and assistance based on these benchmarks. These calls for replication and feedback justify the characterization of the site as dialogic.

Lastly, various research notes focus on internal community dynamics, from current events and platform suggestions to updates to the site itself. Toward the former, posts on the latest in the net neutrality debate at the time stand out from the data collected. Toward the latter, prime examples include organizing the feed the site provides members upon logging in to highlight "legitimate" research as well as Google Summer of Code (GSoC) projects, prominent within research notes. GSoC projects from this time include an improved image processing library; an improved email notification system that does not clog users' inboxes; a map that pins relative (not exact) locations of Public Lab projects; a comments functionality that allows users to comment on specific sections of a research note rather than simply at the bottom of the research note; and a chatbot for the website. Research notes from this span thus demonstrate Public Lab's ties with Google and how the site functions as a social technology for the community, aligning with assertions of Wylie et al and community opinions on site functionalities.

Outside of these virtual modes of dialogue, much of the formal face-to-face conversations between community members occurs at annual barnraising events. Barnraising events, like traditional conferences, are organized into different sessions, but differ in being more conversational toward pinpointing problems Public Lab's approach can address. Be it through speculative tools, research procedures, or recommended resources, they imagine tactics through which members can immerse themselves fully in the dynamics of a given problem. Members often compile reflections and experiments from barnraisings within Public Lab research notes.

Barnraising sessions at the last LUMCOM barnraising in Louisiana focused on disaster response efforts; using grassroots mapping tools; DIY microscopes; collaborating on kit guides,

outreach efforts to new members; reconfiguring GoPro knockoffs promoted toward the new mini kits as infragram cameras as well; and data logging and sensors. There were various material products developed as a result of the proceedings, including one member's microscope build. The design featured parallel LEDs on a popsicle stick and a microscope enabled by a Raspberry Pi camera with the lens taken off.

The interests of those attending were varied. Regardless of their interests coming into the event, many who attend the Barnraising events find this approach different and inspirational. One retrospective began with a member's reflections from childhood "at the front lines of climate change in the United States" in Louisiana, with so much of coastal New Orleans losing its coastlines and its marshes. But there were equally attendees without this level of personal knowledge, be it from other areas of the United States or from China or the United Kingdom.

The user's research note deemed the barnraising model well-suited for the problems coastal Louisiana faces from "exploitative . . . resource extraction," with communities adopting "a culture of resiliency and self-sufficiency" in response to ecological and capitalist crisis. It is within this resiliency that this particular member expresses hope that coastal Louisiana can serve as a laboratory for needed accessible technologies when climate change hits more and more areas over time. Indeed, Louisiana is a precarious environment used to justify a more flexible and citizen-driven approach to crisis management, equally seen in developing and rural contexts such as Alaska.

The critique again lies in how state spatial perspectives are too distant and isolated, more interested in maintaining oversight and establishing legitimacy over space from afar rather than allow impacted communities of practice on the ground to help decide for themselves what the right kind of response should be. The aforementioned research note conveys this thusly:

> open source, accessible tools are necessary in order to rapidly and thoroughly document a vulnerable landscape. Governmental organizations simply do not have the most important

> resource to complete the tasks at hand: they lack the sense of purpose, the ability to create place, and the inherent power residing in a group of people united.

This critique, which carries over from constructions Chapter 4 establishes, is pervasive in many of the spaces and events in which Public Lab operates, which the next section overviews. I begin with the institutional space from which it in part began and expand from there to show how different settings for Public Lab's work resonate with the humanistic, the pedagogical, and the postmodern.

Spaces of Pedagogy, Governance, and Environmental Data Justice

MIT's Wiesner Building, which houses the Center for Civic Media program among other lab spaces, is named after Jerry Wiesner. Wiesner became President of MIT in the 1970s and built the impetus as president for the Media Lab – a focal part of his legacy of multidisciplinary programs and centers at MIT – and a sustained engagement with the arts. These moves are key to how Wiesner is remembered. A commemorative exhibit inside the building heralds Wiesner as "the quintessential Renaissance man" and "an insatiable humanist." He helped develop radar at MIT amid WWII, shaped science policy at the federal level, and forged key relationships for international and corporate support for the Media Lab.

Wiesner's fondness for problems he saw as meriting multidisciplinary solutions, including calming Cold War nuclear weapons development (which MIT itself participated in), led to the development of multidisciplinary at MIT. The exhibit claims that this is especially the case with arts development at MIT under Wiesner's stewardship, centered on "humanizing" MIT. MIT developed the List Visual Arts Center, housed in a connected space, in tandem with the Media Lab.

Public Lab tactics, thinking through matters of public data and access to proper means of visualizing it, bridges many of the concerns of this space. The "organic" platform and mode of

production Public Lab embraces helps to constitute a multidisciplinary assembly that complicates structures behind scientific knowledge production within humanistic considerations. The emphasis on craft – on assembling and stitching – is equally artistic and performative, distinctive from the conventional construction of scientific knowledge production as objective.

Not far from the Wiesner building, a local makerspace that partners with Public Lab shows how these concerns translate into pedagogy. On visiting the makerspace, I met with one of its workers, who has been involved with Public Lab from the start and whom I will refer to as Seth. To Seth, the makerspace practices an "autonomy-based pedagogy." He defines this model in how the makerspace offers classes "based on suggested interests" and creates "a culture of empathy."

After Seth guided me through different stations of the makerspace (including, but not limited to, painting, woodwork, and sewing stations) and the makerspace library, he pointed out that the makerspace sticks to what he calls a formal method. To him, a formal method stipulates what can and cannot be done with the tools at children's disposal. I noted the stoplight-inspired color coding the makerspace uses for its tools to convey the degrees to which different tools require adult supervision. An informal method (what some might call an "anything goes" approach) has implications aside from those of safety to Seth – it would leave children confused about what would be possible with the tools at their disposal. These concerns of method match up with the aims of fostering technological and data literacies within the maker movement at large. This need for formal method is also notable within HOT and OSM activities, as request protocols and IP strictures can put bounds on work that can sometimes stifle interventions but can also safeguard in the name of ethical data maintenance or generate the impetus for creating productive workaround approaches that can eliminate "blank spots" of data for communities of impact.

Public Lab events at the makerspace, though irregular, constitute most of its adult education programs. Additional adult-centered programs are fixing events that teach adults how to repair

broken tools and teacher meet-ups. Seth equates the makerspace with Public Lab as part of what he calls the "first generation hackerspace movement," as the two started up at the same time. He hazards a guess at how he met one of the foremost figures in Public Lab (whom I will refer to as Robert) as he walks me over to Robert's office in a shared elementary school space the makerspace and Public Lab both use.

I first met Robert during the OpenHour session on aerial mapping. My conversation with Seth and Robert Much as that session was not primarily about technology or making, my conversation with Seth and Robert concerned the nature of contemporary education far more than more obvious considerations. It started with a critique of formations with educational technology, with corporations like Microsoft mentioned as taking the lead. The general critique Seth and Robert launched was that this should be a "bottom-up" approach, rather than communities having to abide by what technologies such large corporations provide enable or disable for instruction. The "one size fits all" nature does not attend to the situated nature of the community in play and how it might be best to facilitate educational instruction to disparate audiences.

Learning is an everyday and fully sensory engagement that, as John Dewey notably writes about, necessarily extends beyond the classroom. Immersive learning opportunities are thus dependent, in the words of Bertram Bruce, "more upon our pedagogy than on our technology."[11] The frame of pedagogy, while evident in views espoused thus far, stretches beyond the views of seminal Public Lab figures into user applications of its techniques. When one reviews locations mapped the most during the aforementioned six-month span, many are schools, with such mapping tactics being a part of the making initiatives growingly becoming a part of elementary and secondary education. One of these is a private episcopal grade school in California. The school spotlights its interdisciplinary efforts in sponsoring a making environment for its students. On a webpage where the school highlights these pursuits, it even includes a quote from Dewey: "Give the pupils

something to do, not something to learn; and the doing is of such a nature as to demand thinking; learning naturally results." The frame of making and crafting that projects like Public Lab inhabit is a deeply pedagogical investment, one that critical theorization of technology and pedagogy anticipates that has an intellectual basis within theorization of educational technology.

Robert and Seth also reflected on a common text amongst the two and other local members: *Blueprint for Counter Education*, by Maurice Stein, Larry Miller, and Marshal Henrichs. None of the members ever opened the book; it remained wrapped in plastic. The book is one Robert explains drew people's attention coming in and out of Public Lab for different reasons, just by the title alone and its original placement above Robert's desk. Even with it being unopened, Robert found members' shared curiosity in the thrust of the book telling.

Even for its time, being published in 1970, the *Blueprint for Counter Education* was a highly experimental text. It presents a "counter-university" that it claims "makes obsolete the traditional university process."[12] Its recent reprint is a box set with three experimental posters mapping out work in modernist and postmodernist critical theory (placing particular emphasis, as the book does, on the work of Marcuse and McLuhan); the original text; and a book of interviews spanning the decades since the original publication.[13]

Blueprint for Counter Education used these thinkers to show "that powerful and novel ideas were being introduced . . . by both." The authors present both thinkers "as central organizing positions for all of post-modern radical thought." They position Marcuse via two terms: the mythopoeic (referencing the creation of alternative myths) and the structural (describing the relation between parts that constitute a whole). The terms they assign to McLuhan are technoanarchist (promoting self-governance using technology) and communitarian (situating the self in community relationships). The authors hope readers use both camps as a mode of self-discovery – to meditate on the modern and generate counter-positions toward participating in the postmodern with a

"participatory counter-language." The reader here is as much producer (or maker) as reader – what the authors fashion as the "reader-player."[14] Considering the findings from Chapter 4, one can say that Public Lab's brand of counter education in working outside of traditional institutional structures toward more equitable research practices seeks to place the user as a reader-player in the sense that the user ideally becomes both a consumer and producer of geospatial data.

The *Blueprint for Counter Education* encourages students to create their own maps of theory through their own sets of practices, participatory actions, and contexts. Pedagogically speaking, in approaching the postmodern, *Blueprint for Counter Education* incorporates play to test out theory (as Public Lab does through speculative design of community monitoring tools) in relation to the subjective and to lived experience.[15] These investments align with Dewey's philosophies on connecting pedagogy to life experience.

To Bruce, Dewey's educational views, partially inspired by Jane Addams, are ultimately in support of "a vision of education in relation to the social organism" – in other words, feeding back into the communities where learning takes place. Here, the school becomes a social institution that can fit the community's needs, with community interests informing the curriculum. In this vision, learning bridges between the academy and other spaces of cultural life (be they vocational, recreational, or familial). It questions the notion that these realms of life are disparate, as the ontological charge of this project laid out in the introduction would equally place in question.[16]

This dissertation has already established how Public Lab's work inherently underscores the need for the kinds of organic intellectuals that these interconnected modes of cultural life call attention to, with pedagogical, political and cultural matters being everyday matters of "the social organism." But in my discussions with Robert and Seth, there was also a comparison of Public Lab and critical making groups to an "adhocracy" as its work relates to political life. Politicians have

invoked the term in contemporary times to identify alleged quick and short-sighted economic policy decisions, particularly early in the Obama administration.

Adhocracy, as thinkers like Warren Bennis and Alvin Toffler originally developed it, refers to spontaneous networks of diverse experts around more sudden problems. Disaster response projects like those in HOT, for instance, are notable adhocracies. They form around particular occurrences and dissolve when the need for response is over. They are modular given the precarious nature of what they respond to – a clear contrast from bureaucracies.[17] Public uses of GPS and mapping can thus challenge traditional organizational structures toward enhanced efficiency and rework the conventional ways they produce environmental knowledge.

The emergence of online collaboration to handle more rapid and flexible production models in a growingly precarious environment is hardly exclusive to disaster management or scientific knowledge production.[18] Public Lab, adopting a workflow reflective of its beliefs in critical data consumption as seen in Chapter Four, serves as an adhocracy that favors interdisciplinary collaboration (the organic society), rather than traditional specialization (the mechanical society), as the key to innovation.[19] It is here that I would argue Public Lab's fit with the legacy of the Center of Civic Media and the MIT Media Lab becomes clear.

Before leaving to host an OpenCall with Public Lab on contributing to the Harvey relief efforts, Robert also brought up another local space Public Lab uses.[20] He described this space as a "room full of voluminous crap" and referenced the Harry Potter universe in comparing the space to the Room of Requirement.[21] Though likely meant to convey the sheer amount of material at one's disposal in the space, I connected the remark to what Robert and Seth espoused about education. In the Harry Potter books, the Room of Requirement is a hidden room in Hogwarts, the school the protagonists attend. It is an unconventional space, appearing when a student is most in need of it. The room contains a plethora of different resources for a given student or group of students to train

toward a solution to whatever problem they are facing. The reference seemed salient in understanding the purpose of the spaces Public Lab operates in – to help foster a deep, situated, problem-oriented pedagogy.

