Mashing-up Maps

Google Geo Services and the

Geography of Ubiquity

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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor in Philosophy in the Department of Geography.

Chapel Hill
2012

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Abstract

CRAIG DALTON: Mashing-up Maps: Google Geo Services and the Geography of Ubiquity
(Under the direction of Scott Kirsch)

How are Google geo services such as Google Maps and Google Earth shaping ways of seeing the world? These geographic ways of seeing are part of an influential and problematic geographic discourse. This discourse reaches hundreds of millions of people, though not all have equal standing. It empowers many people to make maps on the geoweb, but within the limits of Google's business strategy. These qualities, set against the state-centeredness of mapmaking over the last six hundred years, mark the Google geo discourse as something noteworthy, a consumer-centered mapping in a popular geographic discourse. This dissertation examines the Google geo discourse through its social and technological history, Google's role in producing and limiting the discourse, and the subjects who make and use these maps.

Acknowledgements

This dissertation was only possible with the help of a large number of people. I owe each a debt of gratitude. Chief among them is a fantastic advisor, Scott Kirsch. His patience, grace, and good criticism saw me through the trials of graduate school. Thank you Scott. I owe John Pickles a great deal not only for his advice and for serving on my committee, but for his tireless administrative support of me personally and of UNC-Chapel Hill's geography department as a whole. This dissertation also would not have been possible without rich input from Banu Gokariksel, Ken Hillis, and Sarah Sharma.

Joseph Palis, Sebastian Cobarrubias, and Maribel Casas-Cortez went before and showed me the way. Liz Mason-Deese, Tim Stallmann, Nathan Swanson, Lan Tu, Murat Es, David Terry, and Adrian Wilson kept me sane as we walked the path together. Denis Wood somehow both provided inspiration and kept my feet on the ground.

In a different field, I also owe a great deal to those who participated in my research. Without their work and their help, I would have nothing to write about. Paul Rademacher, Mano Marks, Greg Coombe, John Coryat, Frank Taylor, Brady Forrest, Andrew Turner and Anselm Hook deserve special thanks for taking the time to talk and/or for helping to organize neogeography through blogs and events such as Wherecamp.

The research itself would not have been feasible without the University of North Carolina's Ferdinand Summer Research Fellowship and consistent support from UNC Chapel Hill's Department of Geography.

I am thankful for the unshakable confidence of my parents, Jim and Carolyn, who made it possible to dream. Finally, thank you Cecilia, my partner, for moving to North Carolina, for your patience, and for your loving support.

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Chapter One: Introduction

> "I will build a motor car for the great multitude."
>
> "Any customer can have a car painted any colour that he wants so long as it is black."
>
> -Henry Ford (72, 73, 1922)

This dissertation explores how Google's geographic services are related to new geographic ways of seeing, subject positions and forms of mapping. Just as the Model T helped create a mass market of motorists that continues to dominate American transportation, **Google geo services**[1] and the discourse around them have the potential to reshape mapmaking and open new opportunities for map **users** and mapmakers. This mapping discourse offers powerful knowledges, but also has real, built-in limits.[2] Google's **web** technologies, cultural visions and associated maps are closely tied to the economic and social relationships around them. For the people making and using maps with Google, these technologies and social relations can facilitate new geographical visions, what Cosgrove (1998), drawing on John Berger (1972), calls "ways of seeing", that are both powerful and problematic.

Set against the cartographic history of the last six hundred years, the discourse around Google geo services is something new. Most of the systematic mapmaking since

[1] Terms that are bolded the first time they appear are listed in appendix a, the glossary for this dissertation.

[2] The Model T was not always limited to a black, but in 1922, the only consumer color scheme was black due to Ford's cost-cutting use of a quick-drying paint then available only in black (McCalley, 1994).

the Renaissance has been state-centric, whether thematically centered on or produced by and for the state, its agents and citizen subjects (Crampton, 2010; Wood, 2010). By contrast, Google geo services are part of a company that focuses on consumer-users. Furthermore, these people play an active role by not only using maps, but also by creating their own new maps in the form of geographic **web applications** (**web apps** or **apps**).

There is more at stake in the Google geo discourse than professional map production or Google's profit margin. These maps and related ways of seeing exist within a popular geographic discourse that extends to everyone who uses Google geo services. Such a common and potentially powerful concept of geography calls for critical examination of its strengths and limitations.

These points underpin the overarching question of this dissertation: How (if at all) are Google geo services producing new ways of seeing and understanding geography, and recursively, how are they are producing new maps and mapping subjects? How can we understand the visual geographic knowledges, maps and subjects at work in the Google geo discourse without resorting to overly-simple conceptions of heavy-handed cartographic dominance by Google, capitalism or the state? To begin to analyze that complexity and productivity we must understand more about Google geo services themselves.

Why Google geo services?

Google entered the world of web mapping in 2004-05 by acquiring several companies and rebranding them as Google services. When Google launched **Google**

Maps in early 2005 and **Google Earth** later that year, it was already clear to technophiles that something new and different was afoot. MapQuest was the most popular web mapping service at the time, having offered free internet driving directions maps since the mid-1990s. At the same time, a few services, most prominently Microsoft's TerraServer, made aerial photographs of the United States available to internet users. Google put all of these qualities together in a more user-friendly package. Its services used true color aerial images and became known for speed and being easier to operate than those of competing products (Kane, 2/8/2005; Donoghue, 4/20/2005, Andrew LePera, 5/31/2005; Francica, 12/1/2005).

Google geo services are also noteworthy because they allow people, mostly non-traditional mapmakers, to create their own web maps. These kinds of maps, known early on as **map mashups**, plot third party data on a web mapping service. For example, one early map mashup, *Housingmaps*, plotted apartment listings from Craigslist classifieds postings onto Google Maps (Porter, 4/26/2005). For reasons this dissertation will examine, Google made the choice to embrace map mashups by institutionalizing them through an official Google geo service, the **Google Maps Application Programming Interface** (Google Maps API). The IT industry term for this practice of allowing and attracting people from outside a company to contribute is **crowdsourcing** (Howe, 2008). Since 2005, map mashups, now more often referred to as geographic web (**geoweb**) **applications**, have grown in diversity and importance. According to ProgrammableWeb, a web development resource center, the Google Maps API is and has been for years the most frequently used of all APIs on the web (Programmable Web; 12/10/2010). Google now also offers other mapmaking services such as **My Places** (formerly My Maps), a

very simple mapmaking tool in Google Maps, and **Google Map Maker**, a toolset that allows people to contribute to Google Maps' underlying dataset. In this research, I observed and talked to a number of different kinds of people who use Google geo services to make maps including professional **geo software developers**, military officers, web mapping enthusiasts, small business owners and **geohackers**. Collectively, these people who make geoweb apps for broader use than their own personal purposes refer to themselves by a number of terms. I refer to them as **neogeographers** because it is one of the most common and inclusive of those terms (Turner, 2006; Wherecamp, 2010). Few of these people have formal or even semi-formal training in cartography or geographic information systems (GIS), but they nonetheless make powerful, effective maps.

Building on the success of Google Maps and Google Earth, the **Google Geo Division** continues to update its services and launch new ones, such as **Street View**, a linked series of human eye-level panoramic photographs. Google geo services have also grown in popularity since their launch. As of October 2011, Google Earth had been downloaded more than one billion times around the world (McClendon, 10/5/2011). In mid-2012, the flagship site maps.google.com regularly had an estimated 30 million site visits a week by more than 14 million different users in the U.S. alone (Quantcast, 12/1/2011). On top of this, Google claims that the total web traffic of the Google Maps API through third party websites is even greater than the central Google Maps service (Jones, 3/31/2010).

That sheer popular reach is one of three reasons why I focus on the Google geo discourse in this study. Popular influence not only impacts huge numbers of people, but also has the capacity to affect multiple ways of seeing as part of whole geographical

discourses, what Gregory (1994) refers to as "geographical imaginations." Google geo services have captured the public imagination, evident in popular discourse, more than any other web mapping service. 'Google Maps' and 'Google Earth' enjoy usage and recognition in direct connection to the verb to 'Google.' Furthermore, Google's geo services are a cultural phenomenon with repeated appearances and references in popular culture, news media, television shows, enthusiast websites, technology blogs and comments by a U.S. President (Saturday Night Live 12/17/2005; The Daily Show with Jon Stewart, 2007; Vacationeers, 2007; Schwartz, 4/2/2007; Ratliff, 6/26/2007; Turnbull and Turnbull, 2008; Doctorow, 5/8/2008; Haines, 3/2/2009; Wallace, 3/27/3009; Dolan and Wrenn, 4/4/2009; Lazzeri and Whelan, 8/26/2009; Helft, 11/16/2009; Smith, 8/23/2010; Top Gear (U.S.), 12/19/2010; Clarke, 2011; Habe-Evans, 7/26/2011; ABC News, 9/13/2011; Sagel and Kasell, 12/3/2011). Second, Google is generally recognized as an industry leader not only in sheer usage but also by industry professionals and scholars (Zook and Graham, 2007; Where 2.0, 2010; Wherecamp, 2010). Third, mashups and geoweb applications have made Google geo services into a hotbed of mapmaking by neogeographers. From the launch of the first map mashups in 2005, the Google geo discourse has been at the forefront of a push to include nontraditional third parties in web mapping, thereby incorporating their ideas and work. Over time, these neogeographers have carved out a position for themselves in wider ideas of geography and mapping. Google was perhaps the first large company to accommodate these web-based mapmakers and today it is one of many companies in the geospatial industry to incorporate their work.

As popular mapping, often by people who are not trained cartographers, these maps are important for their social conditions, potential, and limits. Google's geo services are part of the company's capital accumulation strategy and thus connected to governance and the state in new and different ways than many other maps made over the last few centuries. As a result, the subject positions and possibilities of this mapping differ from many other kinds of maps, albeit in ways limited by Google and its own strategy on the geoweb. Google geo services are something new and important in how people can see the world.

Problem statement

As the stakes indicate, the Google geo discourse is rich not only with mapping technologies, but also ways of seeing and noteworthy subject positions. These qualities prompt the foundational question of this study: How (if at all) are Google geo services producing new ways of seeing and understanding geography, and recursively, how are they are producing new kinds of maps and mapping subjects? To understand the context and complexities of such processes, I use three research questions to structure the study:

Question 1: What are the historically specific conditions of possibility for the discourse of Google geo services? How did historically state-facilitated ways of seeing using professional methods become everyday geographic tools for millions of internet users?

Understanding the implications and possibilities of this discourse requires understanding its limits and structure, and therefore the genealogy through which it developed. To understand these conditions, I analyze the geographical ways of seeing

that converge in Google geo services. This work involves the early production of cartographic ways of seeing, their shift into consumer use and Google's endorsement of map mashups.

Question 2: How does Google and its capital imperatives shape the Google geo discourse through geographic technologies and knowledges? How does this discourse delineate possible geographical imaginations and processes of mapping?

Analyzing Google's accumulation of value and information is key to understanding the cultural geographic limits and possibilities of the Google geo discourse and related technologies. Google's business strategy of free services and targeted advertising underlies the purpose, structure and function of Google geo services.

Question 3: How does the discourse of Google geo services shape social roles and understandings of geography outside Google Inc.? How does the discourse produce mapping and mapmaking subjects? How is it shaping new kinds of mapping, geographical understandings and epistemologies of mapped (and unmapped) things?

The influence and possibilities of the Google geo discourse extend beyond the company and its corporate strategies. Neogeographers' and users' ways of seeing help define what can and cannot culturally and technically be mapped and known with the geo services. Through these people, mapping and mapmaking grows and develops in important ways. Some use maps to understand geography in new ways on a huge, popular scale. Others push the cultural and technological margins of the discourse with their geoweb apps.

Three general themes

In answering these questions, three general themes are apparent that mark the discourse of Google Geo services as important to studies of mapping, of geographical imaginations, and of technologies: First, the nature of Google's capital accumulation and ways of seeing in managing that strategy on the geoweb; Second, a consumer orientation of mapping in this discourse; Third, a particular historical and continuing relationship with the state.

1. Ubiquity

Google's business strategy of organizing information and targeted advertising means the company must constantly strive to simultaneously organize knowledge in a totalizing, standard way, and yet serve it and ads to users in an individualized way. In Google geo services, this tension is apparent in a geographically ubiquitous strategy that serves individually customized maps to users through particular ways of seeing.

Google's core function is to allow any user to search the entire internet using the Google search engine. This all-encompassing approach reflects Google's general capital accumulation strategy, which is focused on what Google's executive chairman and former Google CEO Eric Schmidt calls "ubiquity" (Schmidt, 7/7/2009; 11/13/2009). Google makes money by placing highly-targeted advertisements near its search results. The combination of these two aspects highlights a tension at the core of Google's capital accumulation. On one side, Google must offer universal, standardized services, such as its search engine or Google Maps, to provide the technological means, a brand, and an entrance for users into Google. On the other, Google needs to make each user's

experience as individually tailored as possible to maintain the flow of highly targeted advertising revenue.

In this context, Google geo services are built around what I label a "geography of ubiquity." This three pronged strategy connects Google's general services to individualized results by attempting to map anything for any internet user who could be located anywhere in the world. This approach is clear in Google's moves to extend its geographic data and service availability globally. In practice, this strategy has obvious material limits, but it has the discursive purpose of a mission that grows with the company.

Using this strategy, Google aims to make its geo services a ubiquitous geographic resource, yet make the services localized and customized enough that individual users will click on advertisements. There is more to maintaining this contradiction than managerial work and technological fixes on Google's part. Users of Google geo services must be able to make the conceptual jump between standardized, iconic, global scale geographic information and the personal, local scale where the information and related advertising is most relevant to them. If users fail to make this connection to their local situation, they won't utilize the individualized dimension of the service and consequently won't click on as many ads.