One of the more recent spaces Public Lab has found its work part of lies with EDGI. EDGI gained traction via various white papers and their annotation of a speech by Scott Pruitt, Trump's former EPA Director, that Newsweek published. Public Lab sponsors EDGI, which emerged from a chain of emails one of its lead figures sent to colleagues in the aftermath of Donald Trump's 2016 presidential election victory.

The concern of this network grew as government websites bore more and more revisions in the amount of information and data available concerning environmental protection as well as the mission descriptions for environmental government agencies. One example EDGI highlights is of an EPA page on sustainable water infrastructure that cut a phrase at the end of the original description about lessening climate change impact, which left the sentence only emphasizing a charge to reduce costs. With this, an elaborative phrase from the original description would be stricken from the public record if not for the group's website monitoring.

Lefebvre anticipates the potential for such censorship in his criticisms of state operations as encapsulated within autogestion. The edits to these websites restrict vital information flows about human-produced climate change. EDGI sees these discursive trends within the Trump administration (equally a focus of the Make Gowanus Great Again project) as reflecting the administration's oversights at the level of policy.

EDGI's efforts involve extensive archiving, website monitoring, and interviewing of federal employees at environmental agencies, as well as running workshops in support of its data archiving and drafting efforts to spread the word on its values and organizational efforts. The subject of an EDGI workshop I attended, one Public Lab highlighted on its events calendar and with many

prominent Public Labbers in attendance, was on formulating a statement on Environmental Data Justice (EDJ). EDJ encapsulates how the great majority of environmental data is so industry-produced that it can prove counterproductive for the communities of concern it seeks to address.

While there has been a growth of alternative platforms and tactics with the rise of the internet as an environmental technology that can inspire environmental justice, they are not necessarily maintained by the identity groups most affected. OSM contribution patterns are certainly resonant here. But more broadly speaking, government organizations like the EPA, whose negligence exacerbated environmental justice in the first place, often oversee such alternative projects. Such contradictions align with paradoxes that constitute constructions of a supposedly "colorblind" or "post-racial" internet which suggests how technological development and the lifting of barriers to participation (among other formations) means that problems of identity have now been superseded rather than further reinforced.[22]

EDJ serves as an injunction against the emergence of "damage-based research" in not only environmental research, but the social sciences writ large. The term references a paradigm of social science inquiry which reifies the status of "marginalized" communities as inferior and unable to co-construct research agendas into spaces of everyday life that may present their subjectivities, communities, and practices in a harmful way. This skirts aforementioned visions of pedagogy as active and everyday. Further, it reifies these communities and their spaces as, in Eve Tuck's words, "defeated and broken."[23] Tuck further quotes from bell hooks to underscore these communities are invited into dialogue with researchers and the public only to recount experiences of cultural trauma or pain. That trend further reproduces how spaces are racialized to frame racialized subjects either as criminals or victims.[24]

Tuck's work was one of various assigned readings in preparation for the aforementioned workshop, and an appropriate one considering critiques many active members of the Public Lab

community mount. Workshop participants placed comments on post-it notes on four whiteboards with the following headers: consent/refusal; criticisms/calls for dismantlement; creating otherwise and alter-politics; and practices of care. EDGI collated these comments toward drafting tactical considerations for environmental research toward an eventual publication on definitions and practices associated with environmental data justice.

The consent/refusal board took the topic in various directions, from nonhuman consent and the right to be forgotten to pedagogies of data, consent, and mapmaking. I brought into the discussion much of the work I had noted from Chapter 4 from Lippincott on the ethics of data capture within grassroots mapping and the necessity of the right to opt out by the community being mapped. An STS scholar within the group responded with a Foucauldian connection – that of the liberal political subject who consents and then gets instrumentalized to serve broader programs. Mappers' use of .gpx tracks to optimize standing OSM representations, for instance, consents to use of personal data ecologies to improve an interface ultimately used by corporate and state actors.

Considerations participants listed in the practice of care group focused on what care looks like in distributed knowledge networks. This includes maintaining respect for how communities originally maintained and narrated data in situated ways toward particular purposes; ensuring responsibility in forming categories from data; defining proper infrastructures and destruction of community curated data; and transparency of methods and practices. This respect for cultural narrations of data partly delves into the mythopoeic – the need to sustain, rather than co-opt, didactic stories that speak to different cultural conditions being researched and express cultural desires rather than propagate narratives of damage.

The creating "otherwises" and alter-politics group discussed alternative pedagogies, ontologies of design, modes of governance, methods, tools, and infrastructures. The conversation on governance underscored the import of making data stewardship a matter of the public sphere,

specifically in determining what data counts and creating qualifications for government data stewardship. Recommended methods encompassed community, collaborative, decolonial, and feminist approaches. The end goal of these applications would be to create data capturing instruments and sociotechnical infrastructures that ensure data is accessible.

Mapping as a decolonizing and feminist medium is a notable contrast from the histories of mapping and GPS use, and one that accords with the grassroots mapping philosophies explored previously. Decolonizing methodologies are "respectful, ethical, sympathetic, and useful" toward plights of the disenfranchised and indigenous communities researchers apply them to.[25] The questions decolonial methods pose, according to Linda Tuhiwai Smith, are very similar to considerations from the EDGI workshop: "Whose research is it? Who owns it? Whose interests does it serve? Who will benefit from it? Who has designed its questions and framed its scope? Who will carry it out? Who will write it up?" and – perhaps most importantly – "Who will listen?"[26] The cautionary tales these questions weave on legacies of imperialism convey the import of the mythopoeic in utilizing mapping within decolonizing frameworks.[27] They reflect the kinds of conversations necessary in reimagining the lifecycle of data, thinking through such issues as matters of ecologies and trust instead of damage and optimization.

Lastly, the breakout group on calls for dismantlement underscored problematic systems of regulation, biases, and overdependencies on data. In general, all the breakout groups emphasized data literacy, a knowledge of how to read and apply data in critical and sensitive ways. This, of course, merits unpacking what data is, what counts as data, and who owns data in specific contexts – all issues each group's discussions speak to as well.

These points of emphasis demonstrate the compatibility EDGI has with Public Lab philosophically. Grassroots mapping often promotes how it is inherently collaborative, and how that

makes its projects far more comprehensive than "top-down" or damage-based approaches. Public Lab's workshop models work to ensure communities of concern can participate in such initiatives.

In spite of Public Lab's ambitions toward ethical co-ownership of data within projects of environmental data justice, one research note following the Appalachia barnraising points out such concerns merit continued consideration in barnraising events:

> Most people in Public Lab are familiar with the concept of experts "helicoptering in" to solve a community-level problem, but end up focusing on their own goals instead of the community's. This occurs with academics, government officials and nonprofits alike, and with experts and non-experts alike. In the discussions I participated in during this Barnraising event, I was disappointed to see the members of affected communities grossly outnumbered by outsiders like me, and moreover in discussions where community members weren't present, to me their voices were painfully absent.

Though it is often difficult in practice, Public Lab's awareness of needing balance between community members on the ground and outsiders with expertise in grassroots practices – a mindfulness HOT's work also shows in balancing remote labor with local quality assurance assessment – is a focus that often carries over into its research notes.

In a comment to the IRB-related research note discussed before, one member brought up "Community Researcher Contracts," a product of research involving indigenous populations in South Africa. They provide clarity on the research program, detail the roles of universities and NGOs within them, what would come out of the research, and means by which researchers would share those outcomes with the studied communities. The power of these contracts, largely operating outside of the ways such agreements are forged in Western contexts, means studied populations are better informed of the research and can thus demand more appropriate conditions for research and sharing outcomes. This case exemplifies how the resource sharing of community members through research notes can provide frameworks for alternative workflows that can circumvent harmful institutional structures that work against ethical community involvement.

To further facilitate resource sharing at the community level**,** another Public Lab research note advocates a workshop format similar to that of the EDGI event that takes a round robin approach between four different groups to tease out questions, entangled issues, and resources that can potentially illuminate four different issue briefs. Part of a scripted introduction to the exercise that the note gives potential workshop leaders the option to use interested me: "People in the Environmental Justice movement talk about limited resources, feelings of isolation, and being small. Finding yourself on the receiving end of the negative externalities of industry is extremely daunting. Those feelings are valid, [sic] big industry has a lot of money, resources, and often political power. Individuals have much, much less."

While such workshops, practices, and philosophies covered in this section can be quite empowering in tone, one Public Lab figure claims that based on personal experience, it is "rare that it totally sticks." Workshops often do not result in a collective taking up grassroots tactics, as was the case in this member's personal experience working with the Vermont Toxic Action Center and GreenRoots, an environmental justice group in Chelsea, Massachusetts. Not only are grassroots mapping tactics not always appropriate for activist efforts, but can also prove difficult to put into action. I explore these complexities in the rest of this chapter.

Using MapKnitter

"Every map comes with its own obstacles," as one member puts it. Trespassing, lack of proper community consent, and use of mapping images following capture all still factor in. Beyond these considerations, DIY mapping can carry alarming moments comparable to "fishing upside down." The member told a story of a balloon nearly falling onto a road with a gust. It reached "head-height," but fortunately on a road empty of vehicles, with mappers quick to cut the line to

release the balloon. The work depends on the whims of the mapped environment; it is not entirely in the control of the mapper.

This mapper also cited this instance as justification for how gender factors into mapping. The reasoning was that men are more socialized to seek such opportunities associated with technology and risk than women. The colonial undertones of tackling a "wild" nature to seek knowledge and management over natural elements itself is a masculine idea. Many of the findings on identity and mapping in HOT and OSM work can thus apply to Public Lab as well.

Yet the feminist metaphor on Public Lab to one's mapping work following surveying – one of stitching and crafting, not enumerating, editing, or managing as on OSM – is distinguishing. Once one's surveying work is done, the broad image archive one has assembled is organized onto a map through MapKnitter, Public Lab's open source aerial stitching platform. The initials steps of creating a new map on MapKnitter include providing a title, the location of the captured area, and a description if desired. Some suggest linking to a research note on the mapping trip or the nature of its content. The great majority do not provide any description at all, often being the work of hobbyists interested in artisanal mapping techniques or wanting to just map a single land feature.

After submitting these details and clicking on Create Map, the page reloads with Google rendering of the area the user put it, ready for the user to upload images to overlay. If the user leaves the map as is, Public Lab automatically recognizes it as a new map, one lacking users' aerial images. A box appears with the following text when one visits it on MapKnitter:

> Looks like this is a new map.
>
> This map does not yet have any images. If you're new to MapKnitter, try watching the tutorial video on the front page for a crash course in how to make a map.
>
> To begin, simply drag images onto the map or click the Upload button in the left sidebar.
>
> Where can you find aerial images? Take them yourself with a camera on a balloon or kite, or out the window of an airplane.

About one in every three maps I surveyed over a six-month span can be classified as a new map. This means a significant amount of map submissions are simply isolating an area, rather than including community produced imagery of the area in question. The production of tactical mappers that engage with environments on the ground and learn from what they articulate in the act of capture, rather than a platform for mainly hobbyists, may thus be overstated discursively.

The tutorial video the New Map text box mentions show how to use MapKnitter using images from a landfill cartography project. Landfill cartography, the subject of an entire Grassroots Mapping Forum issue and a focus that has entered into OSM work as a landscape feature sorely lacking in dominant mapping platforms, charts location-specific effects of how waste travels and where it is left in communities.[28]

Since many mapping trips can result in hundreds of images, often approaching or surpassing a thousand, it helps to organize ideal images into separate folders or classifications beforehand for easy access. Once one creates a map, one clicks on the Upload option beside the map to upload images, and selects the Place option for the image to appear over the map. Images that contain GPS tags may be auto-placed onto the map, but users can drag images to place them correctly.

Users rotate, enlarge, and distort images to match markers they see on the aerial imagery best.[29] A small rectangular menu appearing over the map organizes these different options, as well as the image outline, delete image, and lock image options. Users use the latter on finalizing their image placement so they can place other images without affecting that finished image. One can click on the option again later to unlock the image for further work if necessary. Various difficulties, however, can crop up in switching between options, especially depending on the browser one uses.

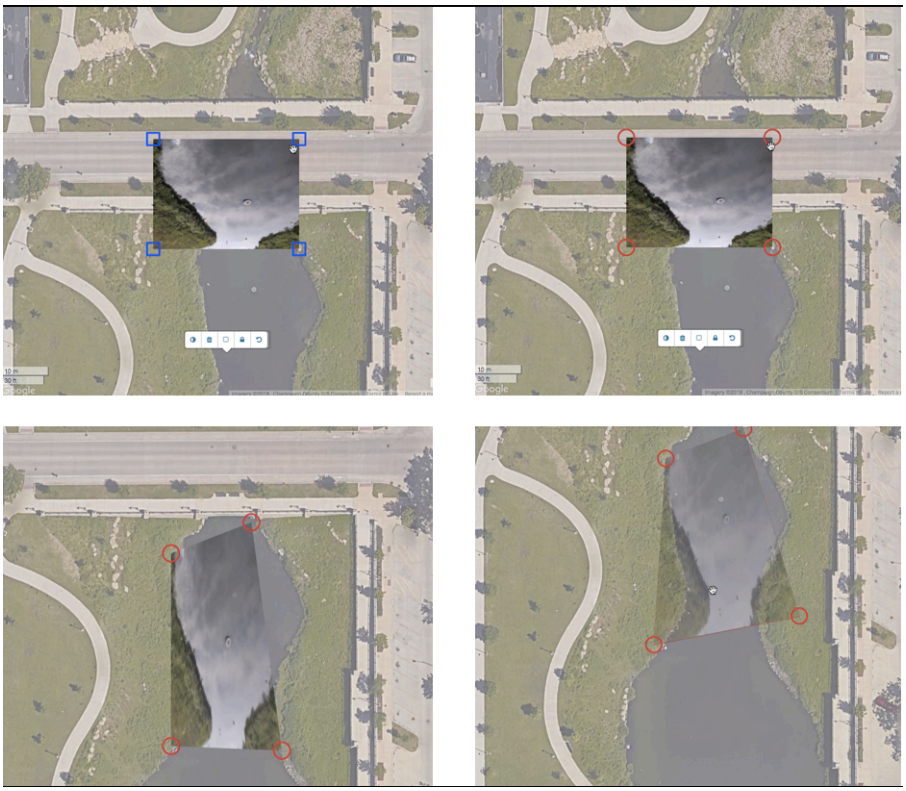

Figure 7.2: Screen shots from using MapKnitter to map the Second Street Basin that show the drag, rotate, image outline, and image transparency functions, from top left to bottom right.

Figure 7.3: An additional screen shot shows the Lock function, indicated by Xs at the corners of the image.

The process behind creating a MapKnitter submission is a unique process of assembling. As discussed before, the Public Lab site as a social infrastructure can function as an assembly – a space of deliberation. But the assembling a submission entails, of selecting and distorting imagery from an

imagery archive, deals in the second sense of assembly as a matter of situating the right kinds of objects (in this case, imagery) toward the particular purpose at hand. Further, the creativity involved harkens back to the original artistic and relative sense to mapping, even if the particular technical dimensions involved are now clearly distinct.

Users can switch to an OSM layer that includes place names the Google aerial imagery layer lacks. The latter affords mappers an easier presentation in terms of color scheme, bordering of shapes, and labelling of roads and buildings to match one's images with the available aerial imagery. The lack of tree cover, a problem well covered in the HOT chapter, also makes alignment easier.

Much can be learned about the environment being mapped by switching between these layers while stitching images. Various submissions I had seen inspired me to complete a test map, so I used map images I had from a US college campus as my first exercise using MapKnitter. In learning how to overlay and match two separate images from the map onto MapKnitter, I noted a name of a lake on OSM that was missing from my map images while seeing another body of water on my own images that was missing entirely from the standing OSM representation. Google's aerial imagery, however, provides obvious aid; in one case, the S-shape on a rooftop in my mapping images also appeared on the aerial imagery and proved valuable in placing my images. MapKnitter has an outline and image transparency options to match building outlines and natural features on the map as best as possible.

When overlaying images, the order in which one uploads and places them can be significant, especially if one photo is meant to appear over another to illuminate a particular feature. Mappers can also incorporate maps onto websites via an embed code or print them after exporting the image in GeoTIFF or jpeg format.[30] But the most important facet of stitching images is arguably the altitude of image capture, which aligns to the dominant representational order of the god's eye view.[31]

My second MapKnitter submission used images I took out of a plane window as the plane descended – an exercise resulting from the suggestion in the New map text box and other submissions using this tactic. After a great deal of research and sorting through the images I took, I was able to identify several landmarks via Google's aerial imagery – a city overpass, a monument, a lighthouse, and a condominium – in a town outside the city in which the plane landed. Though the images came out well, most were still far too close to the ground to stitch as is.

This is where MapKnitter's distortion function comes in. With it, users can stretch out or steepen images to match up with aerial imagery. But the ardor involved and the loss of resolution in the process reveal how much the need for high altitude imagery is encoded in the platform.

I learned a great deal about the mapped area in this exercise. Due to its proximity to a major airport and to a city that has strict restrictions for balloon and kite mapping, other Public Lab tactics for capturing aerial imagery would have proven difficult. By the same token, it took me quite some time to place the image of the monument, one I had no prior knowledge of in spite of my strong familiarity with the area. Though other experiments I engaged in with capturing aerial imagery from a plane – including a creek in Maryland that decades ago had to undergo extensive community cleanup due in part to pollution from an airport and a lake nearby Grand Rapids, Michigan – required a similar investment in time, they were far easier to place since I was able to improve the camera angle toward ideal capture. Once I gained more comfort in using MapKnitter, I began experimenting with kite mapping locally to learn more about grassroots mapping tactics.

The Mini Kite Kit

The mini kite kit is most ideal for flying in wind speeds ranging from 10 to 20 mph. Small, well-constructed kites can even fare well in 20 to 30 mph winds. However, when winds are less than

10 mph, a balloon fares better. My selection of a kite as my means of mapping given it is less cumbersome, more affordable, and more easily carried out independently thus restricted the kinds of conditions in which I could expect quality capture.

Wind direction is also important; one must be "upwind" for the kite or balloon to fly best. Additionally, one must be wary of trees and power lines in the area since balloons or kites can get caught in them. Storms are of obvious consideration, as is whether or not an airport is present within a five-mile vicinity - equally a consideration with drone capture that many companies and hobbyists ignore.[32]

For mappers, the work behind these tactics includes the construction of a rig; the construction of a rubber band harness to hold the camera within the rig; planning a trip through satellite mapping to ensure it meets previously mentioned considerations for safety; attaching the camera via a carabiner; conducting a test fight sans camera; setting up GPS tracking to record latitude and longitude; and carrying out the flight and image capture.[33] There are various rig models posted as activities on Public Lab, one made out of a two-liter soda bottle and another from a 64-ounce juice bottle. After rinsing either out, allowing sufficient time to dry, and removing the label, one cuts off the top of the bottle for the camera to hang inside, with slits cut on the sides to tuck the ends of the rubber band harness under, keeping the camera in place. One can either create wings for the rig (which helps keep the rig from spinning and blurring pictures too much) from the remaining portions of the bottle by cutting the middle of the bottle into two strips or constructing them out of cardboard.[34]

Users construct a camera harness for the kit from rubber bands the kit provides. Constructing a harness entails doubling up several rubber bands and tying them together in such a way that creates two doubled up rubber bands to tie around the camera. Each of these has a single

rubber band tied in that connects to each other, with an additional single rubber band tied into their connection point, from which the camera hangs.[35]

While *A Pocket Guide to Grassroots Mapping with Balloons and Kites* (a collaboratively authored Public Lab publication that comes with its mini mapping kits) details how to assemble a balloon mapping kit, it excludes best practices in handling a kite. Proper technique is critical to ensure one does not lose or damage equipment mid-flight. The guide does convey that kite mapping as a process has fewer steps than balloon mapping. Rather than having to tie a specific type of overhand loop to attach a balloon to a carabiner, one can simply tie the kite string around the inner part of the open carabiner five times, with the open end of the carabiner put through the outward rubber band for the camera rig to secure the camera to the string upon closing the carabiner. Various other considerations that go into balloon mapping (including the need for a mooring weight, a helium tank, and multiple mappers to fill and handle the balloon) are nonexistent with kite mapping.[36]

Having said this, there was still a great deal of experimenting necessary with the prototype kit. One was experimenting with the nature of the rig given the more compact camera the kit is intended to use. An early test flight with an early version of the kit that a member wrote about on Public Lab simply attached the smaller camera to a triangle of foam hung from the carabiner to stabilize the camera without weighing the kite down too much, which would compromise flight altitude. What I do often when flying is tie the loose rubber band usually meant to tie into the rig around the camera for increased stability, and to then insert the carabiner into the resulting loop.

One can use a WiFi-enabled action camera set to shoot continuously to capture pictures. Mappers can use apps to facilitate this capture, control the camera remotely while in the air, and download images from for later use. While listed under the broad app category of "photography," the particular app I used is, as described by Google Play, "streaming video surveillance software." This particular use of this technology is thus arguably a turn on its design.

The general process of grassroots capture is fairly straightforward. One stands with his or her back to the wind, holds the kite or its bridle (the knotted bunch tied with strings attached to the different segments of a parafoil kite) before them, and releases once the kite catches wind, with the reel of kite string secure in the other hand. If one has not already done so, one then wraps the string around the carabiner as the kite ascends. The mapper then can set the camera to shoot continuously from the phone app if the mapper did not do so before the flight. Patting down a segment of the kite string within reach and beginning to wrap the string back around the reel is enough for the kite to begin descending so that a mapper may land it safely.[37]

In line with Bennett's conception of thing-power, the kits' need for wind proves poetic and ecological. Winds are usually higher during the day, specifically from 2 pm to dusk, as nature's accounting of how sunlight heats different areas unevenly, creating pressure variations.[38] Grassroots tactics thus take advantage of the ecological correction winds provide.

My first attempts with the kit involved mapping a public park under construction, with the tennis court as the only space not covered by fencing or trees at the time. During this research, I noted various submissions from different users mapping tennis courts and other types of sports fields, likely due to the amount of space they take up, their location within public parks that can more easily be mapped, and the ways they stand out from other park surroundings in aerial imagery. The idea was to document the construction and to compare the resolution that grassroots mapping afforded in this investigation to that of drone efforts in capturing the park pre-construction by a local news outlet.

But this proved unwieldy. The highest I was able to fly on a low wind day – one windy enough to carry the kite high enough to draw attention from others in the park, but not the kite and the extra weight the rig provides – nearly made the kite wrap around overhead lights on the tennis courts, the only unobstructed spot to fly that would not prove even trickier with nearby streets.

I learned considerably from these initial experiences on proper attachment of the rig to the string and camera set up, as the camera's protective casing may have ended up blurring the imagery through the condensation collected within it. Prior grassroots mapping initiatives using older kits had equally found this in their efforts. The next section specifies my local kite mapping projects, following these lessons and others, and their import.

Boneyard Creek and Copper Slough

As digital maps themselves often aggregate various layers of meaning in relation to one's actual or imagined location, so too does my pursuit of mapping find meaning in the legacy of my prime mapping location. Urbana-Champaign was itself an early site of experimentation with online environmental advocacy, and as such seems worth considering in a study that approaches the formation of online communities of mapping critically. While MapKnitter submissions underrepresent the prairie, as brought up previously, it nevertheless has firm grounding in histories of digitally-based environmental advocacy that Public Lab continues.

PLATO, though housed in Urbana-Champaign, was clearly global in its effects, ranging from technical innovations as an early (if not the first) online social network to its development of plasma display panels.[39] But it also had lesser-known local uses such as the CREEK PLATO lesson. The lesson was the result of a 1970 experiment enrolling local governmental officials, advocates, and residents to get locals involved in urban planning decisions with Boneyard Creek. The lesson became arguably the first online citizen involvement space in general, not just in environmental matters.[40]

My first kite mapping projects centered on Boneyard Creek. I chose Boneyard Creek for similar reasons as those behind the PLATO lesson – as a local issue with a contentious history that

may warrant further resources to advocate around. The creek has a notorious legacy on the campus for problems with overrun exacerbated by overdevelopment from the time of white settler colonials first arriving to the area on and sheet piling, the main focus of the PLATO lesson. Graduate students involved with the Alternative Futures project and the Biological Computer Lab, a pioneering second order cybernetics lab at the University of Illinois, were behind the project. The graduate students who designed the lesson included diagrams, maps, key terms in a glossary, and commenting functionalities meant to introduce the issue, historicize it, overview competing plans, and present and discuss unconsidered options and points for citizen action.[41]

My personal experiences surrounding the creek and exploring its contamination – specifically from documenting a workshop on campus led by a Public Lab practitioner in which participants found nurdles in creek samples – also informed my focus on Boneyard Creek. Nurdles are small globes of plastic that are popular to use in corporate plastics production given the ease of shipping them and their rapid, even melting. Should they spill into the environment from improper handling or corporate pollution, they can prove deadly. Fish, birds, and other animals can mistake them for food.[42] While the creek is far less of a hot button issue since its rampant flooding issues were addressed decades ago, these findings showed how monitoring of the creek could prove useful.