Google geo services employ two ways of seeing to help users connect a totalized global map to recognizable local scales: **hyperlocality** and **accessible aerial imagery**. Reading Cosgrove's description of landscape through the work of Foucault, I use Cosgrove's concept of ways of seeing[3] as visual, geographic cases of Foucault's power knowledges (Cosgrove, 1988; 1998; Foucault, 1980; 1995). Hyperlocality and accessible

[3] I go into greater depth about my use of this concept in Chapter Two.

aerial imagery are ways of seeing the world that work as visual, geographic forms of power-knowledge. Hyperlocality and accessible aerial imagery, much like Cosgrove's landscape, are ways of seeing produced through relations among people and between people and the Earth. These relations are socially situated and materially mediated by socially-shaped technologies. I further describe hyperlocality and accessible aerial imagery as power-knowledges for three reasons. First, they help illustrate how things happen in the Google geo discourse. For example, they allow users to visually connect local views with global ones and thus allow Google to manage its profitable tension between ubiquity and individualization. Second, Foucault's concept of power includes broadly distributed micro political relationships and resistances, which fit with some processes at work in this context such as the transgressions of early map mashups. Third, Foucault offers a useful framework, genealogy, with which to analyze power knowledges over time. In the following sub-sections, I introduce each way of seeing.

Seeing hyperlocally

"Hyperlocal" is a Silicon Valley neologism that appeared repeatedly in this research in discursive texts, conversations, and interviews. The concept of "local" has many meanings and constructions of scale, including practices of everyday life, regional economies, adjacent areas plotted on a Cartesian grid, and the output of Global Positioning Systems (GPS). The term hyperlocal dates at least as far back as 1991 as a description of geographically-targeted news coverage (Farhi, 3/11/1991). Current technophiles apply the term to everything from neighborhood-oriented "hyperlocal" blogs to targeted "hyperlocal" marketing to playing "hyperlocal" geographic games with

a smartphone (Wherecamp, 2009; 2010; Where 2.0, 2010). One of the clearest examples is a short story by Bruce Sterling entitled "Dispatches from the Hyperlocal Future" that appears in the same issue of *Wired* as the magazine's first in-depth article on Google geo services (Sterling, 6/26/2007; Ratliff, 6/26/2007). The story takes the form of a blog by a technologist-celebrity named Harvey Feldspar. Beyond Feldspar's brash, obnoxious confidence, the story highlights very localized location-aware technologies throughout the character's world, city, residence and even his body. Each tiny piece of technology and information in this story is precisely geographically indexed.

> You see, the difference between the old-fashioned semantic Web and the new hyperlocal Web — that's hyper as in linked, and local as in location — is that the databases of the new Web are stuffed with geographic coordinates. Real positions. Real distances. (Sterling, 6/26/2007).

At the same time, the story articulates how the hyperlocal is always "linked" or situated within a total, global context.

> I like kimchee and bulgoki as well as the next guy — in fact, I'm a major fan of samgyeopsal with garlic and onions — but an entire YEAR in the same city? An entire year? The whole point of the hyperlocal revolution was to transform our relationship to the surface of the planet. We're supposed to glide across the planet's rugged surface with the same point-and-click ease that we did with an Internet screen. (Sterling, 6/26/2007)

While this global connection is often simply assumed in the rhetoric of technologists, it is fundamental to the concept. Without a visual connection across scales to a continuous, global mapping scheme, plotting the location of a single object or person holds less significance. What hyperlocality illustrates is the power of connecting highly local events within a standardized, global geographic scheme. Due to its totalizing and multi-

scalar nature, hyperlocal geographic precision allows Google geo services to smoothly visually shift between the global and local, ubiquitous and individualized.

Seeing with accessible aerial imagery

Aerial photographs are a power-knowledge that articulates the links in western cultures among vision, a view from above, and truth. As a technology, aerial photography combines the cultural authority of photography with a "god's eye" perspective (Crary, 1989; Haraway, 1991; Kirsch, 1997; Cosgrove, 2001; Pickles, 2003; Dodge and Perkins, 2009). Such imagery, captured from satellites or planes, is usually quite expensive to produce, even today. Aerial photography shot from satellites also takes on the additional cultural mythos of a space-based platform that most people cannot see from the ground.

I add the term "accessible" to aerial imagery to highlight how the availability of aerial imagery in Google geo services differs from other, frequently top secret or highly professional applications. While technically available for decades, aerial photographs as a way of seeing were still novel to many people in the early twenty-first century. There were a few easily accessible web-based aerial imagery resources before Google Maps, most notably Microsoft's TerraServer and for a brief period on MapQuest (Balint, 7/11/2005). However, not enough people knew about and used these services for Microsoft or MapQuest to justify further development. Google Maps' inclusion of aerial photographs facilitated use of aerial imagery by so many people that in popular culture "looking on" Google Earth or Google Maps or even just something geographic on Google became almost synonymous with using aerial imagery (The Daily Show with Jon

Stewart, 2007; Vacationeers, 2007; Top Gear (U.S.), 12/19/2010; Clarke, 2011; Habe-Evans, 7/26/2011; Sagel and Kasell, 12/3/2011;). When non-experts do view aerial imagery, it can be surprisingly difficult to fully understand without experience or training. Though some in the GIS industry point to imagery as an easy-to-read epistemological authority, Parks persuasively argues that interpreting individual features in aerial imagery is actually quite difficult for untrained users (Green, 7/28/2010; Parks, 2005; 2006). Judging from the recent addition of oblique-angle local-scale aerial imagery by both Microsoft and Google, the companies also have concerns about the legibility of straight-down aerial imagery for users.

Google's visually uninterrupted global imagery coverage links global scales to local scales through the authority of aerial photography. Aerial imagery also includes many more geographic features than appear on maps, such as vegetation and built infrastructure. On a local scale, these features may allow people to identify with a location even if it is not labeled. Combined with hyperlocality and Google's search capabilities, these characteristics provide an apparently neutral vision of navigating or flying around the world 'as it really looks.' This rapid movement around the globe jumps across scales, photographically connecting the global and the individual local to make that connection visually comprehensible. For example, in Google Earth, when you search for a named location, the program zooms you away from what you were looking at on the Earth's surface and then zooms back in on what you searched for. There is no break between scenes.

Hyperlocality and accessible aerial imagery are vital to the discourse around Google geo services. They are central to understanding the visual, geographic genealogy

of Google geo services in Chapter Three. They help link together the mass global scale and the individualizing local scale in Google's business strategy of ubiquity in Chapter Four. Finally, they are important to the construction of cartographic authority by subjects in Chapter Five.

2. Consumer-oriented mapping

Google geo services' ways of seeing, popular influence, position within a private company, and the activity of mapping subjects mark it as something different. We cannot assume that the Google geo discourse works in the same cultural ways as professionally-oriented, scientifically and administratively ordered mapmaking or GIS. Nor can we assent to Google's claim that its hundreds of millions of users and more than a hundred-fifty thousand map mashups automatically translate into an equitable or democratic form of mapping (Jones, 5/28/2008). In comparison to other kinds of mapping, especially GIS, Google geo services and similar web mapping services, constitute a distinct kind of mapping, a *consumer-oriented* mapping.

Consumer maps in general have a long history from Ortelius' ornate atlases in the 1500's through to maps published by The National Geographic Society and Rand McNally (Harley, 2001; Schulten, 2001). Google geo services mark a new kind of consumer mapping beyond these cases and early web mapping services, such as pre-2005 MapQuest, in two important respects.

First, the geographic views available through Google geo services are far more customized and specific than is possible with any mass-printed map. Mapping in Google geo services tends to be more focused on the interests of individual users than traditional

mapping applications such as urban planning, national security, the census, environmental sciences, community GIS projects and other forms of spatial analysis. Second, Google encourages people to participate in the construction of its geo services, including the targeting of themselves as consumers. Crowdsourcing data production, error correction and innovation blur the lines between map users and mapmakers.

Mapping subjects who live and work in this environment may have or make an individually-tailored map according to their interests and priorities within the limits of the services. The structure of Google's geo-technologies strongly encourages people to be individualized user-subjects through their own personal hardware, Google account and browser history. Users may communicate and work collaboratively, but they ideally initially become part of the discourse as individuals with individually customized maps and targeted advertising. Occasionally, a neogeographer or user may use the geo services in a new way and the discourse must adjust to or limit such actions. Early map mashups were an example of this sort of neogeographer-prompted change.

3. The state

Even with a consumer orientation, the state has a complex historical and continuing role in the Google geo discourse. Historically, the state and its programs were the most important social institution in mapmaking. Modern mapmaking and the nation-state developed through one another in the European Renaissance and elsewhere at other times (Buisseret, 1992; Thongchai, 1994; Biggs, 1999; Wood, 2010). Cartographic ways of seeing facilitated modern territoriality, transcontinental empire-building, national defense, and state sciences including Geodesy and GIS (Buisseret, 1992; Edney, 1997;

Warner, 2002; Cloud, 2002). These sorts of maps are important in this study as the precursors to the ways of seeing at work in Google geo services. Google Earth in particular uses visual logics employed by the military during the Cold War for missile targeting. Later, in the early 2000s, the software code behind what is now Google Earth was written at a company named Keyhole Inc. The company's founders named it after top secret satellite reconnaissance programs. Without an established consumer market, Keyhole Inc. narrowly avoided bankruptcy and only survived through CIA-backed venture capital and related military contracts around the war in Iraq (Hanke, 10/11/2007; In-Q-Tel, 6/25/2003).

Today, the state has a complex, continuing role in the Google geo discourse. State programs, though important, are less central in the Google geo discourse than in previous kinds of mapping. Unlike Keyhole, Google makes most of its money from individual consumers and advertising, though the company does continue to license special versions of Google Earth to government agencies, including the U.S. military.

In addition to software licensing, the state continues to play a role in other, indirect ways. Google aggressively solicits government agencies, often local municipalities, to give copies of public agency geographic data to Google for it to use in its geo services. Google also partners with government agencies and other companies to generate data, such as the partnership between Google, GeoEye and the National Security Agency around the GeoEye-1 satellite (Brinton, 2/9/2009; Siegler, 8/29/2008). For Google, these sources of government-generated or government-sponsored geographic data externalize the hefty costs of acquiring geographic data. In addition, some state agencies are becoming involved with the consumer aspects of Google geo services and

map mashups in particular. In some cases, mashups demand action by state agencies. For example, some geoweb applications map potholes that need to be filled (Clarke, 10/1/2008).

The state also plays a role in limiting the Google geo discourse. To an extent, state regulation protects the state's own geographic knowledges. For example, the U.S. government restricts the maximum spatial quality of satellite imagery to 0.5 meter resolution in most cases.[4] Secret, military imagery can be higher quality. States may also limit Google geo services according to law on behalf of their own citizens for privacy reasons. For example, government mandates are the reason for face blurring in Street View (McGee, 5/12/2009; Hanchard, 11/13/2009).

The combination of these processes shows the role of the state in the Google geo discourse to be multifaceted. State programs were foundational in the history of geographic vision behind Google's services. Today, the state may not be at the center of Google's geographic business, but it still shapes the geo discourse in subtle and important ways.

Thematic relevance

These themes are pertinent to several ongoing conversations concerning geography, technology, and mapping.[5] All three themes are important to continuing critical cartographic conversations around power, vision and the social relations in mapping (Crampton, 2010). The Google geo discourse and the geoweb in general are a

[4] 0.5 meter resolution means that the smallest object visible on such an aerial photograph is 0.5 square meters in size.

[5] This dissertation goes into each of these conversations in greater depth in Chapter Two.

new context of mapping that involves new kinds of geographic, mapped knowledges and subjects (Parks, 2005; 2009; Kingsbury and Jones, 2009). These qualities set the geoweb apart from the well-studied connections between maps and the state (Crampton, 2010; Wood, 2010). Still, this new popular web mapping is no less contextually political due to the role of Google, mapping subjects and a new, continuing relationship with the state.

Compared to other studies on web mapping, the core themes of this dissertation go deeper than existing research. To date, many publications about the geoweb have been based on relatively recent texts (Sui, 2008; McConchie, 2008; Kingsbury and Jones, 2009; Lee, 2010). This dissertation includes a detailed historical component and builds on direct interaction and interviews with key actors and neogeographers in the field. Furthermore, neogeographers are having a parallel conversation of their own about the possibilities of the geoweb. A goal of this work is to add historical, political and cultural depth to those conversations.

In addition to mapping, the Google geo discourse's visual, geographic knowledges and social relations add a rich dimension to critical approaches to technology. The ways of seeing utilized in the Google geo discourse are a powerful combination of the perceived authority of technology with imagery. Together, they constitute not only a view of the world but also a powerful concept of what web technologies can accomplish. The social relations and subjects that help produce this view, such as targeted advertising and crowdsourcing, are quite common in the information technology industry and throughout the internet. This research brings together visual and technological dimensions to examine their combined limits and possibilities.