Over several mapping trips, I took images of the creek and the park between E University Ave and E White St, as well as the Second Street Basin and various points at which the creek runs through North campus. Other areas were either riddled with power lines, in people's backyards, too close to streets, and/or had too much tree cover. Though many of the images came from kite flights, others came from smartphone capture – more usable considering the narrowness of the waterway at certain points than it would be for most projects – from higher ground. This is a tactic I would later return to in gaining imagery in Chicago considering the challenges implementing DIY techniques in a major city may pose. Several images from the Second Street Basin, where the

aforementioned water sampling finding nurdles occurred, included ducks nesting and a heron wading in the middle of the basin. While I had seen various geese and more common birds by the basin previously, capturing these particular species in light of the knowledge of the pollution in the area underscored the range of species impacted.

The reflection of a new University Group high-rise that appears in much of the imagery adjacent to the basin – only seen in Google imagery at an early stage in construction in August 2017 and perhaps in part responsible for further pollution of the Boneyard – is also pictured over a layer of green atop the creek water, which one would not also see in Google imagery likely due to the timing of the capture. While Google imagery is precisely the kind of snapshot that Scott and others critique, this work is more "living" in comparison, in line with trends the preface establishes, due to its more updated capture.

The temporalities of grassroots approaches prove advantageous here. They can aggregate more recent imagery or different imagery sets in different seasons, a major benefit for monitoring initiatives as came up in the OpenHour discussion. Grassroots capture can serve as a stark contrast to what stands in Google's dominant imagery archive. When surveying Boneyard Creek via Google's archive, I noted that construction obstructed much of the imagery available on Google. This was not the case with the images I captured, resulting in a clearer record of the area. As Benjamin advocates, these tactics can thus aid in narrating change within space when its output is compared to that of dominant archives of spatial representation.

After mapping segments of the creek, I decided a small delta kite, rather than the parafoil octopus kite Public Lab chose for the mini kite kit, would be preferable moving forward. Though the latter is still highly portable, the bridle would get knotted from being packed and re-packed, affecting flights significantly. This would add a great deal of time in untangling, wasting valuable camera battery time as well as the windows of weather most ideal for high altitude flying. A delta kite

is just as portable if one detaches and reassembles the spine rods when packing and unpacking the kite.

I switched to the delta kite by the time I had begun mapping part of a park area nearby Copper Slough. Copper Slough is another Champaign watershed running through various public parks, to the west of Boneyard Creek. I chose mapping Copper Slough in part for being accessible for mapping with far wider fields than what I was working with before. This made it a logical choice to continue experimenting with lower altitude flying for higher resolution given the narrowness of both watersheds.

Copper Slough suffers from invasive plant species, pollution, and insect infestations, all the while being an area boasting an impressive ecology of heron, muskrats, ducks, and hawks – some of which I was fortunate enough to see while mapping, but not to capture in resulting photos.[43] The most striking facet of the imagery I gained was, again, how much it differed from that of Google due to different seasons of capture. Whereas the watershed is flush with greenery on Google Maps, the tan wild grass of the watershed in images I captured late in the fall season shows a very different state of the creek. It is quite possible that due to the resolution limitations of satellite imagery that this coloring is simply automated rather than a difference in the time of year. Either way, this serves as further evidence of the affordances of grassroots imagery in monitoring capacities for being not only more in time, but more entwined and informed by the current state of the ecologies or communities of concern. One can argue that the ecologies of mapping in play within Public Lab are more ethical and more bound to the particularities of the environment at hand than other communities of digital mapping examined here.[44]

Conclusion

While there is cohesion within Public Lab through its community infrastructure and its online platform, the possibility of myriad MapKnitter submissions of the same area resists the sense of authority OSM privileges in its singular representation and its policy toward favoring "ground truth." The pedagogical values underlying much of this chapter's discussion match this rhizomatic production of maps on MapKnitter. It circumvents typical institutional relations of technological production to look at the level of community via the right kinds of tools, as Latour desires to take place within the assembly. The metaphorical area of craft, rather than of management, seems more accessible, less rooted in expertise, and more feminist in tone – significant given how the nature of mapping work on MapKnitter and of DIY interventions writ large can appeal more to how men are socialized.

When one speaks with Public Lab members, the critique of state uses for maps shows through. One member I interviewed resents how the government is more likely to sponsor projects like mapping "bike trails everyone uses" – projects analogous to much of the work OSM performs. The member contrasted this with the kinds of projects Public Lab fosters. He specifically brought up the OpenGov movement and its insistence on transparency with open data without providing the means on how to employ said data, assuming a literacy amongst the citizenry. This member was specifically involved in a Public Lab project involving PetCoke mapping in Chicago. The contaminant is shipped from Indiana, where it receives less regulation, fitting in with the networked ramifications of commodity relations existing as relative space (ones impossible to patrol in absolute spatial terms alone) that Harvey pinpoints.[45]

In line with the rhizomatic and Deleuze's image of the orchid and the wasp, various nonhuman agencies in the form of cement cracks, weeds, nurdles, diverse species, and so on can

speak of histories and of historical effects from the human manipulation of the environment as they manifest in legal frameworks and environmental policies. Within such actions, these agencies resist such formations. Regarding weeds specifically, the Environmental Performance Agency (or, in an obvious pun, EPA) invites considerations around what a system of governance and pedagogy based upon weeds might look like and how weeds participate and articulate within broader ecologies.[46] These elements of the mapped environment, part of the "stuff" of politics (as covered in the introduction), thus become transparent as rightful political actors. My own experiences mapping while prototyping the mini kite kit show this, as does my work with OSM from prior chapters and the conversations that take place within Public Lab.

There are several other important themes to underscore from this chapter before reaching a summation of the project in the next and final chapter. First, much of what this chapter overviews encapsulates work toward integrating more of the public sphere into plans and visualizations typically beyond the public's control, and to make the systems perspective toward these initiatives more ethically mindful as Habermas desires. Aside from the perspectives on educational technology and environmental data explored here, the experiences in kite mapping I share in this chapter cement how much kite mapping is tactical. The design of the system itself makes it more difficult to use in densely populated areas than in suburban, rural, or developing contexts with larger fields or public parks. This builds in the ethical constraints discussed in Chapter 4 as constraints within the design of the system itself, bringing the concerns of the lifeworld into the technical.

This first point, however, sets up the second, which serves as a contrast: the production of tactical mappers that engage with environments on the ground and learn from what they articulate in the act of capture may be overstated discursively in comparison to how most practice these tactics. Most analyzed MapKnitter submissions were one-off projects; many lacked stated aims toward the impactful, and seemed mostly performed as a hobby or for aesthetic purposes rather than being a

part of any explicit monitoring project. Research notes, in turn, do not necessarily sponsor dialogue across all the corners of the community. It is mostly, instead, among the handful of members most involved in Public Lab and other members who never pen or comment on another research note afterward.

Third, this analysis confirms (much like the OSM chapter) that much of the work of mapping is shifting to app-enabled ecologies. Through my own mapping experiences, I show how Wifi-enabled action cameras pair with phone applications to control the camera remotely and to download aerial images off of as part of grassroots tactics. Even with the specific apps one can enroll in such work possibly being developed as a surveilling technology, the line between surveillance and monitoring as mediated by these technologies is blurry, as findings from Chapter 3 suggest. Even outside of considerations of apps, much of the work of prototyping the Public Lab mini-kits was in response to technological changes that made further portability of kits feasible – work that some of the findings from this chapter help realize.

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[1] For one example of the press coverage Make Gowanus Great Again has achieved, see April Joyner, "Meet Brooklyn's Cohort of Environmentalist Hackers," *Technical.*ly, last modified July 12, 2017, https://technical.ly/brooklyn/2017/07/12/nyc-public-lab-environmentalist-hackers/.

[2] See "Mining," https://www.skytruth.org/issues/mining/.

[3] While the previous chapter drew in part from a similar analysis of OSM diary entries, to visualize such work in a similar way (or Public Lab research notes for that matter) would prove less fruitful for several reasons. Contributions are far more widespread and less dependent on a handful of gatekeepers for dialogue. Many OSM users skim through the diaries and comment on entries as they see fit, dependent on their particular expertise and interests. MapKnitter in some ways presents the opposite problem for such an analysis of research notes, given that a fair amount of its submissions are published anonymously.

[4] The network visualization omits labels for the nodes in accordance with the aim of this project to ensure anonymity. The intended point – that the network is stabilized mainly by the contributions of a handful of gatekeepers and one clear cog – does not require them.

[5] See Latour, "From Realpolitik to Dingpolitik."

[6] See Kathy Snediker, "ResearchGate v. the Coalition on Responsible Sharing," *In Your Library: Scholarly Communications at USC*, November 6, 2017,

http://library.sc.edu/blogs/scholcomm/2017/11/06/researchgate-v-the-coalition-on-responsible-sharing/

[7] Shortly after this research note, allegations arose that ResearchGate scraped academia.edu accounts and messaged account owners encouraging they contribute to ResearchGate. Though CEO Ijad Madisch denied the allegations, the news proved quite relevant to the points the research note made. See Sarah Perez, "ResearchGate CEO Denies Scraping Accounts from Rival Site to Generate Sign-Ups," *TechCrunch,* last modified December 5, 2017, https://techcrunch.com/2017/12/05/researchgate-ceo-denies-scraping-accounts-from-rival-site-to-generate-sign-ups/

[8] See Julia S. Stewart Lowndes, Benjamin D. Best, Courtney Scarborough, Jamie C. Afflerbach, Melanie R. Frazier, Casey C. O'Hara, Ning Jiang and Benjamin S. Halpern, "Our Path to Better Science in Less Time Using Open Data Science Tools," *Nature* (2017), https://www.nature.com/articles/s41559-017-0160.

[9] Wylie et al, "Institutions for Civic Technoscience," 122.

[10] Ibid, 122.

[11] Bertram Bruce, "Ubiquitous Learning, Ubiquitous Computing, and Lived Experience," in *Ubiquitous Learning,* ed. William Cope and Mary Kalatzis (Champaign, IL: University of Illinois Press), 21-30.

[12] As quoted in "Blueprint for Counter Education: Expanded Reprint," accessed May 22, 2018, https://metalabharvard.github.io/projects/blueprint/.

[13] Maurice Stein and Larry Miller, *Blueprint for Counter Education: Expanded Reprint*, edited by Eugenia Bell (New York: Inventory Press, 2016).

[14] Ibid.

[15] Scholars typically consider postmodern theory a rupture from modernist theory countering its false distinction between high culture and mass culture, the politics of periodizing history, and the reliance on grand narratives. But Paul Rabinow deems the modern a fluid process, one defined relationally by, but not inherently opposed to, tradition. What appears as new is simply the by-product of this flux. Technological advancements in approaching old categories, including via mapping visualizations, should thus not mean that we replace prior meanings of these categories completely. See Rabinow, *Marking Time,* 2, 3.

[16] Bertram Bruce, "Ubiquitous Learning, Ubiquitous Computing, and Lived Experience."

[17] See Timothy E. Dolan, "Revisiting Adhocracy: From Rhetorical Revisionism to Smart Mobs," *Journal of Futures Studies* 15.2 (Nov. 2010), 33-50.

[18] See David Harvey's discussion of post-Fordist production and flexible accumulation in *The Condition of Postmodernity.*

[19] Dolan, "Revisiting Adhocracy." I also find it worth mentioning here that, as Morozov does with digital mapping, Dolan points out that the emergence of digital adhocracies can have both positive and negative valences, such as piracy sites or hate groups.

[20] OSM had already begun assisting by that time by having members re-map road networks for first responders to update the inaccurate TIGER data that they were finding for the area. In a research note he later composed summarizing the OpenCall, Robert referenced these efforts.

[21] This was far from the only popular culture reference I found during my visit. On entering Robert's office, one of the first things I noticed was a black and white Jurassic Park logo printed on computer paper taped to the back of Robert's computer monitor, only with the words "Jurassic Park" replaced with "Public Lab." The basement of the makerspace (which contained many of its larger tools as

well as the lightsabers from one of its recent making projects) also featured a popular quote from the Austin Powers franchise on lasers.
[22] Lisa Nakamura and Peter Chow-White, "Race and Digital Technology: Code, the Color Line, and the Information Society," in *Race After the Internet*, ed. Nakamura and Chow-White (Milton Park: Routledge, 2012), 1.
[23] Tuck, "Suspending Damage," 413.
[24] Ibid, 414.
[25] Linda Tuhiwai Smith, *Decolonizing Methodologies: Research and Indigenous Practices* (Zed Books: 1999), 9.
[26] Ibid, 10, 71.
[27] D. Soyini Madison's coining of critical ethnography notably highlights similar concerns. See Madison, *Critical Ethnography*.
[28] See Pablo Ray Mazon, "Touch, Collect, Display, Order, Measure, Map, Inflate, and Build with Waste!," *Grassroots Mapping Forum* 6, https://publiclab.org/wiki/touch-collect-display-order-measure-map-inflate-and-build-with-waste.
[29] jeferonix, *Intro to Public Lab's MapKnitter 2*, YouTube video, 7:29, February 11, 2015, https://www.youtube.com/watch?v=0h6MBH6f2js.
[30] Ibid.
[31] See Haraway, "Situated Knowledges."
[32] NBC News, *Close Calls Between Drones and Airplanes on the Rise,* video, 1:48, February 9, 2015, https://www.nbcnews.com/nightly-news/video/close-calls-between-drones-and-airplanes-on-the-rise-396474435862.
[33] Public Lab, *A Pocket Guide to Grassroots Mapping with Balloons and Kites* (2017).
[34] Mathew Lippincott, *Part 3 – Assembling a Soda Bottle Rig*, YouTube video, 12:06, January 29, 2012, https://www.youtube.com/watch?v=c-HBZW2l6Ig&t=1s.
[35] Mathew Lippincott, *Part 2- Making a Basic Rubber Band Harness*, YouTube video, 3:56, January 27, 2012, https://www.youtube.com/watch?v=XDxQRSobPr8.
[36] Public Lab, *A Pocket Guide to Grassroots Mapping with Balloons and Kites*.
[37] Ibid.
[38] Tom Skilling, "Dear Tom, Why Is Daytime Windier Than Night? Gusty…" *The Chicago Tribune*, June 2, 1999, http://articles.chicagotribune.com/1999-06-02/news/9906020035_1_winds-heating-force.
[39] David R. Woolley, "PLATO: The Emergence of Online Community," *Think of It* (1994), http://thinkofit.com/plato/dwplato.htm.
[40] See "Impeachment," in Brian Dear, *The Friendly Orange Glow: The Untold Story of the PLATO System and the Dawn of Cyberculture* (New York: Pantheon Books, 2017): 196-211.
[41] See Lamont, "New Directions for the Teaching Computer: Citizen Participation in Community Planning."
[42] State of California, "Pre-Production Plastics (commonly known as 'Nurdles,'" last modified August 28, 2018, https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/Industrial/Nurdle.html.
[43] See "The Copper Slough Watershed of Champaign, IL," *ArcGIS*, accessed November 20, 2018, https://www.arcgis.com/home/webmap/viewer.html?webmap=76ec267597aa4ddda4800f3ed387bf57; Maddy Kangas, "How One Master Naturalist Changes Our World," *University of Illinois Extension*, June 19, 2017, https://web.extension.illinois.edu/cfiv/eb397/entry_12652/.
[44] My work on MapKnitter is available via my Public Lab member profile at https://publiclab.org/profile/cugrassroots under the MapKnitter Maps tab. The 14 map

submissions I made during my research, enough to merit inclusion into the percentage of high-contributing MapKnitter users that the introduction identifies, are all mentioned in one way or another in the sections within this chapter on MapKnitter. Information on my HOT contributions from Chapter 5 can also be found at http://www.missingmaps.org/users/#/cugrassroots.

[45] Harvey, *Cosmopolitanism and the Geographies of Freedom,* 135.

[46] See an exhibit page on "The Environmental Performance Agency (EPA): Department of Weedy Affairs," *Transformer,* accessed May 19, 2018, http://www.transformerdc.org/exhibitions/overview/exhibition-the-environmental-performance-agency-epa-department-of-weedy-aff.

CHAPTER 8

MAPS AS ECOLOGIES

Historically speaking, communication and media research has a blind spot to audience participation in media forms. That is particularly at hand within participatory location-aware media at large and the work of the communities at hand specifically. This dissertation follows discourses and practices within these communities to show how mapping is not simply a matter of rhetoric or representation, but of testimony, assembly and communication. I reference Bruno Latour's concept of assembly on various occasions in this dissertation to speak not just to the need for the construction of tools *and* spaces for political deliberation as he theorized, but also to add media forms, modes of documentation, and modes of editing, drawing in the association between the montage and assembly. It is this third meaning to the assembly that this project makes a strong argument toward thinking more overtly about within communications and media research.

The assemblies this dissertation documents clearly reflect drives of the lifeworld. They facilitate interactions necessary to develop a shared sense of the public good. Each strives to design interactions and concerns of the lifeworld into systems of capture. The chapter-by-chapter design of this dissertation, too, matches Habermasian considerations. "An Archaeology of GPS and Grassroots Mapping" and "A Critical Discourse Analysis of Public Lab" trace issues of mapping from the levels of system via government imaginaries and lifeworld via public use and framings of geospatial data capture respectively. Later chapters on HOT, OSM, and Public Lab highlight interactions exemplifying collisions and negotiations between the two through immersion within open mapping communities and interfaces.

The point in doing so is to assume a more holistic approach to the discourses, practices, and conflicts surrounding interventions in digital mapping systems. The chapter design follows Kellner's

suggestion to complicate Habermas' take by tracing organic uses of media that turn techniques oriented toward the system to concerns of the lifeworld. What results resists the romanticization of communication and communication technologies (or, more specifically in this case, practices within communities of concern) as entities in need of protection from a system (the "top-down") in which they are already imbricated. They serve as means to reinvigorate these concerns within technological designs and environments of use. It is within the fullness of the analysis this project assumes – entwining discourse and practice, human and nonhuman, and a better-informed perspective on the imbrication of space-times at work in mapping – and advocates be applied for further work in this realm that such complexities surface.

In this conclusion, I tie these considerations and the contents of the body chapters with issues the preface and introduction broach more closely. After summarizing the case studies at hand, I devote a section to each research question the introduction poses. I close by commenting on the methods this dissertation employs; how the evolution of public forms of mapping that the dissertation traces fits in an ecological framework to communication; and directions for future research in data, ethics, and digital mapping. In discussing the latter, I judge the implications of this research for critical/cultural communications scholarship. Throughout these threads, I reinforce, as developed throughout the dissertation, that negotiations between legibility (a marker of a system's spatial perspective) and trust (which requires enrolling diverse agencies and publics) merit fashioning maps and map production under a "living" framework as both an artifact and facilitator of dialogue. Within this frame, the visions of living maps these communities host serves as an exercise in building trust to enroll the lifeworld into systems of legibility in which the system invests. The stakes are thus high on the policy front and for communities of impact in a world becoming more and more entangled with how it is represented and practiced digitally.

Communities of Interest

OSM launched in 2004 to attempt a level of accuracy in geospatial representations that could counter the follies of government-led and proprietary mapping. HOT and Public Lab gained momentum at the same time six years later as applications toward disaster response. All three are 501(c)(3) nonprofits and community produced, even if through different approaches.

OSM began with an edict of on the ground contributions, often aided by technologies of tracking. The nature of its volunteer contributions has changed, but these philosophies continue to crop up in everyday work within the community, from border disputes to labels for points of interest. While the field of participants is largely white, male, Western, and retired within OSM work, HOT's body of contributors is more diverse, with close to a 50-50 gender split.

HOT can differ from OSM in its more rapid organization around moments of crisis and the state and NGO partners with which it works at an equally rapid pace. After these networks formalize campaigns, corporate aerial imaging companies enter into the fold to donate copyrighted aerial images they produce. Prominent community members, concerned citizens, YouthMappers from across the world, and unpaid interns are among those who use these imagery sets to the best of their ability to map and validate according to the particular crises and instructions at hand. HOT also funds necessary internet access, technology and training toward projects across the globe within its microgrants program, which includes Map Lesotho and Crowd2MapTanzania.

Public Lab, by contrast, offers community-produced aerial imagery capture techniques. They are based on dialogic technologies encoded with ethical considerations toward data capture. Use of these technologies, broadly speaking, does not rely on the licensing strictures of private or government entities. They are equally steeped in the pedagogical and the experimental, perhaps more overtly than the other communities documented.

In such community work, as Chapter 4 conveys, open sourcing is seen as allaying Habermasian fears of technology as an inherent threat to the public. While there is still potential for bad actors and malicious acts in open source frameworks, this potential is "outweighed by the benefits of openness" by practitioners. All three communities at hand endorse open source community mapping, but in practice, these endorsements manifest different structures.

While OSM's original insistence was largely to map on the ground, different contexts, state policies, and data structures have led to a broader acceptance of different means of mapping. HOT is largely remote mapping – for better or worse on the accuracy front, depending on the level of expertise of remote contributors, or on the caliber of the local mapping community that already exists or can be galvanized by the project. Public Lab's approach is deeply grounded in natural entanglements, but its tactics (despite their discursive framings) can also be tedious or inappropriate to instantiate depending on the context at hand. The scale of community projects can also differ.

The nature of backend institutional relations behind involved campaigns – pairing with governments, satellite initiatives and NGOs – can be similar. But a metaphor of completion in standing base layer data characterizes HOT and OSM work, while Public Lab's work is based within craft as an approach to data. Despite these differences, common elements exist between these communities in their values and beliefs.

Cultural Work: Integrating the Lifeworld into Contemporary Data Practices

Much of what ties these chapters together is the fashioning of digital mapping and its associated infrastructures, technologies, and legal frameworks as *purposeful systems*. I see the charge to make public-produced maps within this as a matter of making maps charismatic – to inspire and compel action. The charge brings concerns of the lifeworld into systems of digital mapping.

For the communities at hand in this dissertation, the goal is clearly to build local capacities for mapping. This goal, however, can play out differently within the operations of both communities. Within OSM, there is arguably not the same urgency in making members more critical consumers of data within information capitalism in community conversations as there is in Public Lab. Public Lab also has far more of a focus on DIY design in data capturing technologies, even if OSM membership can demonstrate comparable efforts in designing rigs for street view capture.

In the communities at hand, many community members produce alternative media campaigns focused specifically on their local communities. They use various forms of media, including the interfaces involved in their respective mapping communities as well as social media, to write about and discuss different social struggles. Neither community imposes dues or restrictions to content, though there are avenues of financial support in the form of OSMF membership, Kickstarter campaigns, and kit purchases. The lack of such restrictions matches the dissolution of many of the modern barriers to entry in spatial and scientific knowledge production Lave identifies.

One of the greatest challenges to this, as findings from this dissertation highlight, is balancing between the requisite sense of legibility that legitimates state and corporate spatial perspectives and the sense of trust that on the ground public perspectives provide. While public mapping can be more trustworthy, its modes of visualization must find ways to stand out from the dependability one typically associates with such spatial renderings.

As one Public Lab member conveyed during a conference presentation for which I was also on the panel, the question of the charismatic in mapping is not of a model that moves from the aggregation and "proof" of knowledge to action, but of a model where the aesthetic of the map (recognizing the artistic side of mapping) incites action. In this member's work, for one, pollution and its evidence are not charismatic, and this poses problems for using maps as calls to action in such matters. To make maps charismatic, one must negotiate (to borrow Scott's metaphor) between

the "still photograph" and the "scene of great turbulence."[1] In the former sense, maps can erase the social ties inherent in space; in the latter, they can complicate space in their recognition of the dialectics of space, either in the representational modes employed or the production model underpinning their development.

The photograph can convey ordering rather than complexity in how it stages space.[2] It summons the viewer to spot details one may only notice in a "frozen" sense of space, or the space that the photograph stages. Though inherently partial, this constructed sense of order can project concerns of the public sphere when this partiality and situated nature is recognized as advantageous.[3] The photograph imprints on epistemological, affective, and corporeal registers, ones irreducible to a single or intended meaning.[4] It is not merely a document, but a phenomenon in and of itself, one shaped by the particular means of capture.[5] In the cases documented here, this opens windows into largely unfamiliar and often invisible infrastructures and processes.[6]

In doing so, work I explore can often rebuke public-private formations in science and information capitalism. The contemporary scientific model, to Claire Pentecost, is riddled with barriers such as IP, corporate partnerships, and fetishization. The critiques of mapping systems and educational technology in Public Lab, as well as conversations on IP in both Public Lab and OSM, aim to find workarounds to such detrimental formations, which embroil mapping as an issue of "new capitalism," one CDA is primed to explore. These formations render community members passive, not active, in designs that seek to understand their communities, environments, and everyday lives. In light of these barriers, Pentecost suggests artists, activists, and members of the public sphere more broadly might intervene by showing how science is material and staged, embellishing the stakes of public involvement, and entering into scientific knowledge production.[7] This suggestion contrasts the detriments of citizen science models as previously explored, which can reproduce problems within information capitalism of the individual being instrumentalized.

HOT and Public Lab aim to build out ethics and norms around contribution toward such effective involvement. The former, in particular, builds out local mapping capacities whenever possible despite HOT being synonymous with a model of rapid and remote data production. Both operate best when operating as a supporting infrastructure or a resource on mapping, rather than serving in a managerial capacity. The former manifests a more ritualistic approach to communication in not being focused solely on the transmission of data, but respecting the particulars of how and where data gets performed and the different ends it might serve in different areas of the world.