Dissertation outline

Working from this introduction, the second chapter of this dissertation examines the concepts behind and approach of this dissertation in the context of pertinent scholarly and neogeographic conversations. In that chapter, I also describe the methods by which I arrived at my findings in that theoretical context. Chapter Three begins the substantive portion of the dissertation. In it, I trace the genealogy of the Google geo discourse's ways of seeing to answer my first research question about conditions of possibility. Two specific ways of seeing, hyperlocality and accessible aerial imagery, are key preconditions for the development of Google geo services through cartography, U.S. Cold War mapping, Keyhole Inc., and early map mashups. This historical work begins to show the basis of Google Geo services' consumer mapping that builds on a long and continuing association with state projects and the playful tinkering of amateurs and semi-professionals. Chapter Four builds on the context and ways of seeing in Chapter Three to more closely analyze how Google's business strategy and capital accumulation help produce and reproduce the Google geo discourse. Google geo services are intrinsically shaped by Google's approach of simultaneously ubiquitous and highly-targeted web services. Chapter Five more closely examines the basis, limits and possibilities of the different subject positions within the Google geo discourse. These subject positions are somewhat different from the traditional roles of professional mapmakers and map readers. In the Google geo discourse, people without cartographic or GIS training make maps and some regular mapmakers are not paid. Related knowledges, maps and mapping practices are partly shaped by the circumstances of these subjects. Chapter Six pulls

together the points of the previous three chapters to make general conclusions about Google geo services as ways of seeing that are capitalistically-framed, consumer-oriented and that have a particular relationship to the state.

Such possibilities and limits in mapping are already impacting popular geographical imaginations and, consequently, the discipline of geography. Critical geographers can make substantive contributions to this discourse, but we ought to enter it with our eyes open, articulating the possibilities, problems and contradictions of these map technologies and ways of seeing.

Chapter Two: Understanding Web Mapping: Conversations and Methods

The innovation, competition, and excitement of the geoweb can make it seem like a spectator sport. Players such as Microsoft, Apple, Facebook, and Google use new hardware and software in strategies to capitalize on cutting-edge geotechnologies. Few participants in the fray step back to consider the larger social processes they are part of in the rush to the next 'killer app' or location-based advertising market niche. Thinking deeply and critically about these processes and their effects requires not only technologies and strategies but also knowledge of political, economic and cultural changes that are more fundamental than an investor's quarterly report.

This chapter sets up the body of the dissertation in two ways. Part I introduces several conversations that frame this research and that this study will contribute to. Critical cartography and its deconstruction of maps in terms of social processes are fundamental to the questions that define this research. The scholarly conversation about geographical imaginations and geographic ways of seeing provides a framework and concept with which to understand the visual basis of the Google geo discourse. Another conversation, this one about critical approaches to technology, also provides an approach to rigorously understand the technologies and social relations of the discourse. With these conceptual tools, the recent conversation about web mapping has a number of openings for more critical research that this dissertation addresses. Similarly, there is a

conversation among neogeographers themselves about mapping and web technologies that this research contributes to.

Part II of this chapter describes the methods and related challenges of this study. It describes the overall discourse analysis approach to the research and how the specific methods of critical textual analysis, participant observation and interviews answer the research questions. Later sections detail how I dealt with two methodological challenges posed by this research. The first concerns the measures I used to ensure the accuracy of the research and the veracity of my conclusions. The second involves developing the position from which I personally conducted the research.

I. Conversations

The questions that guide this research are directly pertinent to several continuing debates within and on the margins of geography. The history, political economy, subject positions and geographic knowledges of the Google geo discourse offer a new and valuable perspective on geographic knowledges and technologies in our time. Specifically, this dissertation speaks to critical geography, including conversations about critical cartography, geographical imaginations, and mapping on the web. In addition, as cultural geographic research, it draws on and addresses both critical studies of technology and industry-oriented neogeographers.

Critical cartography

Crampton and Krygier characterize critical cartography as an intellectual "one-two punch." On one hand, they recognize maps as power-knowledge claims within

social processes. On the other, they recognize the legitimacy and potential of many different forms of mapmaking beyond standard, professionalized cartography (Crampton and Krygier, 2005, 12). Central to this critical movement is a historical investigation of how, among multiple geographic knowledges, maps and cartography came to be as powerful and authoritative as they are today. Cartographic historian J.B. Harley (2001) illustrates that maps were intricately linked to the functioning of transcontinental empires and related knowledges. He also points out that those who commissioned and presumably most often used official maps were sovereigns and elites. Other scholars highlight a fundamental link between the formation of modern mapmaking discourses and the development of nation-states (Buisseret, 1992; Thongchai, 1994; Biggs, 1999; Crampton, 2010; Wood 2010). For the last six to eight hundred years, state projects, exercised through state authority and state-funded initiatives have dominated official mapmaking and cartography. This role is clear in Schulten's (2001) analysis of how the growth of the United States as a global power was apparent in American citizen/consumer maps made by the National Geographic Society and Rand McNally in the late nineteenth and early the twentieth centuries.

Given cartography's deep historical association with the state, the Google geo discourse presents some noteworthy complications. Google geo services are intimately linked to the state and the U.S. government in particular. However, the state's role in this mapping discourse is balanced against the consumer orientation of Google's business. In a further break from longer established kinds of mapping, Google geo services are blurring the line between mapmakers and map readers and thus the knowledges of each. In the Google geo discourse, the person who wants a map made, the person who creates

the data, the person who plots the map, and the person who views and uses the map may all be one in the same.

Given these characteristics, it is tempting to lump web mapping in with the development of critical GIS, participatory GIS and/or counter-mapping. Many criticisms of GIS in the 1990s and early 2000s highlighted technocratic GIS programs as non- or insufficiently democratic and positivist (Pickles, 1995; Schuurman, 2000; Sheppard, 2005; Sieber, 2006). Working from these criticisms, critical scholars, activists and some policy makers have worked to create forms of mapping and geographic decision making that include the input, perspectives and even ways of seeing of people who don't normally have a say in mapmaking and/or GIS programs (Turnbull, 1993; Sparke, 2005). To this end, a great deal of time and effort has gone into participatory mapping and GIS projects with mixed results (Schuurman, 2000; Walker and Peters, 2001; Hodgson and Schroeder, 2002; Craig et al. 2002; Pickles, 2003; Sheppard, 2005; Elwood, 2006; 2010; Sieber, 2006; Miller, 2006; Bryan, 2009; Wood, 2010). "Participation," variously defined, by non-expert mappers is often at the center of such projects. These participatory initiatives use close, social collaboration, tend to be small-scale, and deal with local planning or environmental issues. Examples include community outreach and indigenous mapping (Elwood, 2006; Hodgson and Schroeder, 2002; Bryan 2009).

While tempting, grouping web mapping in with these participatory GIS or counter-mapping programs at the current time is misguided. As this dissertation argues, web mapping is far more centered on mass individual consumption than participation, particularly in small-scale, collaborative mapping or GIS programs. Furthermore, few neogeographers I spoke with were familiar with GIS, much less these debates in the field.

Rather, they tended to dismiss most things "GIS," including participatory GIS initiatives, even those programs that resemble neogeographic initiatives.[6] Finally, compared to Harris and Hazen's inclusive definition of counter-mapping,[7] the Google geo discourse does not directly challenge the "assumptions or biases" behind many cartographic conventions. Nor does it inherently produce maps meant to "upset power relations" (Harris and Hazen, 2005, 115).

In this dissertation, I apply ideas and questions raised by critical cartography to the Google geo discourse. Due to its technological basis, shifting subject positions and Google's capitalist nature, this discourse does not fit neatly into existing approaches to mapping focused on the state or counter-mapping. Nevertheless, as a popular and influential mapping discourse with hundreds of millions of users around the world, the cultural processes of the Google geo discourse call for scholarly attention (Jones, 3/31/2010). I propose a form of critical cartography concerned with the cultural, political processes and subject formations of broadly popular forms of mapping similar to Schulten's historical work on American geographical imaginations (2001). As becomes clear in the web mapping sub-section, I am not the first to critically analyze Google and its geo services. What this study offers is a broad, rigorous analysis of a currently popular, influential and therefore relevant geographical imagination that uses critical cartography's ideas and questions about power and subject positions.

[6] As web mapping methods and applications become more complex, there are increasing signs of technical integration between web mapping and GIS techniques. In my own experience and observations, the same cannot be said for the ideas and concepts of critical GIS. Instead, neogeographers seem to have created parallel forms of participatory, grassroots mapping in recent years. Open Street Map and Ushahidi (http://ushahidi.com/) are evidence of that work.

[7] "any effort that fundamentally questions the assumptions or biases of cartographic conventions, that challenges predominant power effects of mapping, or that engages in mapping in ways that upset power relations" (Harris and Hazen, 2005, 115).

Geographical imaginations

People perceive, know and imagine space in many different ways, and each depends on the respective social and historical context (Harvey 1990).[8] Denis Cosgrove describes how the geographical concept of landscape developed as a "way of seeing" in a variety of social contexts and historical periods. The concept and phrase "ways of seeing" comes from from John Berger's work in art history (1972).[9] Cosgrove applies it in geography to show how landscape is inherently visual and historically-situated, "a way in which some Europeans have represented to themselves and to others the world about them and their relationship with it, and through which they have commented on social relations" (1998, 1). He investigates landscape ways of seeing in Renaissance Venice, Palladian-influenced landscapes in Italy and England, landscapes related to Western cosmographies, the sublime landscapes of the Romanics in reaction to industrial capitalism, and visions of the American West (Cosgrove, 1988; 1993; 1998; 2001; 2008). In the case of Renaissance Venice, noble Venetians envisioned landscape through early modern scientific, engineering, and artistic methods in relation to their capitalistic programs. The landscape way of seeing helped commodify the land into material

[8] This study focuses on the discourse around Google geo services in part by building on Marxist concepts of ideology from various sources including Cosgrove (1998) and Marcuse (1964). I center this study on a discourse because it is a framework that can articulate and describe both Marxist ideological expressions (and visions) of class interest as well as dimensions of geographical knowledges that are less relevant to economic class and labor value. Within this discursive context, writings using ideology bring robust approaches to visual, geographic knowledges (Cosgrove, 1998) and theories of technology as political and as producing differentiated subject positions (Marcuse, 1964; Feenberg, 1999; 2002). Furthermore, some of these very scholars make use of ideology and discourse in connection with one another. Feenberg writes of ideological and discursive technological concepts in parallel (2002) and Cosgrove describes his concept of landscape as an ideology as a "discourse" in the second edition of his *Social Formation and Symbolic Landscape* (1998).

[9] Which itself takes ideas from of Benjamin's *The Work of Art in the Age of Mechanical Reproduction* (1936).

capitalist social relations. Thus, landscape is simultaneously a subject and an object (Cosgrove, 1998, 17). It works not only in the eyes of its empowered, capitalistic subjects, but also as a powerful, geometric truth inscribed into the land itself, reshaping marshland around Venice into the form of canals and private property to match the vision (1988). Later, Palladian landscapes in England further extended visual expressions of paternal order that concealed capitalist industrial development (1998). In a different context, Don Mitchell (1996) argues that the materiality of landscape that conforms to such ideological visions is only possible through the back-breaking labor of working the land. The aesthetic appeal of an orderly or picturesque landscape conceals those capitalist labor relations in plain sight as the landscape way of seeing naturalizes the look of the worked land.

Gregory (1994) takes the concept of a way of seeing and applies it as a kind of Foucauldian power/knowledge in various geographic discourses in addition to landscape. In doing so, he uses the concept to examine and problematize the basis of modern, spatial knowledges and "geography" in general (Gregory, 1994, 4, 16). In particular, Gregory works from Timothy Mitchell's concept of a "world as exhibition"[10] that visualizes a whole world through a colonizing power from outside and often above (Mitchell, 1989; Gregory, 1994, 36). Mitchell further articulates this concept in terms of Benjamin's description of late 19th century exhibitions as "sites of pilgrimage to the commodity fetish" to describe how the "the character of the commodity [was extended] to the universe" (Mitchell, 1989; Gregory, 1994, 37). Using the nineteenth-century exhibitions in France and the writings of Vidal and Durkheim, Gregory flips the colonizing power of

[10] Itself a reworking of Heidegger's concept of modernity as the "world grasped and perceived as a picture" (Gregory, 1994, 34; Mitchell, 1989).

the world-as-exhibition back on the West itself. This viewing, imagining and thus understanding of the world-as-exhibition helped establish western knowledges within and about the world through colonizing social relations (Gregory, 1994, 46). The case of the world-as-exhibition is important for Gregory because, drawing on Foucault, he approaches it as a visual discourse, a sort of "greatly enlarged" conversation that "refers to all the ways in which we communicate with one another, to that vast network of signs, symbols, and practices through which we make our world(s) meaningful to ourselves and to others" (Gregory, 1994, 11). The world-as-exhibition he describes is noteworthy for it is a geographical imagination, a visual, geographic discourse about the world that helps produce modern, western knowledge. People realize this geographical imagination through ways of seeing; themselves as situated viewing subjects looking at observed objects.

Building on his findings about the basis of the world-as-exhibition, Gregory argues that the concepts and claims of mid-20th century spatial science were a direct continuation of that geographical imagination. Spatial science's basis in ordered, abstract space entails an outside observer to plot and view geography within that abstract geometric framework (Gregory, 1994, 53). In a parallel to Don Mitchell's concept of landscape, that very view of order obscures the work that goes into creating and plotting objects in this space. Geographic information systems that use space-based aerial photography combine the "god trick of seeing everything from nowhere" with the power of automated computer systems (Gregory, 1994; Haraway, 1991 188-189). Such a concept of computer-mediated space facilitates the idea of seeing the world in a mirror and thereby gaining "unproblematic access to "reality" " (Gregory, 1994, 68). This

suggests to Gregory that GIS, as a precise, scientific, immersive and yet remote geographical imagination, is "perhaps the apotheosis of the world-as-exhibition" (1994, 52).

Historically speaking, the ways of seeing in the Google geo discourse are descended from both the GIS concept of mirroring the world to view geographic truth as well as the earlier, more popular and consumable 19th century exhibitions. Geographical concepts such as spatial science's (and GIS's) abstract spatial coordinate system underpin the technologies that allow Google geo services to work as intended. Google's business strategy and the way Google's geo services are used by large numbers of non-experts to gain a view of the world from outside resemble the earlier world-as-exhibition. Given this combination, tracking one's own movement on a phone-based Google Maps app is "traveling *through* the world-as-exhibition" even more than the GIS that Gregory describes (original italics, Gregory, 1994, 63).

Reading Cosgrove's ways of seeing through Gregory's discursive framework provides a useful conceptual means to a critical cartographic understanding of the visual geographic knowledges, subjects and processes within the Google geo discourse. Cosgrove's use of the "ways of seeing" concept provides a way to conceptualize visual geographic knowledges and related practices as part of contextual social processes. In particular, the inherent tie between Cosgrove's ways of seeing and capitalist social relations is relevant to web mapping in the context of Google's capital accumulation. However, there are limits to Cosgrove's concept because he concentrates on a specific way of seeing, landscape, in select historical periods. Gregory's geographical imaginations provide a broader discursive framework within which to situate ways of

seeing other than landscape. Gregory is concerned with a broad set of geographic discourses and particularly those geographic knowledges with a visual basis. Adopting Gregory's discursive approach allows me to apply the questions of critical cartography in concert with ways of seeing in the context of Google geo services. With this approach, I analyze the genealogy, practices, limits, and possibilities of the Google geo discourse. Moreover, using critical cartography and ways of seeing in this case grounds the sometimes overly vague concept of a geographical imagination in the actual knowledges and social relations of Google geo services.

Critical studies of technology

Answering the questions posed in this study requires a critical approach to technology to complement and contribute to understanding geographical imaginations. A common, uncritical concept of technology is that social changes, such as increasing global interconnection, are simply the result of technology. Jenkins (2006) even goes so far as to argue that accessible digital technology is producing a more democratic society. This technological determinist approach assigns the basis for social changes to a technology itself.

In contrast, Harvey argues that capitalism's growth imperatives compel and use technological innovation as a means to overcome limited space. "Technology, then, is a means through which underlying social forces are expressed; its integration into society is necessarily a process of social relations" (Kirsch, 1995, 531; Harvey, 1982). Marcuse offers a way to analyze capitalism in connection with other kinds of social processes to understand the social relations and politics of technologies in a way that includes the state

and culture. He describes how applied science allows the "organization and handling of matter as the mere stuff of control" which may be used for any kind of purpose (Marcuse, 1964, 156). However, such science in actual practice "becomes susceptible and subject to the objectives which predominate in the society in which science develops" (2007, 27). In material form, technology "cannot be isolated from the [political and ideological] use to which it is put" (1964, xvi). Thus utilized, science and technology are irrevocably part of contextual political programs. In practice, science and technology possess only the appearance of neutrality, which serves to re-affirm an instrument's authority. Consequently, science and technology in context sustain and extend social processes "not only through technology but *as* technology" (original italics, Marcuse 1964, 156-58).

A problem with Marcuse's theory is that it leaves little room for technological change by anyone other than elites who have little incentive to change the overall system. Feenberg advances a critical theory of technology and technological change that takes points from Marcuse, Foucault[11] and others. Foucault's examination of everyday practices as social and material mechanisms of control is a sign of how people experience social imperatives as technical constraints rather than as political coercion (Feenberg, 2002, 69). Feenberg describes how these mechanisms are "condensed" into the design of technologies, materializing social relations. In this way, the materiality and resulting social relations of technologies may serve social imperatives such as Google's capital accumulation. The people who plan and design technologies occupy a primary technological subject position as subjects who make masterly, often capitalistic, strategic moves in technological development. However, not everyone is a primary subject and

[11] Foucault's thought has some of the same shortcomings as Marcuse's. Feenberg notes that both Marcuse and Foucault conceptualize society as "a gigantic machinery regimenting its members" (Feenberg, 2002, 64).

technical mediation in practice cannot be wholly anticipated for all people. "Technological strategies create a framework of activity, a field of play, but they do not determine every move" (Feenberg, 2002, 86). This unpredictable field includes a secondary technological subject position of people who encounter and use technologies in their everyday lives (Feenberg, 1999; 2002). They don't design technologies but instead use technologies in their own context, which may or may not be what the designers intended (Feenberg, 1999). These subjects occupy a limited yet unpredictable margin between built-in technological biases and discursive limits (both material and perceived possibilities).

Feenberg and Bakardjieva (2004) describe a number of empirical studies of online communities in which researchers could not fully predict the actual practices and norms of participants based on technical or designed characteristics. They describe how online community members will overcome the limits of a communication technology to create images and/or appropriate system features in unexpected ways. For example, Feenberg describes a case in which an information technology firm designed and created an early corporate worldwide computer network. Some employees used the system to facilitate conversations that were irrelevant to the company, but meaningful in employees' everyday lives, including a conversation about Heidegger's philosophy (Feenberg, 2002). In a similar example, Morley (2006) analyzes the historical domestication and subsequent spatial dislocation of media. He describes the individualizing qualities of consumer technologies such as the car, the Walkman and the mobile phone. These mobile technologies are not available to or open to modification by everyone, but for the individuals who use them, they become part of the person's everyday life and related

spatial practices. In a final, cartographic example, Kingsbury and Jones (2009) describe how users sometimes use Google Earth in ways that are not self-evident parts of Google's advertising or even the scientific rationality of cartography and GIS. They review cases of users playing with the Google's technology to consume odd and humorous images.

This dissertation examines the context and subject positions of the Google geo discourse and how those subjects see and understand the world. In doing so, it introduces a cartographic dimension to critical conversations about technology and visual technologies in particular (Morley, 2006; Parks, 2005; Hillis, 1999). Working from Feenberg's subject positions, it also examines the multiple subject positions and ambiguity around them in this discourse. Finally, following a common theme of individualization in consumer technologies (Williams, 1974; Hillis, 1999; Morley, 2006), this research investigates the individualizing dimensions of Google's customized geo services and related targeted advertising.

Mapping on the web

In the first decade of the twenty-first century, texts about mapping and the web proliferated under a wide variety of names and concepts including distributed mapping (Crampton, 2003), maps and the internet (Peterson, 2005), cybercartography (Taylor, 2005), GIS 2 (Miller, 2006), digiplace (Zook and Graham, 2007), multimedia cartography (Cartwright et al., 2007), **Volunteered Geographic Information** (VGI) (Goodchild, 2007; 2009), ubiquitous mapping (Gartner et al., 2007), wikification of GIS (Sui, 2008), web mapping 2.0 (Haklay et al., 2008; Gartner, 2009), and the geoweb (Crampton, 2010). Roughly speaking, there are two general approaches to the topic of

mapping and the web represented in this variety of terms. One approach comes out of cartography and GIS literatures and tends to concern the mapping technologies themselves and the geographic data associated with those technologies. A second approach uses questions and concepts from critical cartography and other critical geographers to inquire about power, vision, and social relations in the context of the geoweb.

GIS and cartography experts were some of the first to investigate web mapping technologies in peer-reviewed publications. Technically, web mapping services work somewhat like smaller scale server-based distributed mapping systems (Crampton, 2003). Thus, for those already working in GIS and cartography, early web mapping represented the expansion of an existing technological paradigm. This approach led to a tendency in the literature to focus on describing the technologies and systems themselves (Peterson, 2005; Gartner, et al., 2006; Cartwright et al., 2007). For example, Gartner (2009) describes the technical characteristics, data, system architecture and traffic of various web services for the purpose of understanding them from a technical standpoint. This sort of descriptive approach tends toward the technologically determinist, with little attention to social context, economy, people's agency, who users are or why they use web mapping services. Other geographers investigate the shifting social roles of users in mapping on the web through what they call **Volunteered Geographic Information** (VGI) (Goodchild, 2007). In the Google geo discourse and throughout the IT industry, this kind of data is better known as geographic "user-generated content" or "crowdsourced" data (Turner, 3/24/2009; Where 2.0, 2010; Wherecamp, 2009; 2010). Some of the first geographers to write about VGI did so in terms of GIS. Here,

researchers conceptualize people who contribute data as volunteering sensors for new kinds of geographic information for analysis (Goodchild, 2007; 2009; Flanagin and Metzger, 2008). This concept of VGI prompts important questions. Are people volunteering or being volunteered, even without their knowledge? Why is the focus on data itself as the mechanism of change (Elwood, 2008)? Michael T. Jones, Google's Chief Technology Advocate and a co-founder of Keyhole Inc., claims that user-generated content and crowdsourcing is a process in which everyone has a voice (5/28/2008). By analyzing the context and subject positions in the Google geo discourse, this dissertation develops a situated approach to the investigation of these new mapping subjects, their labor and their geographic knowledges.

Beyond the technologies and specific questions of VGI, others have begun to analyze web mapping services and discourses, particularly Google's, from more critical, theoretical perspectives. Kingsbury and Jones highlight Google Earth's playful feel and relate it to Benjamin's "Dionysian" investigations of Paris (Kingsbury and Jones, 2009). Perkins examines the developing concepts of play involving maps and cartographically-related video games (Perkins, 2009). Others highlight the social potential of map mashups to overcome some of the traditional limitations of GIS, including the expert/amateur divide and geographically-limited access (Miller, 2006; McConchie, 2008). Still others are beginning to work through the cultural and political relationships at work in increasingly accessible aerial imagery and Google's humanitarian initiatives with Google Earth (Dodge and Perkins, 2009; Perkins and Dodge, 2009; Parks, 2009). In part drawing on this body research, Dodge, Perkins and Kitchen (2009) advance a manifesto for mapping studies that calls for closer investigation of digital maps,

cartographic visual culture, and map authorship using methods that include political economy as well as directly interacting with mapmakers and map readers.

This dissertation contributes to these conversations in four ways. First, in terms of focus, this study centers on Google geo services and the surrounding discourse as a whole. Google Maps, Google Earth, other Google geo services and derivative geoweb applications are increasingly interconnected and in some cases merging. The analysis of any one separate part is increasingly difficult and less relevant than the importance of the discourse as a whole. Second, as Kingsbury and Jones note, Google Earth is part of noteworthy processes of geographic subjectification (2009). Working from that paper, Dodge et al.'s manifesto, Lee (2010), and Leszczynski (2011), this study deeply and empirically engages the viewing subjects and political economic processes of that research with original research on the Google geo discourse. Third, methodologically, most current studies are theoretical and/or investigate online texts or services. In addition to theoretical and textual sources, I base my analysis on in-person interaction with key actors at Google's corporate headquarters and industry conferences. This fieldwork provided a better feel for the discourse and deeper insight than texts could by themselves. Fourth, the genealogical section of this research more thoroughly examines the historical context of the Google geo discourse than existing publications. For example, John Cloud (2001) has written about the TALENT/KEYHOLE U.S. intelligence programs of the 1960s and McConchie (2008) writes about early map mashups. This dissertation pulls these disparate parts together within a longer timeframe of the Google geo discourse's visual, epistemological ancestry.

Neogeography

Over the same period that geographers and other scholars attempted to label and understand mapping on the web through GIS and critical theory, those independent programmers, geo software developers, hackers and enthusiasts who work with geo services have been busy defining themselves. They also use a variety of names for overlapping, if slightly different mapping concepts including "map hacks" (Erle et al., 2005), "neogeography" (Turner, 2006), "map mashups" (Clarke, 2011) and "augmented reality" (Wherecamp, 2010). For many I read and spoke to in my research, the term **neogeography** (and **neogeographer**) works as a discursive umbrella term to include many of these practices (Wherecamp, 2009; 2010; Where 2.0, 2010). Andrew Turner defines neogeography in three overlapping ways: First, it is made up of "a set of [digital mapping] tools and techniques", that are distinct from traditional, PC-based, closed-source GIS (2006, 2). Examples include Google Maps, Open Street Map (OSM)[12] and other, similar resources. Second, "Neogeography is about people using and creating their own maps, on their own terms and by combining elements of an existing toolset" (2006, 3). Working from the networked technology of the first component, mapping for oneself has the upshot of connecting individual people to "[convey] understanding through knowledge of place" (2006, 3). Third, Turner highlights how neogeography is "fun" (2006, 3). This characterization of playful, do-it-yourself mapping by anybody differentiates neogeography from "paleogeography," a somewhat tongue-in-cheek word for academic or professional GIS, cartography and other kinds of geography (Wherecamp, 2009; 2010). Jo Walsh, another neogeographer, incisively writes that this

[12] An independent, open source, open data, user assembled web mapping service alternative to Google Maps. http://openstreetmap.org

sort of rigid distinction is a useful marketing strategy for neogeographers and technology companies, but that the actual line between GIS and neogeography is much less clear cut (Walsh, 2/8/2009).

In addition to books (Erle et al., 2005; Turner, 2006) and presenting at conferences (Turner, 2009; Wherecamp, 2009; 2010; Where 2.0, 2010), neogeographers write blogs (Erle, 4/7/2006; Frank Taylor, 7/20/2009; Clarke, 2011; Turner, 2011), news articles (Brady Forrest, 6/17/2009) and above all make maps on the web (Rademacher, 3/4/2010; Clarke, 2011; Ajmani, 11/9/2011). Much of this literature is promotional and/or highly technical with only a little social critique or self-aware, reflexive analysis thus far (Erle et al., 2005; Turner, 2006; Walsh, 2/8/2009; Maron, 4/11/2011). For this reason, neogeography demands critical consideration. Neogeographers in part stake their claims to novelty on criticisms of GIS: that it too often uses closed software, that it is expensive, that it is not well integrated into the web, that it is difficult to learn and isn't suitable for use by large numbers of lightly or un-trained people (Turner 2006; Turner 3/24/2009; Wherecamp, 2009). A number of neogeographers I spoke with in the field were interested in deeper examinations of their own kind of mapping and the impact of Google (Where 2.0, 2010; Wherecamp, 2009; 2010). Of all the conversations related to mapping on the web, the neogeographers are often the closest to the production process and regularly make maps and geoweb apps themselves. Since Google is unlikely to change its business practices based on this study, neogeographers are in the best position to take advantage of this research to directly affect the design of web mapping technologies around Google and throughout the rest of the geoweb. I hope that this study

offers a reflexive, sympathetic, critical analysis that neogeographers can use to better understand the social processes and possibilities of the mapping they practice.