The matter of space-times in production between these approaches is important. Public Labber essays often highlight the BP Oil Spill to exemplify the slower pace of cultivation Warren constructs and Public Lab advocates in creating space and time for alternative spatial understandings. The point is to cultivate, rather than reduce, social relationships around the mapped environment and mapping as a process. This cultivation connects grassroots modes of mapping to early definitions of culture, contemporary practices of civic hacking, and punk science.

But as technologies and techniques for mapping become more distributed and portable, more literacy on who or what produces maps and what maps produce as real is needed. This literacy can foreground ethical debates surrounding mapping techniques as they evolve. Public Lab's techniques are widely available and cost-effective as a "punk" praxis, but again, they are not intuitive or suitable for all mapping projects, nor is the output of citizen tactics toward the geospatial more broadly legible to all users given the lack of critical literacy on a wider scale in attending to maps.

This is also not to say that a slower pace and situated considerations do not enter in with OSM work, particularly as it begins to tackle broader formations than those of absolute space. Projects based on OSM like Mapeo and efforts to map more of Alaska, for instance, show how relative and relational space enter in to community mapping efforts. This entrance can alter the social and technical infrastructures embedded in the ecologies of public mapping initiatives to

convey multiplicities of understandings and aspirations entwined within space.

There are various different running commentaries within these ecologies and surrounding their effects. Debates about authorship, diversity, spam, and vandalism on the platforms at hand are all present in experiences I recount. The Western, gendered inflections to these projects are especially notable, whether existing in the lack of acknowledgement over silencing and harassment of women or in the broader problem of who has access and is trained to use technologies.

For these reasons, *Ecologies of Digital Mapping* compares interface logistics, practices, and community conversations to their discursive framings. Doing so clarifies how "open" platforms do not solve all problems surrounding citizen involvement in mapping by themselves. Tracing embedded ecologies of work and practice can help demonstrate the complex formations at hand in such issues.

Ecologies of Practice: Local Data, Institutional Partnerships, and the Nonhuman

It is worth briefly clarifying some distinctions in the ecological approaches discussed previously. Though Star, like Altheide, similarly invests in ecologies as an analytic framework, the investment and its intent differ. While Altheide's concern, for instance, lies within an ecology of communication, Star's is within the imbrication of multiple ecologies operating in tandem. Though media ecologists and mediatization scholars included here alike distance themselves from a perspective of technological determinism, Star's distancing is far more explicit.

Altheide and Star's projects both trace relations that constitute a situation, but the range of aims and actors Star includes is far more honed on fashioning the subject as a density of different space-times, personal relationships, institutional logics, and practices.[8] Star strives to dissolve the "great divides" of science and knowledge production through ecologies: namely, those between

"organism and environment," epistemology and materiality, human and nonhuman, and formalism and empiricism.[9] Tactics, tools, subjects, and environments can all convey knowledge and house memory in ways that are not easy to attribute fully to one over the other.

Ecologies of Digital Mapping offers a variety of methods commensurate with this conception of ecologies. Through it, one can trace imaginaries surrounding a given technology, identify the obstacles it may have in overcoming social barriers, and pinpoint inventive practices surrounding a technology that can illuminate the complexities of such broad issues.

Within these communities, many users enroll various different aspects of their data ecologies – their phones, their locations, and their tracks through areas in which they work, live, and/or travel – as part of their work. OSM and Public Lab have well-defined methods of review and support respectively, with conversations carrying over across various community interfaces, social media outlets and video chats. While there is obviously a fair amount of conversation on proper use of community tools, techniques, and standards, there is equally a fair amount of ontological dialogue over what counts as "real" in space and debate on proper approaches (be they in terms of the right materials to use to capture data within Public Lab or in classifications, "real" spaces, and borders within OSM). Though nonhuman entanglements might be more obvious within the forms of mapping Public Lab tactics employ, from studying work in HOT and OSM, the nonhuman can equally articulate in aerial imagery sets or in surveying.

Overall, following licensing alongside these entanglements is fundamental to understanding ecologies at play. OSM may purport there is "no monopoly on place," but there can be in terms of the images of places, or datasets capturing elements of place. Within OSM, DigitalGlobe and Bing aerial imagery sets stripped of important context help inform decisions mappers make in tracing. With regard to institutional presence, supposed bottom-up interventions in spatial knowledge production necessarily partner with "top-down" work and co-opt dominant perspectives in the

name of the tactical. Contributions, in turn, can feed back into these platforms toward the strategic. With Public Lab, successful imagery can augment an imagery archive (Google Maps) produced in a manner that community dialogue critiques.

Despite previously reviewed proclamations that OSM is not about politics surrounding data, its partnerships can include state agencies, nonprofit organizations, or satellite imaging companies. Though Public Lab work may seem more politically motivated by contrast (especially in matters of climate change or Trump associates and policies), OSM work and interests at the level of individual contributors exhibit related political applications even as many of its members deem OSM's work separate from politics. Overall, like the "complete" map, the notion of open data is a horizon of sorts, an aspirational category that is not attainable but nevertheless worth pursuing when framed in transformative ways. It is one OSM's work often looks toward, fueling its actions to ensure as much open data is available for members to work with and use for their own projects or visualizations as possible.[10] The ambitions toward the "open" and the "complete" play out in the frictions embedded in the appropriations of geospatial technologies and infrastructures this project identifies.

Frictions and Entanglements: Automation and Completion as Reinvigorating

The philosophies surrounding grassroots modes of mapping display frictions between situated and remote or algorithmic data production. Shifts toward capturing facets of environments that are not always human observable make the need for human labor even more vital, rather than alleviating the need for human labor in mapping. But the values embedded in both modes of production contend with each other in ways that engage with broader ethical dialogue and keep users mapping in increasingly complex frameworks.

While fears of rationalization (perhaps best encapsulated by Marcuse and Benjamin) in drone and machine learning advances can play into Habermasian anxieties on the surface level, mapping itself has long been machine-mediated. The point Chapter 6 raises about how on the ground surveying being privileged over alternate modes of mapping disregards how GPS underpins the former demonstrates this. Formations in mapping that some practitioners and discourses determine as "new" and inherently negative can ignore these longstanding ties to infrastructures and technologies outside of the settings where mapping occurs.

Though machine-mediated mapping interventions can prove irresponsible when not fully conceptualized or inclusive of local mapping capacities, thinking about the role of automation as a contributing force in these ecologies and not an overpowering one avoids generalizing characterizations of their effects. Further, mapping platforms utilizing machine learning can equally demonstrates the human role in training algorithms that facilitate governance, whether in road safety or spatial management in humanitarian work. Be it within Missing Maps, StreetComplete, MapRoulette, or Mapillary (with the latter exemplifying many of the critiques in the unethical use of mapping in geospatial systems) OSM projects can gamify this sort of labor. Public Lab's work eschews such modes of gamification for their instrumentalization of the individual, but facilitates an entirely different metaphor.

The frictions exhibited in this dissertation start as early as Chapter 3 with the ambivalent and contradictory stance toward technology within *Hollow*'s narrative approach. OSM, in turn, both shapes and is shaped by burgeoning and problematic formations in geospatial capture. On the one hand, it embraces supposedly bottom-up spatial knowledge production within a "living" map that emulates the real-time status of a space as best as possible. For OSM, the "living" map is a singular representation subject to constant updating and thus never a "frozen" artifact; for Public Lab, the "living" map is a rejection of any pretense toward a single representation in favor of the vibrancy of

user images that stand out when compared to more static spatial representations. While there is cohesion within Public Lab through its community infrastructure and its online platform, the possibility of myriad MapKnitter submissions of the same area resists the sense of authority OSM privileges in its singular representation and its policy toward favoring "ground truth."

On the other hand, as OSM addresses more complex spatial information in urban areas, arguably more problematic modes of capture through automation and machine learning and increased run-ins with different IP structures mean its work as it is practiced is countering philosophies core its forming. Notable examples explored here include corporate investments in such means of mapping and state differences in how open data is. Mapping aims on the platforms discussed are reinvigorated (not stifled) by closed data and automation practices in mapping, and turn invasive technologies often seen as harbingers of surveillance into catalysts for vital activism in developing contexts.

Drone use and remote sensing capabilities fall within the aforementioned dual consequences of the Internet of Things from Chapter 3 in creating both possibilities for enhanced citizen participation in spatial knowledge production and enhanced opportunities for data harvesting. In turn, the relations of equivalence and difference Chapter 4 identifies between action and rhetoric and the legal and the ethical in mapping systems play out across the chapters of this dissertation. Notions of trust and legibility in mapping underlie all of this; both are seminal for actionable imagery and responsible data practices.

There is thus a delicate balance between affordances and dangerous use of the technologies, broader technical infrastructures, and practices each community employ, as conversations within the communities underscore. The communities are critical of "internet giants" for the lifecycles of data they generate, which ignore practices of care in data work. These platforms are adamant that communities must invest in learning how to map for themselves to best determine whether mapping

is in fact the best means of action for articulating their desires, as EDGI investments would advocate. Instances that demonstrate this critique are the drive behind HOT to establish local mapping capacities whenever possible, the vitriol Facebook's use of OSM inspired from various OSM members, and Public Lab's issues with satellite imagining and education technology excluding publics and local community concerns into their practices. The participant observation chapters convey how the development of mapping capacities in these communities not only performs valuable labor for governments and corporations even if contributions may very well be seen as a hobby or interest, but augment the legitimacy of associated tools, practices, and platforms. Those technologies emerge as ones these actors can gain from participating within and extracting from.

Public Lab's aim, ironically, is to speak back to dominant spatial representations while also seeking incorporation from those very platforms as a means of legitimacy. Members often celebrate when they can still find high quality captured images from their flights incorporated into Google Earth, with kite strings visible in the imagery being the marker of its grassroots capture. At the same time, state and corporate control of spatial knowledge and mapping imagery that platforms like Google Maps and Google Earth engender best often fuels members' projects.

This emphasizes the co-constitutive nature between corporate and grassroots modes of capture. One site of friction this dissertation examines is thus that public mapping initiatives can conform to and perpetuate the very visual and infrastructural orders being critiqued. The ideal MapKnitter submission – one that strikes the balance between altitude and resolution, so much so that it ultimately gets incorporated within the Google aerial imagery archive – is one that mimics the problematic god's eye view of the map, even if the imagery contains information (like kite strings and mappers) that makes the nature of its production more visible. Imagery via drone capture – which, given the lack of strings imaged in many of the MapKnitter reviewed through this project, may be of increased use on the MapKnitter interface – can also prove problematic. Due to this and

various other reasons Chapter 7 conveys, the foundational framing and ethics of grassroots tactics as "community satellites" thus does not always translate into practice within community submissions.

The strive for the complete map, in contrast, and the recognition that maps are always highly situated artifacts requiring continuous local-level updating is a productive, rather than obstructive, facet of these communities. It keeps them mapping in service of changes in the environment, such as in disaster mapping or monitoring of human-driven changes to the landscape. This offers renewed purposes toward mapping areas that may have been overlooked previously or through perspectives that have been historically overlooked in general, never mind with spatialities.

Lifting Barriers to Participation: Motives, Actors, and Meanings

Coleman's ethnographic work on open source work holds true within open source mapping communities in the diverse motivations afoot. For practitioners, the meanings behind these projects can vary from experimenting with the enrolled technologies as a hobby, learning more about one's own environment, learning about distant environments, and/or laying the groundwork for sustained local action. My own experiences contributing within disaster mapping, mapping of FGM-afflicted areas within Crowd2Map Tanzania, mapping of malaria-afflicted areas, mapping toward routing refugee sanitation areas in Uganda, bus route mapping, and waterway mapping show how subjects might get involved with open mapping communities with diverse projects in mind. Other projects this dissertation covers range from mapping of fire hydrants, indigenous territories (namely through Digital Democracy's Mapeo tool), building accessibility levels, oil flares, pollution sites, and landfills.

Another broader commonality between the communities discussed lies in expanding the field of actors in mapping, which again recognizes maps' social dimensions. Students, hobbyists, government workers, activists, and academics or alt-ac scholars have a pronounced presence in this

work. The participation of students is often framed as vital to gaining valuable skills in the global knowledge economy. OSM and HOT have a low barrier of entry for participation, but they are not always successful in building community capacities for capturing spatial data in practice or sufficient social infrastructure for the oppressed to contribute on a broader scale. The decline of US mapathons and Maptime events demonstrates the difficulties in sustaining a social infrastructure on OSM. The concentration of labor in Public Lab Chapter 7 charts similarly validates this.

Mapping via the forms this dissertation discusses can create spaces of dialogue and time for further deliberation of issues a community prioritizes and decides to address via mapping, foregrounding tactical interventions into space. Mapping initiatives are often not in the control of the working class – and if they are, they can still feed broader systems of suppression, not cultivate. As a matter of passivation, mapping technologies and projects can certainly accord with the kind of system Habermas dreads. The normalization and diffusion of manifold means of surveillance within increasingly distributed mapping and data ecologies brings with it potential for increased nascence of surveillance practices. This runs counter to individual freedom and democracy. These concerns align with Progressive Party anxieties about corporate power over governance, media, and the public sphere from the introduction. They also justify Habermas' perspective on the blurring between public and private leading to a less active citizenry and system functions going unchallenged.

In Public Lab, shared interest and conversations on pedagogy and EDJ are some of the most overarching ties. Specific interests in technology, mapping, or other more specific avenues of data capture via monitoring are also present. Yet all these communities can demonstrate interest in what one might deem as the adhocratic. The ability of the few to coalesce around emerging moments of crisis and address their effects expediently equally presents obvious utility providing "situational awareness" in matters of governance, though various dimensions of this were unanticipated.

Transmission and Reinvention: Comparisons to Government Imaginaries

When maps display inaccuracies, the trust in their authority is broken. The different chains of agencies they enroll – be they environments, governments, publics, or technologies – break and begin to articulate new meanings. The "successful" or legible map, by contrast, often has unquestioned authority in everyday use, is authored by professionals or those in the seat of power, and serves as an artifact of transmission rather than dialogue (as the aforementioned interlinkage of agencies would indicate). Recognizing these chains as public investments in mapping often do means seeing how malleable of an enterprise mapping can be in the first place.

Overall, a return to the archive through archaeology shows how the meaning of a given formation is never static. The past is always fluid through the lens of the present. To this end, there is certainly now a notable difference between the grand and disciplinary tenor of government imaginaries in their fashioned applications for public GPS use toward the military and economic as opposed to more everyday, vocational and environmental visions for the public use of that infrastructure. Use of everyday materials to create community-oriented data capturing tools is omitted out of the government visions recounted here. Government imaginings were more about enhanced efficiency or the transmission of information or value, and not about fostering dialogue (the ritualistic). Within them, public GPS became part of broader initiatives that strived to streamline governance with the proliferation of digital media forms in the name of citizen empowerment.

Associations with a more mobile and "new" economy and the standing "old" economy, as well as constructions of GPS creating jobs and factoring into international economic partnerships, gave publicly available GPS a clear economic framing. As it was being imagined, public use of GPS was not seen as dangerous in tracking individuals in such ways as it would later be with its ubiquity. Ensuring security was a far more pressing issue at the outset.

As the Grassroots Mapping Forum interview on ethics and mapping from Chapter 4 suggests, the issue of state surveillance through GPS persists in public consciousness, even if the consensus is that grassroots approaches are not lending themselves toward surveillance. The state must balance a fine line between knowing enough through such means to ensure safety but not so much as to thwart public trust.[11] The subject as a productive individual remedying such miscalculations in spatial representations stems from the prompted productivity of the population within governmentality. In a "socio-cultural history of governmentality," Patrick Joyce acknowledges how reifying much of the economic and the social as self-regulating systems within modernity meant "cultivating" equally self-regulating and flexible political subjects.[12] The dialectical nature of system and lifeworld in the Habermasian sense thus plays out in the need for constraint to legitimate investments in the state as a rightful overseeing body.

Though disaster response campaigns are not explicitly how the US government imagined public mapping would be instantiated when it made GPS publicly available, the application matches the spirit of its goals. It accords with the discursive frame of GPS as a safety of life system (be it in emergency situations, airport security and air traffic investments, and transportation of hazardous materials) that finds its translation into the community work documented here. More broadly, as Chapter 5 shows, development strategies are paying more and more attention to geospatial markers and data as conveying knowledge about developing areas.

The application also realizes a more efficient citizenry contributing to the work of government in ensuring safety. Public GPS as a safety of life system enrolls pronounced public-private partnerships, reflecting how governance has sublimated into media use writ large. It also buttresses platform for the disaffected to assist in humanitarian work or environmental monitoring (toward diverse applications, as the range of work here shows). The discontinuation of SA thus

opened up the opportunity for this labor in a framework of governmentality that enables seeing vital infrastructures at smaller scales to render spaces more legible.

Innovations in GPS at this time also served disciplinary measures. Just as GPS was focal to a framework of Reinventing Government and of E-Government, so too was it a major factor in a reinvention of military action. In its evolving work, as already mentioned, OSM increasingly instrumentalizes members into the work of governance. The spatial perspective of governance is, again, one OSM originally formed in opposition to on the grounds of its view of space being so inaccurate. That makes this instrumentalization, whether enmeshed in public-private interventions using the platform or in service of NGO initiatives like those of CHAI and the UN, ironic.

There is now a clear need for grassroots map production in face of a spike in natural disasters resulting from climate change and human activity. As human-produced climate change leads to more and more disasters and flooding – formations that, like pollution, do not easily conform to absolute visions of space – the dialectical work crowdsourced mapping provides fills a need in face of state failures to prepare and respond to disaster effectively at such scales. This helps ensure the safety of those affected by disaster at a time when government responses to disasters are under heavy critique within the media and the citizenry. The rapid and unprecedented pace of these disasters and climate patterns mandates action to prepare states and NGOs as best as possible.

Aside from the significant disaster mapping assistance HOT provides, shifts to more concerted efforts and events mapping bike routes and walking trails accord with the biopolitical agenda of mapping toward furthering the health of the population. Even the notion that volunteering for HOT can correlate with a healthier lifestyle and enhanced engagement with one's community hints at a related incentive on the part of those participating. Generally speaking, this instrumentalization reflects broader changes concomitant with the digitization of mapping and its availability for public use that media ecology and mediatization perspectives can illuminate.

Mediatization, Media Ecology, and Mapping

Mediatization broadly signifies how means by which we interface with mediated content change with institutional changes that diffuse into social relations. Stig Hjavard claims mediatization prompts "a virtualization of institutions," as "individuals . . . can partake of many different institutions, irrespective of their physical location."[13] The virtualization of government work that public GPS participates in from Chapter 3, including (but not limited to) ensuring security and disaster management is one evolving out of modernization campaigns across the government as a result of both public GPS use and commercial innovations off GPS. In such examples, one notes the frame for technologies of governance including GPS as needing to transform in light of the affordances of it in other sectors and applications, meriting the mediatization of GPS.

Relatedly, McLuhan contends that "once a new technology enters the social milieu, it cannot cease to penetrate that milieu until every institution is saturated."[14] As Altheide's metaphor of shifts in a baseball field over time additionally identifies, technological advancements can thus have broader social effects when operations of more institutions become enrolled into their use. It is as much a matter of the field adjusting to the actors as the actors displaying affordances that may merit envisioning transformations in the field.

Equally crucial from a media ecology perspective is that, following McLuhan's lead, communications research must ask how mapping extends us as people. Just as the classroom environment (as Neil Postman writes about) encourages route memorization and recall over critical inquiry by its very structure in ways that align with McLuhan's adage that "the medium is the message," so too does digitized mapping typically encourage thinking in terms of routing and efficiency, rather than activation and critical inquiry.[15] The range of applications *Ecologies of Digital Mapping* documents provides ample evidence of map use toward both ends.

At the same time, one must consider what remains constant in mapping as a set of practices and as a broader pursuit despite this mediatization process. This accounts for Niels Ole Finnemann's view of mediatization as a co-evolutionary process "of old and new media, . . . a matter of politics, culture and civil society, and of new genres and changing relations to audiences."[16] Within the archaeological analysis of Chapter 3, some of the most concrete images of bridging between the new and the old include soldiers on horseback using GPS and GPS creating new modes of value production while furthering old ones like truck driving. More abstract at the time were the kinds of productive governance frameworks diffused into civil society and the transformed relations between users, data and infrastructures in spatial knowledge production.

In turn, as part of a media ecology framework, McLuhan conveys that "the content of the new medium is some older medium."[17] Within the emerging form of grassroots maps, for instance, the camera itself is ideally part of the content. Strings, mappers, kites, balloons, and shadows are all pivotal to understanding the means of image capture once incorporated onto a dominant platform. The reliance on satellite imagery within much of HOT's efforts and on app-facilitated street view capture in both HOT and OSM projects equally harkens back to the form of aerial photography (which itself expanded mapped territories during WWI) and the camera via smartphone capture.[18]

I summarize the evolution of mapping within a media ecology and mediatization perspective through four steps that such perspectives often diagnose in developing media.[19] The first step (as McLuhan in part elucidates) is to see how the "new" platforms, infrastructures, and technological uses at hand serve as a medium for pre-existing actions, activities, and technologies. The imperial and economic applications (among others) discussed in Chapter 3 are of obvious consideration here. The ways mapping has historically facilitated control and conquest at a distance plays out in forecasted uses for public GPS at the level of governance in different applications toward enhanced governance, productivity, militarism, and security for the citizenry.

The second step, however, is to establish how these "old" applications adapt to the "new" medium. In the case of governance, the more "open" government imagined in part due to imaginings of public GPS was part of a broader "reinvention" of governance processes toward more efficiency and more inclusion of lay publics, a vision to which GPS imaginaries contributed. The capabilities of GPS thus became advantageous for longstanding use of mapping in enhanced management of complex environments (be it in cases of disaster management, monitoring, or warfare) in a different manner – more distributed and less authoritative, thus overcoming historical detriments of state or corporate spatial perspectives.

The third step is to isolate how this adaptation becomes naturalized. It reflects a core precept in media ecology – that "media become more natural, less artificial, more human, as they evolve."[20] As earlier chapters explore, user consent into technical systems that extract value from locations certainly serves the economic factor one finds in government imaginings of GPS, even if not the exact route to it government actors anticipated. Google capitalism and Google's role in both its public-private partnerships and its broader hindrance of opportunities for public participation to weigh into spatial matters manifest some of the unforeseen structures to come in such matters.

Mapping's increasing diffusion into everyday interactions and personal data ecologies – not just in matters of navigation, but advertising and wellness monitoring – make it seem natural rather than produced in complex ways. This naturalization may also impact perceptions of the downsides to the medium at hand. Fears over potential insecurities in GPS use at the user level in mapping practices are barely mentioned in community discussions despite being pronounced as GPS was being opened up to public use. As this project follows, fears in these communities have evolved more so to concentrated ownership of data, machine learning, drones, and corporate tracking than vulnerabilities in GPS as a system writ large. GPS use being perceived as less "new" or somehow less machine-facilitated as other means of mapping may very well play into this naturalization and

change in sentiment. For instance, as OSM community conversations reflect, constructions of GPS as a mediating force in mapping have transformed over time. GPS itself, in this naturalization, has now become more everyday and "human" within the mapping process, being seen as part of an on the ground approach that in its material infrastructures is quite the opposite.

The aforementioned Human in the Loop framework for algorithmic mapping interventions is one clear example. The reference to geospatial data and data more broadly as having a "lifecycle" within the Grassroots Mapping Forum can equally reflect a naturalization that merits "reimagining" to account for enhanced responsibility over data. This aligns with a feminist perspective on data and accords with the need for public trust that data is being used ethically. This makes the project's considerations of Habermas as his work relates to contemporary data ecologies vital. Such talk of a "lifecycle" of geospatial data equally reflects, from a media ecology perspective, a humanization of geospatial technology use over an alienated process of data production and management within powerful corporations and nation-states.

Figure 8.1: A proposed mediatization framing of evolving public GPS use

The fourth step recognizes how, at the end of the process, "new" possibilities and activities emerge. As users employ "new" media at first largely for similar purposes as prior modes of mediation, these purposes adjust to the affordances and constraints of a new medium before more emergent uses come to the fore that eventually appear nascent. Military, safety, and commercial applications apparent in government justifications toward opening GPS use, while likely an afterthought at the user level considering this naturalization, remain resonant. Emergent use for

GPS in the publication of user-generated aerial imagery (in ways that both respond to issues of resolution and seasonal capture within Google's imagery archive and can augment its imagery archive) can carry over such frames. "New" processes that emerge can thus exhibit a range of positive and negative valences.

Despite these insights, as brought up previously, this project has various reservations on the media ecology perspective. In an obvious departure, for one, the project argues that the map is not just a medium in its extension of sensorial capacities, but also an aggregation of a host of different practices and techniques. Maps, again, are both living and mediate living processes. While their mediating capacity resonates with a representational take on mapping, what maps perform and the human-nonhuman entanglements practices underpinning mapping can either occlude or bring to life – depending on the manner in which it is conducted – means going beyond a sense of content, social field, or a media logic that inevitably envelops the entirety of the social field, and into a more poetic fold of craft and assembly. The project's integration of participant observation, which I comment further on in the next section, largely realizes the vision inherent in the latter.