II. Methods

To participate in these important conversations, I organized the dissertation and the research program from which it draws by using the three core research questions identified in Chapter One. This part of Chapter Two explains the modes and challenges of that research process. It begins with an overview of the methodological framework I use to answer the questions of this dissertation. With the stage set, I describe how I executed my research through textual analysis, participant observation and interviews. I describe in depth how I used each of those three methods to answer the research questions. The final section is a discussion of two methodological challenges I encountered in my research. The first concerns how I performed my research in a sufficiently rigorous way to produce legitimate scholarly knowledge. The second involves the question of my personal standpoint as a researcher in critically analyzing the Google geo discourse, even as it is a persistent presence in my life and the lives of my informants.

Methodology

This dissertation takes the form of a discourse analysis: a critical, systematic examination of the construction, characteristics and limits of the Google Geo discourse through its subjects, objects, and modalities of knowledge (Foucault, 1995, 27). Specifically, I use a combination of several scholars' discourse analyses that allows for

the contingency and complexity necessarily to understand the cultural processes at work in this context. For Fairclough, "intertextual" critical discourse analysis is an approach to how texts or cultural artifacts work within "sociocultural practice" (1995, 7). To apply this methodology to maps and related visual knowledges, I use Rose's (2007) form of visually-oriented discourse analysis to identify "key themes," limits, power/knowledges, ways of organizing those knowledges, and subject positions within the discourse. Beyond texts, Brown and Laurier's (2005) "ethno-methodological" work shows the importance of observing map practices and talking to the people who practice mapping. Finally, to best integrate this methodology with my topic, I use Derek Gregory's (1994) concept of geographic imaginations, discourses that can shape and produce subjects, their knowledges and the material world around them.

In the research, I employed a particular strategy to put these methodological ideas to work. Over the course of the research, I thoroughly familiarized myself with the source materials. This familiarity allowed me to identify "key themes" and common concepts within the discourse (Rose, 2007, 157). Examples include Google's mission statement, the idea that neogeography is fun, and the historical role of the state in mapping. Through this familiarity with the discourse, I understood and moved beneath the surface of Google's rhetoric to scrutinize underlying logics, economic processes and discursive limits. Though these deeper processes are often limited, temporary and contradictory, they are still invaluable to understanding the production of knowledges and subject positions (Rose, 2007, 164). In practice, this discourse analysis took the form of

three research methods: critical textual analysis, participant observation and semi-structured interviews.[13]

Critical Textual Analysis

For this study, the vast majority of relevant texts are available online and/or in a growing number of books. The discourse is replete not only with dry official press briefings, but also opinionated texts such as blog postings. This variety of sources allows me to trace both facts and subjects' standpoints within the discourse.

Identifying useful sources within the vast realm of somewhat relevant discursive texts takes time and patience. Procedurally, I searched and navigated the web, systematically going over potential resources to identify illustrative or key discursive texts. Practically speaking, this meant lots of searching, following links or citations, and skimming or reading important texts, especially blogs. I also took advantage of the structure of the web. Relevant texts often include hyperlinks to other relevant texts. Sources that are widely referred to in the discourse usually have many links back to them.[14] For example, former Keyhole employee Avi Bar-Zeev's first-hand account of the original inspirations for Google Earth is linked to from many different sources (Bar Zeev, 7/24/2006). Furthermore, by paying attention to the network of linking between sources, I could identify some of the limits of the discourse over time.

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[13] Building on pilot research from 2007-08, I began familiarizing myself with the discourse through textual analysis in late 2008. I dedicated the period of spring of 2009 through August 2010 nearly entirely to research. This period included multiple rounds of fieldwork and correspondence with informants in addition to continuing textual analysis. In the fall of 2010, I turned my attention to writing.

[14] Not coincidentally, the original Google search engine algorithm for ranking relevant web pages, PageRank, uses a similar logic of counting the number of links to a website to estimate its importance. PageRank was originally based on the systemic structure of academic citations (Battelle, 2005).

Following every relevant-looking link on each online text made for complex web browser sessions with tens of browser tabs open at once, but it did allow me to find and identify many useful texts.[15] A few especially rich sources, usually blogs, were so important that I worked through the entire archive for useful information. I subjected the blogs *Google Maps Mania* (Clarke, 2011), the *Google Earth Blog* (Taylor, 2011), and Avi Bar-Zeev's *Reality Prime* (Bar-Zeev, 2011) that thorough going-over.

Critical textual analysis was important for all three of my research questions. For the historical research, I used textual analysis to unearth the knowledges and historical conditions that led to the Google geo discourse. Using and emulating the geographical imaginations and critical cartographic literatures, I analyzed the social and technological conditions that enabled the Google geo discourse to become what it is (Gregory, 1994; Cosgrove; 1998; Cloud, 2002). Texts included official Google documentation, blog postings by and about Google or Keyhole, secondary historical sources, press accounts, and many blogs. Most recent texts are native to the web, but this analysis also included books, scholarly articles, periodicals, videos of speeches, conference proceedings, and government reports that pertain to Google geo services and their history.

I also employed textual analysis to help answer my second and third questions, which concern the political economy, knowledges and subject positions of the current Google geo discourse. I used many of the same kinds of discursive texts to answer these questions. Texts also included Google's legal terms of service, Google's quarterly

[15] Performing this kind of critical textual analysis requires procedural and archival organization. To practically and conceptually organize textual sources and my notes, I used Zotero, a bibliographic web browser add-on. It archives online texts as a searchable snapshot of a webpage that is associated with bibliographic information, bitmap screenshots and a "note" feature that I use for field notes and initial reflective analyses. Within Zotero, I organized online and offline texts by thematic labels and tags to help identify and think critically about common themes, ideas and visions. I also exported the notes to compare them with field notes.

reports to shareholders, pertinent email listservs, industry literature, online discussion forums, comment threads, map mashups/geoweb applications and the geo services themselves. The texts familiarized me with details, key concepts, themes, and the internal rationalities of Google's business strategies and the geo discourse. This analysis untangled Google's system of organizing geographic information to accumulate capital, information, and the geographic visions and subjects associated with that process. Within the general discourse analysis framework, this approach utilized critical cartographic questions about authorship, power and design (Monmonier, 1996; Harley, 2001; Wood, 2010). Some of the visual texts also required me to utilize a light, flexible form of the systematic visual content analysis suggested by Rose (2007).

Field Methods

Going beyond textual sources to observe and talk to people within the context of Google presented a problem. It is not easy for a no-name scholarly researcher to get inside Google and talk to, much less spend extended time with, its employees. Google does not publish contact information for its employees and the Google Press Center rebuffed my attempts to contact **Googlers** through official means. Furthermore, one mid-level Googler told me that he receives so many emails a day that interview requests just get lost in the wave of correspondence (Rademacher, 3/4/2010). In addition to the difficulty of talking to Googlers, many third-party neogeographers live and work throughout North America if not elsewhere around the world. As a consequence of these conditions, ethnographic-style extended fieldwork in one area was not a viable or appropriate approach to this research.

Instead, I structured my fieldwork around pertinent annual and intermittent conferences and events. These gatherings, including Google product launches as well as the *Google I/O*, *Where 2.0*, *Wherecamp*, and *Geoweb* conferences offer an open forum to approach and talk to Googlers. In contrast to Google's Press Center, Googlers attend these conferences and events with the express purpose of talking to people, building relationships with those outside the company, and advocating for Google's geo services (Marks, 5/22/2009; Fox, 5/22/2009). Beyond Googlers themselves, these events also offered a strategic way to talk to neogeographers in the discourse while many of them were in one place at the same time. Even elusive key actors, such as John Hanke, the former CEO of Keyhole and head of Google's Geo division, attended or presented sessions at conferences at which I made contact and even conducted interviews. Contacts made at events also allowed me to perform subsequent interviews over the phone and in person, including dedicated visits to Google's corporate headquarters, the **Googleplex**. Finally, as conferences, these forums offer a way to watch influential key actors converse with one another. For a list of interviews, see Appendix C of this dissertation.

In the early stages of research, attending and interacting with people at these events provided opportunities for participant observation, allowing me to get a feel for the discourse in a different way than textual research. Most of the events were in or near Silicon Valley, which made for a particular atmosphere that was new to me. Talking to people and even just being in the room allowed me to perceive personalities, social nuances and cultural assumptions that are lost in the written text of articles and blogs. One of the events, *Wherecamp 2010*, even took place at the Googleplex, though on a marginal part of the campus (fig. 2.0). I took the opportunity at these events to identify,

observe, and build rapport with key actors and potential interviewees. I also participated in open workshop discussions at the conferences to interact and learn about other participants and their experiences.

As research progressed at subsequent events, I interviewed Googlers and neogeographers of all kinds including historical key actors, geo developers, venture capitalists, web map enthusiasts, bloggers and other event attendees. From these interviews, I identified and made further contacts to interview later over the phone or email.

Answering questions with participant observation

The events at which I preformed participant observation offered the opportunity to engage Googlers and neogeographers while many of them were in one place and in a social, casual setting. *Wherecamp* in particular is an "unconference" an independent, self-organized forum for sharing and trying new ideas or applications among neogeographers. The 'just for us geeks' (inside and outside Google) mentality makes for conversations not just about emerging technologies but also about major discursive issues such as privacy, intellectual property, profit and the long-run trajectory of geotechnologies.

By observing and participating in sessions, product demonstrations, social events, and mealtimes, I saw and heard how Googlers talk about and work within the Google geo discourse. I also interacted with neogeographers who don't work for Google and learned about how these people got into mapmaking, if it is a job or hobby, their relationship with Google, how they understand this mapmaking and what they do with it. I usually did so

by sitting down and talking to people at pre-conference coffee, between sessions or at meals. What with the general socializing conference atmosphere, most people were receptive and helpful.

Answering questions with interviews

Answering each of my three research questions in depth required some form of structured questioning. Researching the history of Keyhole in Silicon Valley, for example, required interviewing key actors because Keyhole Inc. doesn't come up in regular conversation at conferences and it is not well documented in publically accessible archives. For my second and third questions, understanding the perspective and experiences of a Googler or a neogeographer required more than textual sources or casual conversation could make clear. Some things could only be learned from direct questioning and the ability to ask follow-up questions (Kitchin and Tate, 2000).

I conducted semi-structured interviews with a variety of historical key actors, Google employees, Google managers, geo developers, enthusiasts, geohackers, geo software gurus, map software entrepreneurs, small business owners who use Google Maps for advertising, and geo-technology bloggers. Depending on the interviewee, I inquired about Keyhole, other historical events, Google's business strategy, daily life in the company, how the geo services work, their personal relationship with Google, their interests in geotechnologies, experiences with and reflections on Google geo services, and changes in the geoweb over time.

Interviews also allowed me to inquire about the bigger picture or assumptions within the discourse. For example, discussions at *Wherecamp* will often use a lot of

jargon and jump to conclusions about why a particular mapping application is worthwhile or 'cool.' If I inquired in that conversation about the jargon or assumed ideas, it would slow down or derail the conversation. Interviews allowed me to ask about jargon and the cultural valorization of particular applications or technologies without frustrating other participants.

Methodological Challenges

Beyond the procedural dimensions, this research posed two conceptual challenges: First, the power of discourse analysis is to call many things into question, including the limits of the object of analysis, the discourse. This presents a challenge in learning how, in the course of research, do I know and understand the validity of my findings. Second, I and huge number of other people use Google's services every day. What is the standpoint of a critical researcher who is also a regular user in the discourse being analyzed? How does that position influence the scholarship?

1. How do you know what you know?

Forms of discourse analysis, most often derived from Foucault in contemporary critical geography, are less rigidly defined than other forms of research such as formal content analysis or quantitative methods. Foucault argues that categories in research should be "held in suspense" because they are the result of real historical processes that merit investigation (Foucault, 1972, 25). Doing so helps prevent categories from silently and arbitrarily structuring research. Critically investigating the categories by which knowledge is organized recognizes constitutive processes and helps show how

knowledges work and what they accomplish. This sort of research enterprise inherently brings up questions of rigor: how the researcher knows what they have found and when the research is conclusive. In this research, the way I worked through this issue usually depended on the research question. There were a few cases, mostly notably talking to people and conflicting accounts, for which I developed more general solutions.

For my first, genealogical research question, I began by asking what makes the discourse unusual or distinct in time. For example, compared to other kinds of geographic knowledge, Google geo services work across scales and use accessible aerial imagery. More than mere technical characteristics, these qualities allowed me to identify knowledges, subjects and objects in history that serve as preconditions to today's discourse. This provided a framework for researching a history of the present Google geo discourse.

My second research question, understanding Google's capital accumulation and how that constitutes the Google geo discourse, was less straightforward than the historical research. On its face, Google is very open about its current business strategies. Like many other IT companies, Google is far more secretive about their "secret sauce" technical details and their future products than about their business strategy. Google managers and executives describe the company's business plan in terms of Google's rhetoric, such as its mission to "organize the world's information…" (Jones 5/28/2008; Schmidt, 7/7/2009; Gundotra, 5/28/2008). However, these ideas are contradictory or don't make clear business sense when you to examine them critically. For example, early forms of Google Maps or Google Earth didn't include advertising. Others, such as the Moon in Google Earth, may never include advertising.