Relevance, Limitations, and Connections in Employed Methods

In studying notions of craft and assembly in mapping, the approach this dissertation takes in its endorsement of a multi-method approach and its particular instantiation of participant observation is distinct in several ways. While inspired by Kellner, the former specifically unfurls in chronological order policy and governmental imaginings, initial use, and present-day use of public GPS in impactful campaigns. The ultimate (though not the only) reason for this particular presentation of the material is that it establishes the "forces looking in" – namely, states, corporations, and academic research paradigms – and the nature of community spatial interventions

via public GPS use before detailing entanglements between these energies. These play out in partnerships between communities and larger organizations, as well as in how the platforms at hand seed "grassroots" projects while at the same time serving corporate initiatives that can co-opt the data said platforms host toward projects that can be out of step with founding philosophies. This is not meant to be overly critical of such initiatives and platforms, but practical – to highlight how complex interventions in mapping are in the current state of mapping, along with the need to continually develop the right social and technical infrastructures in light of these complexities.

Likewise, in its enactment of participant observation, this project follows the lead of work in digital participant observation studies as previously cited. It also differs, however, from such work. Though this project conceptualizes digital mapping initiatives as projects of virtual world-making in that established tradition, the communities at hand do not exhibit the same scale or time commitment scholars typically associate with virtual worlds like those of Second Life or online gaming environments. The project does take up the charge of "being there" and provides an extensive look at what forms online contribution to the mapping efforts of the communities surveyed takes. But the consideration of immersion in communities that work at such scales and in such "ad hoc" ways are ones that the field must consider more moving forward as online modes of organization become more ubiquitous.

Though the glimpses at community member interactions in the act of surveying is not as prominent in the proceedings as many may very well find are rightly due, it provides a strong first step for such avenues of research by charting broader facets of surveying in these communities that merit establishing first and foremost. Doing so provides the important lesson of needing to tread very carefully with potential research designs taking a more grounded look at member interactions moving forward, considering critiques this dissertation broaches on the dangers of co-opting and outsider perspectives onto community-level projects.

Overall, claims that participant observation studies are not rigorous are steeped in the academy's debates between interpretivism and positivism. While the latter finds legitimacy in generalizability and replicability, the former (in the lead of both cultural studies and STS scholars) recognizes the study of culture as more complicated. Predictive, hypothesis-driven experimental models do not capture the richness of culture.[21] Studying culture requires flexible research and interview questions, prepared for the unanticipated and often unconscious – a model participant observation fits.

Situated contexts and the cultural training of researchers equally inform the scientific.[22] Boellstorff et al note that, "[r]ather than pretend a 'God's eye view' of the world is possible, it is more scientific to realize that a science generates situated knowledge." Part of this situatedness involves different social locations observers may embody, as "[s]ubjectivity is an inescapable condition of science."[23] Critical distance must be understood as similarly situated in cartography.[24]

Recognizing subjectivity in the cartographic and scientific process can reveal frictions and ecologies in play. Friction can only be seen if one recognizes universal aspirations like the complete map are internalized and remade in distinct ways in different locations that ultimately fuel the pursuit of that universal idea. This recognizes there is not just one way to mount activist or scientific interventions, an undercurrent to Boellstorff et al's perspective equally present in STS scholarship.[25]

While participant observation is at the project's core, a full consideration of the discursive frame, visual nature, and phenomenological dimensions at play merits pairing it with other methods. Ethnographic methods can emphasize the discursive and the practice-based in participant observation, but can ignore the import of the visual (a critical facet to this research) in shaping these processes, neglecting Gillian Rose's drive to see its role in mobilizing power and practices.[26]

CDA, in turn, focuses on globalization's consequences and imagines different formations for the betterment of humanity. With much of the work highlighted here engaging in such work, CDA

fits project aims to evaluate such aims at the level of text and practice.[27] As CDA is critically attuned to discourse and practice at the community level, so is archaeological analysis attuned with the construction of archives and historical narrations that bear weight on both. A study attuned to the ecological invests in similar interests as CDA as a result of its focus in conditions of possibility, discourses, practices, entry points for public interventions, and interlinkages in space-times.

Future Orientations

The methodologies employed here and their attention to these features reveal several entry points for further work in digital mapping and grassroots contributions to spatial knowledge production. A consideration of the cartographic as an increasingly powerful mode of communication is warranted in the contemporary media environment, and this project takes up that mantle. From a critical/cultural standpoint, tracing how discourses of class, colonialism, gender, indigeneity, and voyeurism enter in open source mapping communities can relay how structures of exclusion that have long underpinned mapping as a form persist. This occurs despite the insistence of select mappers that the "open" in open source translates to inclusivity in and of itself.

These considerations, as Star points out, are not matters of supposed "de-socialization," which only holds within a reified vision of the social lacking material considerations of an ecological perspective, such as access to resources and structural barriers to participation.[28] These material conditions are ones Public Lab addresses through the design of low-cost DIY capturing technologies, while HOT mainly addresses this by seeding community-initiated projects across the globe. While far from the only considerations worth addressing in increasing public capacity for mapping, they are important first steps.

Though the illegibility of aerial imagery is well-documented at the scale of government in the literature this dissertation draws upon, there are pronounced difficulties at the level of the public that warrant further examination. The policy implication here is a need for better communication both at the federal level and at the level of individual contributors. The goal for doing so is to establish proper IP considerations and maintain respect for prior on the ground data**.**

The lessons this research offers for implementing crowdsourcing in aerial imagery assessment is that such work benefits from both modeling norms and particularities of the aerial imagery at hand and underscoring the high degree of subjectivity this assessment entails. What the nonhuman – including oil, species of wildlife, nurdles, and cement cracks – articulates in such imagery is not easily human or machine observable. Just as with citizen use of GPS in navigation, mapping on these platforms encompasses negotiations between human and nonhuman commensurate with an ecological perspective.[29]

The social dimensions of modelling these practices are equally important. HOT demonstrates that planning in dedicated social interaction – be it through intern mentorship or feedback from hackathons and peer review – to highlight these particularities and judgement calls can aid in such work significantly. Modelling actions within particular tasks, rather than relying solely on broader task instructions, increases accuracy and efficiency. Without it, projects can either lag or face difficulties in quality control and impact. In addition, the mentorship of organizational leaders as a means of building in social relations can build members' motivation and confidence in providing such complex and valuable labor. Similar findings can emerge in analyses of Public Lab's crowdsourced intervention into government Hurricane Harvey response efforts.[30]

There is much to gain through a research agenda focused on what contemporary non-expert cartographic collaborations communicate and perform. To start, studying open source mapping communities can reveal a great deal about best practices for crowdsourced disaster response as a

sociotechnical system. Interfaces, algorithms, and hackathons are all in play in these campaigns. Learning from the strengths and omissions of how organizations design these elements into campaigns can illuminate the factors that enter into ideal campaign design.

Other interests within research on crowdsourcing that this work resonates with include the efficacy of different modes of peer feedback and the roles of curiosity and intrinsic motivation in contribution. Research in Human-Computer Interaction (HCI) on HOT provides a fair starting point for exploring the former. More research on the timing of feedback, the experience of the peer reviewer, and the adherence to certain norms in private feedback remains vital moving forward.[31]

Studies on crowdsourcing show that creating curiosity within task design can increase contributions and the quality of the resulting data.[32] User interest in exploring distant areas through this work may likewise motivate. One can at the very least identify within HOT's calls for contribution online moments in which HOT promotes this facet of the work (albeit problematically, given cartography's colonial history) as a persuasive tactic.

However, contribution is not merely a matter of curiosity, but of perceived imperative.[33] This can equally inform work in Public Lab in a focus on environmental monitoring and communities of impact. Yet, overall, intrinsic motivation factors remain relatively undertheorized in studies of crowdsourcing.[34] Thinking through how projects frame crowdsourced tasks in meaningful ways is also worthy of attention. Research indicates meaningful framings increase the likeliness to participate within crowdsourced frameworks without compromising the quality of the work.[35]

When this work carries over into different social events like hackathons and mapathons, there is a need to measure the impact of social events on the platform, on the participant, and, if applicable, on the institution or requesting organization running the event.[36] More exploratory and qualitative work on how these events model norms and behaviors (similar to research on HOT that

has identified a need for isolating the effect of norms and reviewers' level of experience in providing feedback) can enrich understandings of how such platforms facilitate complex work.

In a broader sense, expanding the purview of archives and online communities this dissertation surveys can fuel continuing work under the lens established here. A more extensive archival project on the development of public GPS working with a broader span of presidential archives is well-warranted. This would include a more intensive archival analysis of Clinton and Bush administration documents as well as those of the Reagan and Obama administrations. Additional archives to analyze could include those housing documents from government organizations such as NASA, the NOAA, and the DOT. Likewise, as noted previously, similar studies of communities like those behind Mapillary, MapStory, Tomnod, Ushahidi, and Zooniverse could add to scholarly understandings of image verification and citizen science platforms.

The critical perspectives this dissertation presents, be they on community ownership of data or the multiplicities inherent in space-times, can extend to critical analyses of other arenas of social science research. As this dissertation shows within monitoring efforts, competing, not authoritative, spatial visions over the extent and effects of different phenomena are merited to complicate understandings of them. Research in place and health factors, for one, encompasses predominantly observational cross-sectional studies relying on census neighborhood boundaries.[37] Studies based on census data of where one resides may misrepresent propensities toward different risk factors when compared to the spaces one actually spends their time. Sticking with absolute visions of space in such research thus may very well miss the mark, and exemplifies the inherent partiality of any approach to data.[38]

Indeed, the moments when projects this dissertation discusses are most aware of their partiality and situated nature – such as in managing a workflow between remote and on the ground work or in gathering user-generated aerial imagery – are arguably the moments when they

demonstrate the most potency and the strongest awareness of the ethics in play. What *Ecologies of Digital Mapping* presents thus speaks to issues that go beyond mapping. Public interventions into data and transnational information capitalism are both stifled and fueled by absolute spatial imaginaries and dangerous corporate investments into platforms of spatial data. These imaginaries shape the kinds of questions and actions citizens can take in contesting spatial problematics, ranging from gendered understandings of space, environmental injustice, land rights contestations, and the like.

Public interventions strive to make geospatial knowledge production less monolithic and out of the hands of the average citizen. They recognize different space-times in operation behind dominant digital archives and interventions into spatial representations, be it in times of crisis, corporate oversight, government data projects, or otherwise. These are only part of the ecological dimensions to digital mapping, alongside various frictions, densities, and practices documented here, that merit further discussion within scholarly work on mapping, especially within critical perspectives on communication and media.

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[8] Star, *Ecologies of Knowledge*, 2, 20.
[9] Ibid, 14, 16, 18, 20.
[10] Naisargi Dave's vision of "the horizon of justice" inspires my take here. See Naisargi Dave, *Queer Activism in India: A Story in the Anthropology of Ethics* (Duke University Press, 2012), 204.
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[23] Boellstorff et al, *Ethnography and Virtual Worlds*.
[24] Burnett, *Masters of All They Surveyed*, 99.
[25] See Kim Fortun, *Advocacy after Bhopal*, 16 and Oreskes, *The Rejection of Continental Drift,* 5.
[26] Cameron McCarthy, "Cultural Studies and Semiotics: Rhetoric of the Image" (presentation, Urbana, IL, March 20, 2014).
[27] Fairclough, *Analysing Discourse*, 203.
[28] Star, *Ecologies of Knowledge*, 10.
[29] See "Annelie Pentenrieder: „Please make a legal U-Turn": Navigieren als Co-Produktion von Fahrer_innen und ihren Navis," *Universität Paderborn*, June 27, 2017, https://www.uni-paderborn.de/termin/calendar/event/tx_cal_phpicalendar/annelie-pentenrieder-please-make-a-legal-u-turn-navigieren-als-co-produktion-von-fahrer-innen-un/.
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APPENDIX A: IRB LETTER

University of Illinois
at Urbana–Champaign

Human Subject Review Committee
Institute of Communications Research
College of Communications
810 S Wright St., Urbana IL 61801

Chair: Norman Denzin

Phone: 217.333.0795
Fax: 217.244.9580
E-mail: n-denzin@uiuc.edu
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Institute of
Communications
Research

June 15, 2017

Edward Prutzer
Institute of Communications Research
119 Gregory Hall
810 S. Wright St.
Urbana, IL 61801

Re: IRB-17-003

Dear Edward Prutzer:

Thank you for submitting your Application for Research with Human Subjects Review. Your research project, "Ecologies of Digital Mapping: Grassroots Maps and Public Lab," is exempt from review by the Human Subject Review Committee of the College of Media based on the judgments that

1) Your research does not involve more than minimal risk to human subjects.
2) Your research falls under **"Common Rule" (45 CFR part 46)** for exempt from IRB review in Title 45, Part 46 of the Code of Federal Regulations for the Protection of Human Subjects (45 CFR 46).

Please proceed with your research project. Should any changes occur to the funding, research protocol and recruiting measures of your project, please inform us immediately.

Yours most sincerely,

Norman K. Denzin