Fortunately, many people are interested in understanding and emulating Google, so there is a whole business literature dedicated to how it makes money with technological, managerial and labor strategies (Battelle, 2005; Stross, 2008; Jarvis, 2009; Howe, 2008). Scholarly works also examine the economy and labor strategies of the IT industry (Thrift, 2005; Kleeman et. al., 2008). From there, it was a short analytical step to how Google accumulates capital. Once Google's strategies of accumulating capital were clear, Google's capitalistic influences began to pop up all over the map.

The question of knowing also concerned the third research question on subject positions and related knowledges. In this question, the methodology of discourse analysis was very important as I did fieldwork, talked to people and read a myriad of online texts. This familiarity with the discourse included listening to different people's perspectives in what they said, what they were talking about and, on another level, what they assumed or were not talking about. To understand and structure this variety of accounts, I used the combination of theories about technology, visual geographic knowledge and mapping described earlier in this chapter (Marcuse, 1964; Feenberg, 1999; Harley, 2001; Wood, 2010; Pickles, 2003). While not a perfect fit, these theories helped differentiate my informants' accounts into the subject positions and knowledges I describe in Chapter Five.

Common to all my research questions were issues of knowing that came with researching texts and talking to people. Authors' and informants' memories were not perfect and more than one seemed most interested in telling a good story. Even in straightforward interviews with key actors the research led to many dead ends or mutually-exclusive accounts. In these kinds of cases, I tried to verify accounts with

independent, documented evidence published or authored by other people. Much of this verification was possible through the sheer volume of textual research that I completed before I got to the field. More than once, someone drew my attention to something I had already read, but had not realized was important at the time. I favored interviewing influential, well-respected actors such as John Hanke and Paul Rademacher because these sorts of people often had well-articulated concepts of web mapping and of their relationship with Google now and in the past. Eventually, I could sometimes anticipate the line of reasoning that some informants would use when I talked to them. The fact that I knew and understood those ideas and the discursive rationales behind them indicated to me that I had sufficiently worked through the rhetoric, key concepts and logics of the discourse to draw conclusions about them.

2. Positionality

Understanding and articulating a position from which to critically analyze Google, its geo services and the discourse around them was a complicated and lengthy process. I personally use Google's internet search engine, Gmail and Google Maps on a daily basis. For the most part, I trust the information these services provide and, as a researcher, I have become very aware of the privacy and advertising tradeoffs of using Google.

Conducting a discourse analysis requires a critical standpoint from which to rigorously asses the discourse, its logics, and its limits, especially for a discourse as seductive as Google's. Nevertheless, stepping completely apart from the discourse would be practically difficult in everyday life and make it hard to work with the technologies

and knowledges that are being researched. Furthermore, I would prefer this analysis be accessible to people currently within the discourse, so that I may help inform new possible geographic knowledges and mapping. Just as Marcuse and more recently Crampton propose, critique can be a positive, productive enterprise of social analysis, questioning unexamined assumptions, and change (Marcuse, 1964; Crampton, 2010).

My own path from Google user to informed critic of the Google geo discourse was a long one. The first time I used Google Maps was in the spring of 2005. I recall being surprised at how much better the interface was than MapQuest. For friends of mine, it was more significant that Google Maps included aerial images. A few years later, I was similarly engrossed when I first learned about map hacking and how Google had embraced these hacks as map mashups. This was intriguingly different from contemporary intellectual property battles in music distribution. These impressions of Google were in no small part influenced by Google's friendly, and at the time, almost saintly public reputation. Google seemed to actually follow their mission of organizing the world's information at the expense of more profitable alternatives. Google Maps and Earth had to be expensive to run, but they were free to use on the internet. It was not at all clear that Google made profit from them. Google geo services seemed like the realization a powerful dream in critical mapping, the search for a generally and truly accessible GIS (Schuurman, 2000; Miller, 2006).

As I delved into the discourse, this impression faded. Part of this process was the maturation of Google as a company. Critiques of Google concerning China and data privacy are more common now than in 2007 (Vaidhyanathan, 2011). Perhaps the most visible criticism of Google is the press coverage of Eric Schmidt, Google's gaff-prone

executive chairman. During his tenure as CEO, he regularly made pronouncements that were honest and innocuous inside Google but that sounded manipulative or even creepy to a broader public audience (Carr, 10/6/2010; Paczkowski, 1/20/2011).

On a personal level, I also became more critical as I learned about the history and processes that are not clear to most users. Understanding Google's capital accumulation strategy was central to forging a critical perspective. Much of the business literature about Google is upbeat and enthusiastic, if not utterly insipid. Nevertheless, what this literature does do is break down exactly how Google collects revenue and the discursive mechanisms around those capitalistic processes that form Google's brand (Taylor, 2005; Vise and Malseed, 2005; Battelle, 2005; Stross, 2008; Jarvis, 2009; Levy, 2011; Schmidt, 7/7/2009). I read this literature and related work on crowdsourcing alongside critical scholarly publications on the IT sector to understand Google's strategies of selling advertising and cheap, crowdsourced labor (Ross, 2003; Ash & Thrift, 2004; Ó'Riain, 2004; Howe, 2008; Kleeman, et.al., 2008; Zook and Graham, 2007).

In the field, I encountered geo developers, bloggers and other neogeographers who have a critical view of Google's legal terms of service, its economy of data and the way Google emulates and commodifies ideas from the hackerish Free and Open Source Software movement (Fee 10/7/2010; Maron, 4/11/2011).[16] Even as critics of Google, these subjects came with their own contradictions and position in the discourse. Their ideas tended to center on the industry of GIS or a fascination with DIY mapping technology. At conferences and events I attended, some of these subjects probably thought me Google's sycophant because it was the subject of most of my inquires instead of their interests in GIS, open data or open software. Perceived sycophant or not, I was

[16] Most notably, Open Street Map (Maron, 4/11/2011).

certainly something of an outsider due to my inexperience in coding and newness to the social atmosphere of Silicon Valley. Unlike most people I encountered at these events, I wasn't literally trying to build a better map mashup or application. I did occasionally involve myself in conversations because I had relevant ideas that might help the neogeographers create a slightly different way of seeing the world. For example, in one conversation, I talked with geo developers about the absolute space of the game Battleship compared to the relative space of the game Go. In another a session we discussed Borges and the dream of a 1:1 scale map. Such contributions allowed me to build rapport with people and interact in the discourse to better understand it.

My own, fully developed critical position concerning the discourse really only solidified as I began to review my research and write. Immersed in the discourse and familiar with the subjects, objects and knowledges, I assembled and reviewed my notes and screenshots. I also returned to some of the critical texts that originally informed the project (Foucault, 1995; Cosgrove, 1998; Feenberg, 1999; Pickles, 2003; Crampton, 2005). Reviewing these texts as I worked through my research materials prompted me to think about their ideas in the context of what I knew about the Google geo discourse.

Even with this critical view, I am still a regular user of Google services. They are simply too useful in my everyday life to set aside. I have become more aware of the information I trade with Google and have taken measures to limit my digital footprint, such as script blockers in my web browser. In time, these measures will no doubt be rendered obsolete in the arms-race of personal privacy on the web. In the long view, the Google geo discourse is a young one and the social position of its technology still somewhat fluid. Given this situation and my own position, it is my hope that this

research will help facilitate deeper thought and analysis about consumer mapping than today's popular press narratives of participation in Google Earth or surveillance in Street View.

Chapter Three: Sovereigns, Spooks, and Geeks: A History of Google Geo Services Through 2005

> "These 'power-knowledge relations' are to be analyzed, therefore, not on the basis of a subject of knowledge who is or is not free in relation to the power system, but, on the contrary, the subject who knows, the objects to be known and the modalities of knowledge must be regarded as so many effects of these fundamental implications of power-knowledge and their historical transformations."
>
> -Foucault (1995, 27)

In 1998, Vice President Al Gore gave a speech in which he shared a dream of seeing the world in ways unfamiliar to most people at the time. The speech, entitled *The digital earth: Understanding our planet in the 21s Century* (1/31/1998) envisioned a "digital earth" that would allow the user to see the world's geography through all kinds of data for a variety of uses. However, unlike then well-established GIS software, this digital earth would be simple enough that a child could use it. To attain this kind of simplicity, it would swoop continuously across scales from the global to the local in a single "magic carpet ride" enriched with aerial imagery. Even before Gore made his speech, others articulated similar ideas about easy-to-use, digitally-rendered views of the world, including cyberpunk author Neal Stephenson (1992) and technologist, neoconservative columnist, and Unabomber survivor David Gelernter (1992). The geographic visions that facilitated their dreams, most notably standardized, scalable geographic space and aerial imagery, were not new in the 1990s (Pickles, 2003). Rather, the issue was one of access. Hyperlocality and aerial imagery were not available to the masses in the way that Gore dreamed of in 1998 and that Google Earth realized in 2005.

The purpose of a history

This chapter assembles a genealogy of the current discourse of Google geo services by tracing the production and transformation of the two ways of seeing introduced in the first chapter. The histories of hyperlocality and accessible aerial imagery are fundamental to the geographical imagination of the Google geo discourse and the geoweb in general. They are also closely linked to changes in science and technologies, the tinkering of enthusiasts and the programs of nation-states. As this history will show, these ways of seeing are implicated in historically situated political, social, and material processes producing technological subjects, objects, and modes of knowledge.

Ways of seeing power/knowledge

In this chapter, I read Cosgrove's concept of contextual geographic "ways of seeing" as instances of Foucault's "power knowledge" to investigate the material and discursive preconditions of the Google Geo discourse (Cosgrove, 1998; Foucault, 1980). In this way, I assemble a visual, geographic form of what Foucault calls a "history of the present" (1995, 31).

Denis Cosgrove uses the concept of a "way of seeing" to understand landscape as a visual basis for an ideological and material relationship between classes of people and between people and the land. He describes in depth how Renaissance-era Venetian landscape was a way of seeing facilitated by and that contributed to capitalistic processes such as the commodification of land. This way of seeing worked through certain visual

technologies and practices, such as surveying and mapping along with peasant labor to re-shape the land around Venice (Cosgrove 1988; 1998).

I take Cosgrove's concept of a way of seeing and apply it in the discursive framework of this study to understand the context of the visual knowledges that presage Google geo services (Foucault, 1980). Doing so allows me to examine ways of seeing other than landscape and the cases Cosgrove examines. Approaching ways of seeing as cases of specific power knowledges also allows me investigate these ways of seeing in relation to more kinds of social processes, including state regulation and micropolitical influences such as early map mashups. It also forges a link it with the rich Foucauldian vein in critical cartography (Harley, 2001; Crampton, 2010).

This chapter focuses on two geographic ways of seeing, hyperlocality and accessible aerial imagery, that are historically contingent yet necessary components of what became the Google geo discourse.[17] As parts of a social, discursive history, these geographic ways of seeing are not naturally or progressively occurring (Edney, 1993; Gregory, 1994). Each is a techno-geographic power-knowledge that had to be invented and continually reinvented over time in different contexts such as Cold War-era U.S. military planning and Google's internet search business in 2004-05. By assembling a situated, conditional history, this chapter examines how the Google geo discourse is both a product of previous mapping programs and a historically distinct production of knowledge, subjects and objects.

[17] I use current terminology to label these specific power-knowledges/geographic ways of seeing because this mode of analysis seeks to better understand the current discourse and processes by examining their preconditions. For example, neither Renaissance Venetian mapmakers nor American Cold War planners would have used the neologism "hyperlocality" because they worked in times and places different from Google's. Nevertheless, their visual rationalities are the historical preconditions for the current way of seeing hyperlocally and therein use the same logics that undergird the Google geo services' geographical imagination.

Lessons from a history

Assembling this history illustrates just how the Google geo discourse is a product of and yet distinct from other forms of mapping and geographical imaginations. Working through this history, three themes emerge that bear directly on the geographical imagination, subjects, and practices of the current Google geo discourse.

The role of the state

For such a vibrant mapping discourse, the role of the state is conspicuously absent from conversations in and around Google. Mapping has a centuries-long, intimate association with state projects and Google is no exception. Notably, many of the knowledges and even some of the personnel behind Google geo services came out of government programs. Furthermore, the state plays a role in supporting geo-technology startup companies. As we will see, the company that originally created Google Earth, Keyhole Inc., largely survived on government contracts and investment until Google acquired it. Google geo services do not represent a complete break from state-related mapping so much as a continuation of it in a new form. This history illustrates a shifting yet continuous relationship with the state from early cartographic knowledges through to governments' use of Google's geo services.

Map play

Complementing the serious business of the state, the current role of playful tinkering and enthusiasts that is apparent in web mapping has a rich lineage. Early aerial

photography was dominated by such experimentation, as were 1990's popular culture and video game technologies that informed Google Earth and Google Maps. In this way, playfulness was literally built into the software and released into a media context that encourages tinkering on the open web. Once on the web, both cartographic newcomers and an existing community of geo-hackers pushed for and created a vibrant, creative network of geoweb applications.

Mapping consumers

For its part, Google was quick to incorporate geoweb applications in its effort to capitalize on web-based geotechnologies. Google geo services are significant for an emphasis on consumer-oriented mapping that often involves non-expert mapmakers. Google's primary purposes for getting into mapping were to serve users local, geographic advertisements and sell ad space to small, local businesses.

Chapter roadmap

I begin the substantive portion of this chapter by examining the ascendance of mapping as a local, visual tool of early nation states, the cartographic basis for what becomes hyperlocality. Next, I shift focus to early experiments in aerial photography and its use by the state. During the Cold War, the U.S. military used these two visual, geographic power knowledges together: Hyperlocality in the form of a global geodetic map to guide ballistic missiles to targets identified in aerial imagery collected from KEYHOLE spy satellites. From there, I turn to mapping initiatives in late 1990s Silicon Valley and video game engineers who developed a way to literally combine hyperlocality

and aerial imagery into a single visual experience, **virtual globe** software. Through a company named Keyhole (Inc.), they attempted to market it to consumers with disappointing results. In 2004, Google bought Keyhole as the basis for a **map service** and therein, geographically targeted advertising. In the final section, I describe how users hacked Google's Maps to create the first third-party map mashups and, equally importantly, Google's choice to embrace map mashups and institutionalize them as part of its capital accumulation.

Sovereigns, maps and the nation-state

One clear precondition for hyperlocality and the view from above is a widespread understanding of the usefulness of modern, geometric maps, and their adoption by governing professionals. Mathematical, geometric maps are not a natural or universal part of human existence. Humans do possess an apparently unique cognitive ability to think about space and location abstractly, but this is very different from having actual mental "maps" or cartographies in our heads (Ellard, 2009; Wood, 2010). Maps and our ways of seeing with them are constructed through our interactions with the environment, each other and larger social processes (Harvey, 1990; Cosgrove 1998; Gregory, 1994; Harley, 2001; Pickles, 2003; Wood, 2010).

Modern mapping as we know it grew out of portolan charts, Middle Eastern Islamic mapping and the rediscovery of Ptolemy's *Geography* in the early Renaissance by European scholars (Livingstone, 1993; Wood, 2010). Systematic modern mapping developed into a geographic knowledge of choice in connection with developing nation-states, empires and the establishment of landholdings as private property. Many of the

very earliest maps in the European Renaissance were local maps and plans that were only later integrated into larger, indexed systems of mapping knowledge (Buisseret, 1992). Denis Cosgrove describes how Venice's sixteenth century noblemen, in part through a Venetian state agency, used geometrical surveying and mapmaking to delineate land for reclamation from swamps for capitalistic appropriation (1988). In time, more European kingdoms began to use maps as plans for various governmental purposes, including architectural plans for fortifications in the British Isles, planning military campaigns in France, provincial administration in the lands of the Austrian Hapsburgs, and for overseas colonial mapping by the Spanish crown (Buisseret, 1992; Biggs, 1999; Wood 2010).

Notably, much of this early modern mapping took place at a local scale. The value of provincial-scale maps, much less maps of the entire kingdom or proto-state was not necessarily self-evident from the outset. Maps and map collections of a whole kingdom or the known world came about through the persistence of particular sovereigns or administrators and a slow spread in the understanding of the value of cartographic views (Buisseret, 1992). Knowledge of geometry facilitated this visual scope beyond what any one person could see to a national or even global scale. The makers of cosmological diagrams had depicted such broad "scales" for a long time, but a visual, modern epistemology and the imperatives of these states demanded a constant, replicable mathematical scale (Cosgrove, 1998, 2001; Wood, 2010). Even with the standardized geometric geographic framework, shifting between scales required breaking the visual, mathematical view by switching between pieces of paper with maps at different scales. Within the limits of the medium, a sovereign or administrator could, with a large enough

map collection or atlas, practice a form of hyperlocality by understanding local maps to be situated within broader maps' geometrical index.

Cartographic subjects

Though mapping and map use began to thrive in the Renaissance, these maps were not for everyone. Harley's writings on historical maps describe two subject positions, a map's patron and a mapmaker (2001). The patron was usually a head or representative of the state, a knowledgeable member of the elite or all three combined. The mapmaker produced maps for the patron according to particular cartographic standards and practices. Most people, especially the populous lower classes and those from other societies, didn't enter the picture except as mapped objects and sometimes not at all (Harley, 2001; Cosgrove, 1998).

For the privileged few who had access, using maps allowed them to see geography in new, powerful ways, dually creating empowered, viewing geographic subjects and the notion of a territorially bounded nation-state as a mapped object. Thongchai Winichakul describes how the Siamese king used new, European-influenced cartographic practices and knowledges to construct a nation by mapping territory in the 1800s (1994, 16). This Siamese nation state, while socially constructed, had material effects "by classifying, communicating and enforcement- on people, things and relationships" (1994, 17). He goes on to illustrate how this geographical conception of the Siamese nation displaced other indigenous geographical knowledges and continues to shape the current Thai nation-state. Thongchai's case shows not only the power of mapping across scales in nation-building projects, but also the subject positions of those

using the maps. As a state knowledge, mapping the nation required multiple maps at different scales for use by the head of state and his representatives. In time, multi-scalar national map collections were reinforced by another geographic way of seeing, aerial photography.

Picturing Location

Photographs offer a material, technical way to produce images that include many geographic features left out of maps and that cater to Western ideas about accessing truth through vision. Aerial photography and remote sensing reinforces these characteristics by adopting an elevated position and by being the object of strict photogrammetric professional standards regarding resolution, orthorectification[18] and other characteristics (Cosgrove, 2001).

The early history of aerial photography is closely related to innovations by enthusiasts in photography and flight. State agencies, often the military, quickly got involved when innovations held potential applications. For example, the inventors of the first permanent photographic process, Nicéphore Niépce and Louis Jacques Mande Daguerre, sold the process to the French state for government stipends in 1839. The first known aerial photographs were captured in 1858 by a Parisian portrait photographer who called himself "Nadar."[19] Unfortunately, none of these photographs survive today. Nadar himself had a complex relationship with the French government and military. He refused to perform reconnaissance for the military of Napoleon III in 1859, but did command the balloon corps in the later Franco-Prussian war (Katz, 1966). James W.

[18] Correcting for the curvature of a camera's lens so a photo has a consistent cartographic scale.

[19] "Nadar" was a pseudonym for Gaspard-Félix Tournachon.

Black and Samuel A. King, also enthusiasts, captured the first surviving aerial photographs over Boston in 1860. Over the next 50 years, photographic and aeronautical enthusiasts experimented with a number of aerial photographic platforms including other balloons, unmanned kites, manned kites, rockets, gliders, airplanes and even pigeons (Katz, 1966; Jensen, 2000; Cosgrove and Fox, 2010). The demands of the First World War pushed aerial photography from an enthusiasts' activity into a systematic technology practiced by professionals in state agencies. The war began with ad-hoc photographs shot by pilots with hand held cameras and ended with dedicated reconnaissance aircraft and trained photo-interpreters processing as many as 10,000 images a night (Jensen, 2000; Cosgrove and Fox, 2010). The demands of the Second World War prompted further development of aerial photography, particularly for targeting the strategic bombings of German and Japanese installations and cities.

Throughout the 20th century, aerial photography remained primarily a professional and/or governmental endeavor, inaccessible to most people.[20] Even when systematized, aerial photography is expensive, requires expertise to produce, is easier to interpret with experience, and includes so much extraneous detail that it is a problematic way present analytical geographic conclusions. Beyond military reconnaissance, state and local governments in the United States began using aerial photography for various administrative and planning purposes in the 1920s and 30s. During Franklin Roosevelt's presidency, the Agricultural Adjustment Administration (AAA) used aerial imagery to measure the scale of crop production to forestall precipitous drops in the market price of

[20] Over the years, aerial imagery was occasionally available to the general public in books of aerial images and in governmental forums, such as Adlai Stevenson's confrontation at the United Nations during the Cuban missile crisis (Cosgrove and Fox, 2010). However, these limited forms of access don't begin to compare with the amount of expert and secret imagery produced at the time or the volume of imagery available through Google today.

agricultural commodities (Monmonier, 2002; Cosgrove and Fox, 2010). Though peaceful, these programs indicate just how state- and professionally-oriented aerial photography was at the time.

Spooks: secret hyperlocality from space

During the Second World War, nearly all of the U.S. government's aerial photography resources went into the war effort. From that time until the closing stages of the Cold War, the military pushed the margins with the most sophisticated, effective aerial photographic systems in the United States and the world. During the same period, civilian aerial photography grew as an industry serving local governmental purposes and government-funded science programs. However, the military led the way in technical complexity and innovation. The power-knowledges of hyperlocality and aerial imagery underwent development behind a shroud of military secrecy with aerial images occasionally let out into public view. In part due to its state secrecy and professionalization, this period lacks the influence of individual enthusiasts and playful photographic or cartographic tinkering that characterizes aerial photography before the First World War and the current geoweb applications.

Hitting the target

The U.S. military developed sophisticated mapping technologies to facilitate military navigation in general and ballistic missiles in particular. The remote targeting and navigation methods used by strategic bombers in World War II would not work for ballistic missiles. A bomber's flight path and location could be adjusted in the heat of the

moment by its pilot. Furthermore, 1940s bombsite technology required the bombardier to view the actual target. A ballistic missile, on the other hand, must be targeted from its launch point based on maps and calculation, not direct visual observation of the target by a person.

The means to assign targets to intercontinental ballistic missiles and to guide them with precision combined two techno-geographical knowledges: 1. targets identified in aerial images captured by spy satellites or airplanes and 2. a precise (hyperlocal) geodetic model of the earth that was accurate across scales. By the 1980s, that geodetic model could help bring ICBMs to within 100 meters of their target from the other side of the world (Mackenzie, 1990). These knowledges were part of a greater convergence of the geosciences around national defense during the Cold War (Cloud, 2001; Barnes and Farrish, 2006).

This particular combination of hyperlocal mapping in concert with aerial imagery was new, a key precondition to the current Google geo discourse. In practice, military analysts derived the knowledge of where each warhead should be aimed from top secret aerial imagery collected from planes and satellites. When the time came, everything from a missile's launch site and line of flight to its warheads' final approach would be guided by calculated inertia in relation to the center of the earth's mass (Mackenzie, 1990). Specialists calculated this path using a global scale, yet highly locally detailed, geodetic map, a geographic knowledge that users of its technological progeny on the web describe as "hyperlocal." This convergence of aerial photography and geodesy illustrates the role of the nation-state in formulating the cartographic logics that underpin Google geo services.

The shape of the Earth

The world isn't flat. Neither is it spherical, nor perfectly ellipsoidal. Even setting aside the peaks and valleys we traverse every day, the earth is an irregular shape. Geodesists compile datums, collections of reference points in space that model the shape of the earth (or parts of it) in relation to the center of its mass. In cartography, datums are the geographical basis for maps' complex mathematical coordinate systems and map projections. Through a datum, you can empirically know the actual shape of the earth, or at least a part of it.

Before and during the Second World War, there was no standardized global datum. Descended from early national maps, different nation-states had their own national datums that were limited to their own territories or continent(s). For the United States in particular, its North American Datum was quite inaccurate for fighting overseas in the South Pacific or Europe. Military planners found that for the United States to accurately project its power around the globe, it needed a global datum to accurately project its maps. Not long after the end of the war, several American military agencies launched global geodetic mapping programs that linked existing national datums together and added new measurements where needed (Warner, 2002). Working through the 1950s, geodesists created a global datum by the end of the decade, the World Geodetic System 1960 (WGS 60). WGS 60 was global in scope yet quite locally precise, a mathematically continuous form of hyperlocality.

With WGS 60, you could calculate the precise location of any point on earth and thus an exact path between any two points in the world. Warner argues that this was one

of the most important intellectual achievements of the Cold War (2002). As a mass-centered datum, WGS 60 was based on measurements of the verticality of gravity, meaning it was no coincidence that U.S. ballistic missile guidance systems came to be based on inertia and gravity. However, since the datum was based on direct observations, reference points were sparse for some parts of the world, most significantly the Soviet Union. Even with satellite images to locate targets, navigation using WGS 60 could only be accurately located to within two to three miles and as far off as 30 miles in parts of Russia (Warner, 2002). Government geodesists updated WGS to improve accuracy in 1966, 1972 and 1984 with more changes since. WGS 84 is the coordinate system that underlies the current global positioning system (GPS). These updates significantly improved locational accuracy down to today's hyperlocal GPS accuracy of few feet or less anywhere in the world (Mackenzie, 1990; Warner, 2002).

Seeing the target through a KEYHOLE

For the military, such hyperlocal accuracy was only useful if they knew what to aim at in the first place. Strategists used both aircraft-based aerial photography and traditional human intelligence for strategic targeting in the Second World War, but the Cold War presented serious roadblocks for both methods. The Soviet government would not allow conventional surveillance aircraft into their airspace and Soviet authorities were very effective at preventing information about nuclear weapons or missile programs from getting out via human espionage (Hall, 1998). In response, U.S. intelligence services began a series of top secret programs to capture imagery of Soviet nuclear activity by less conventional means. The ideal solution, proposed by the then recently created RAND

corporation, was an automated reconnaissance satellite, because it would be very difficult to shoot down (RAND, 1946). However, in the late 1940's, the technology for such a satellite didn't yet exist. For the time being, the CIA and other intelligence agencies used top secret stop-gap measures, first with balloons in project GENETRIX,[21] and beginning in 1954, the high altitude U2 spy plane program. In the meantime, the Directorate of Central Intelligence (DCI) developed a reconnaissance satellite program designated CORONA. In 1960, Soviet forces successfully shot down a U2 in their airspace, reinforcing the case for reconnaissance satellites. In August of that year, the U.S. successfully launched the first CORONA satellite and it began to collect imagery of the Soviet Union (Cloud and Clarke, 1999).

To oversee aerial imagery intelligence, the DCI, Air Force and the defense department's Advanced Research Projects Agency (ARPA, precursor to DARPA), created a new, unprecedented security protocol for aerial imagery and a new agency to organize it, the National Reconnaissance Office (NRO). The security protocol was top secret in a series of compartmentalized code words broken down by topic. That way, the staff of one codeword program would not necessarily have clearance for any other codeword programs. The protocol designated aircraft-based photographic intelligence, such as the U2 program, "TALENT" and spacecraft reconnaissance, such as the CORONA program, "KEYHOLE" (Cloud and Clarke, 1999). CORONA and subsequent reconnaissance satellites used special cameras designated KH # (KEYHOLE #) to signify the version of the camera. The KEYHOLE secrecy status also extended to the images captured by the satellites. The early KH cameras used in the CORONA program shot

[21] By convention, U.S. intelligence and defense program names and security designations appear in capital letters.

analog film that the satellite jettisoned back into the Earth's atmosphere. A CORONA film canister had to be caught during its decent with a specially-equipped US Air Force plane lest the top secret film be lost or destroyed. Successor SAMOS satellites scanned analog film inside the satellite and transmitted it to ground receivers (Cloud and Clarke, 1999).

In practice, the secrecy around TALENT-KEYHOLE was not total. Secrecy functioned as what Clark and Cloud describe as a "shuttered box" whereby secret technologies and knowledges could be released to the public through obfuscated or indirect means (1999). For example, the first American aerial satellite imagery of the moon was shot with a SAMOS reconnaissance satellite rebranded for public consumption. Aerial imagery experts cycled through private corporations, universities and the NRO, whose very existence was top secret (Cloud and Clarke, 1999). In short, satellite-based aerial imagery existed, but very little was accessible to average people in its native, photographic from. Only specialists and government officials with KEYHOLE security clearance could access that imagery.

CORONA's primary mission was to locate targets for U.S. ballistic missiles (Thompson, 5/25/1995). In this pursuit, the program was a great success. Analysts found previously unknown Russian military installations in the very first CORONA mission and that mission alone returned more imagery of the USSR than all previous balloon and U2 flights combined (fig. 3.0)(Wheelon, 1995). The spatial resolution of CORONA images improved over the course of the program down to 2.8 square meters after 1963 and as little as 0.6 square meters at times (fig. 3.1)(Cloud, 2001). For comparison, the

highest resolution satellite aerial imagery in Google geo services allowed by U.S. law in most cases is 0.5 meter resolution.[22]

With target locations identified from CORONA imagery, the navigation data could be loaded into the guidance systems of missiles using the new hyperlocal WGS 60 datum of the world. In fact, CORONA's imagery quality was so good that government geodesists began to use it for locating precise points on the earth in the construction of subsequent WGS datums in areas of Russia they could not visit in person (Cloud, 2001). Thus, aerial imagery served as such a strong intellectual knowledge that its secondary use of locating precise geographic points served to reinforce the datum behind hyperlocal missile guidance. CORONA not only allowed photographic precision in a global context, it facilitated mathematical, geodetic precision as well. The CORONA program concluded in 1972, but top secret U.S. satellite intelligence continued with presumably even more precise systems of which many are still classified.

What's in a name? KEYHOLE and Keyhole

Beginning in the early 1970s and greatly expanding in later decades, the field of imagery satellites expanded to include civilian U.S. government programs such as Landsat, other countries and the private sector. By the 1990s, aerial imagery was more available than ever before, but remained a specialized industry. In the meantime, video game graphics engineers began work on software that would change the accessibility of that imagery. Much like Cold War defense agencies, it would deploy the power-knowledges of hyperlocality and aerial images in concert, but now together in a single software package intended for a mass audience. Before long, the software was the basis

[22] Images collected from airplanes may be higher resolution.

for a new startup company with a name none other than Keyhole (Inc.). Though it tried to reach a mass audience, Keyhole repeatedly almost went bankrupt. It survived by serving as mapmakers had for centuries, making maps for state programs. In 2004, Google bought Keyhole, rebranded its software as Google Earth, and successfully shifted the business plan to consumers.

Neither a secret nor a best-seller

In the late twentieth century, civilian satellite-based aerial imagery, much like civilian aircraft-based imagery, was technically available but had real limits that prevented it from becoming a common consumer tool. The United States launched several kinds of imaging satellites in the 1960s-70s. Of these, the most significant remote sensing satellites were part of the Landsat program, which launched its first satellite in 1972. A partnership of a number of government agencies including NASA, NOAA and the USGS, Landsat supplied government agencies, businesses, scientists and educators with satellite imagery. While the stated purpose of the Landsat program was to study natural resources and processes, the program struggled for years to put Landsat technology into practical use (Mack, 1990). In its first decade, one could even purchase a Landsat photograph for as little as $8 (McHaffie, 1995). However, the spatial resolution was at best in the tens of meters, severely limiting the number of everyday features laymen could identify in an image (Mack, 1990). At the time, high resolution imagery did exist, but only from expensive aircraft-based private vendors or in the top secret intelligence programs. In the late 1970s and early 1980s, with foreign competition on the horizon, the Carter Administration set Landsat on the path to privatization (Lee, 2011).

In the 1980s and 1990s, the amount of satellite imagery for sale exploded. Foreign governments and partnered companies launched satellites including France's System Probatoire d'Observation de la Terre (SPOT) and Helios satellites, Israel's Ofeq satellites, the private IKONOS satellites and others (Richelson, 2006). In addition, the Soviet Union began to sell satellite imagery from their military reconnaissance satellites (Jensen, 2000). The primarily peaceful uses of this aerial imagery were scientific research and planning, not individual consumer applications. The technical, professional nature of cartography and related geosciences from the Cold War continued in the form of trained scientists and GIS professionals who most often worked with aerial imagery. Aside from limited views of aerial imagery in books, National Geographic inserts or planning meetings, most people had little perceived use for aerial imagery as it was sold in the 1990s.

Despite the practical limits on aerial imagery at the time, the 1990s also saw the rise of several influential ideas of how aerial imagery could be more widely applied in digital globes. Technologist David Gelernter (1992) imagined a digital "mirror world" that perfectly represented the world to all kinds of people. Neal Stephenson's (1992) dystopian cyberpunk novel *Snow Crash* imagines a virtual, digital globe for consumers that displays live, real-time aerial imagery of the entire Earth. In his digital earth speech, vice president Al Gore also articulated the idea of a digital globe for use in education, fighting crime and environmental issues (1/31/1998; Pickles, 2003).

Meanwhile, in Silicon Valley

Vice President Gore gave his speech in the midst of the dot-com boom around software, personal computing and the internet. At the center of this boom was Silicon Valley, a hotspot of technological innovation, venture capital and internet startup companies. One of the most exciting sectors of the valley's software industry was digital graphics and the hottest place to work on graphics in the mid-1990s was Silicon Graphics Inc. (SGI). SGI attracted employees from many fields including computer science, physics, mathematics, business, design and former federal government employees, including former intelligence "spooks" looking to earn more than the U.S. government would offer (Gauge, personal communication, 4/3/2010; Hanke, 10/11/2007). It was this combination of people, capital, and network technologies that lay the foundations for the imagery-rich, consumer-oriented, hyperlocal virtual globe that we now call Google Earth.

SGI did not set out to create a virtual globe, much less a consumer-oriented one. Its business was high performance computing systems hardware, including the chips for game consoles and specialized "Onyx 3000" 3D workstations for graphics and video game development.[23] In 1996, an engineer at SGI, Mark Aubin, needed a "killer demo" to show the extent of what an SGI's Onyx 3000 could do with a new graphics rendering technology called "clipmapping" (Aubin, 4/2006). Around the same time, Dan Gordon, president of a company named Autometric,[24] presented a virtual globe called Edge Whole Earth at SGI's offices that ran on an SGI platform. Brainstorming, and perhaps

[23] Most computers at the time did not have dedicated graphics cards capable of extensive three-dimensional graphics rendering.

[24] At the time, Autometric was a "boutique" mapping and geo-visualization firm that worked primarily for government agencies and military contractors such as Lockheed Martin and Raytheon (Wakeman, 9/24/1998).

influenced by Gordon's presentation, Aubin's team came up with an idea inspired by the "flipbook" of the *Powers of Ten* (Aubin, 4/2006). The *Powers of Ten* was originally a short documentary film from 1968 that visually "zoomed" incrementally across spatial scales at a power of ten per step.[25] The film begins with an image of one square meter in a park in Chicago and sequentially zooms out at the rate of an order of magnitude every ten seconds to a scale of 10^{24} meters, one billion light years. From there it quickly zooms back into the park and down to 10^{-16} meters, picturing a quark in a proton in a carbon atom (Eames and Eames, 1968). After some discussion, Aubin and his team chose to emulate the *Powers of Ten*'s quick zoom back to earth in their demonstration by zooming from outer space into a particular spot on a rendered 3D virtual globe.

> We'd begin by heading toward Europe, and then, when Lake Geneva came into view, we'd zero in on the Matterhorn in the Swiss Alps. Dipping down lower and lower, we'd eventually arrive at a 3-D model of a Nintendo 64, since SGI designed the graphics chip it uses. Zooming through the Nintendo case, we'd come to rest at the chip with our logo on it. Then we'd zoom a little further and warp back into space until we were looking at the Earth again. – (Aubin, 4/2006)

The demo, referred to as "Space to your face" was very popular and powerful for audiences in the mid-1990s and remains so today. When Google Earth opens, the first thing it does is zoom some distance toward the Earth (fig. 3.2).

Even though the demo had great visual-geographic power, its purpose and context at SGI was as a demonstration of its computer graphics systems. Before long, several of the SGI employees who crafted the technology behind "Space to your face," including Brian McClendon, Michael T. Jones and Chris Tanner, formed a new startup company, Intrinsic Graphics, which focused on video games. A short time later, Tanner invented a

[25] The *Powers of Ten* film and print versions of it are adaptations of Kees Boeke's 1957 book *Cosmic View.*

way to do clip mapping purely with software, making a virtual globe much easier to create. He, McClendon, Jones and others created new startup company around it named Keyhole. The company's CEO, John Hanke, claims that they named the company "Keyhole" somewhat humorously after Tom Clancy novels, because the author used the term "KEYHOLE" very indiscriminately to apply to any sort of "overhead" U.S. intelligence (Hanke, 3/31/2010a).

In the beginning, Keyhole (Inc.) was mostly staffed by former SGI employees including Mark Aubin, Chikai Ohazama and engineers with similar programming and graphics backgrounds, such as Avi Bar-Zeev. Board chairman Brian McClendon brought in an entrepreneur, John Hanke, to be CEO. Hanke had successfully sold two video game startups and was impressed with the "Space to your face" demo (McClendon, personal communication, 7/20/2009; Hanke, 10/11/2007). Before coming to the Bay Area around 1993, he worked for an undisclosed branch of the U.S. Government in "foreign affairs" in Washington DC, Burma, and elsewhere in Southeast Asia (Ratliff, 6/26/2007).

Keyhole's way of seeing

The heart of Keyhole (Inc.) was a virtual globe program called Earth Viewer. Former Keyhole employees describe several inspirations for it in addition to Mark Aubin's *Powers of Ten* for the SGI demo. Taking cues from Stevenson's *Snow Crash* and David Gelernter, Avi Bar-Zeev was inspired by the idea of a "mirror world" that could become similar to Stevenson's virtual reality Metaverse in which users assume avatars (Bar-Zeev, 7/24/2006, 12/11/2006; Gelernter, 1992). Michael T. Jones talks about being inspired by the tricorder device from Star Trek (Parsons, 3/27/2006). John

Hanke cites flight simulator video games (Maney, 3/212003; Bar-Zeev, 7/24/2006). Taken together, these examples are some indication of the visual ideas bouncing around Keyhole at the time. For a company in Silicon Valley staffed with graphics geeks and headed by a CEO with video game business experience, such examples are quite fitting. In addition to sovereign nation-states and Cold War intelligence, some of the important ideas behind Earth Viewer were playful, with inspirations in popular culture.

These playful cultural inspirations were apparent in the user's experience of Earth Viewer and now in Google geo services. Earth Viewer looked smooth, loaded very quickly and easily shifted scales without the user turning on and off layers of imagery data.

> Google Earth cleverly and progressively loads high-res information for what's at the focal "center" of your view…and resolution drops off by powers of two from there. As you tilt and fly and watch the land run towards the horizon, Universal Texture is optimally sending only the best and most useful levels of detail to the hardware at any given time. What isn't needed, isn't even touched. That's one thing that makes it ultra-efficient. – (Bar Zeev, 7/3/2007)

Quick zooming and "flying" is significant beyond the spectacle. The visual path that Earth Viewer/Google Earth follows, smoothly flying between exact locations by zooming away from and then back towards the Earth, is similar to the flight path of a ballistic missile and its warhead. Earth Viewer's programmers were well aware of this fact (Bar-Zeev, 7/24/2006). Much like WGS 60 and KEYHOLE, Earth Viewer/Google Earth is a construction of hyperlocality and aerial imagery, now seamlessly rendered together and accessible in consumer software. It is a shift from the global to the very local that is visually consistent and therefore easy to understand for many people, including non-experts. Before Google acquired it in 2004, this accessibility was tempered because

Keyhole could only afford high resolution aerial imagery of a few cities around the world. Aerial imagery was expensive, especially for a startup company. Even with these limitations, Earth Viewer looked stunning (Gauge, personal communication, 4/3/2010). Its slick graphics rendering and smooth movement, though descended from Cold War science and technology, were dedicated to more than hard effectiveness and accurate science. Rendering the zooming and panning was meant impart "an aesthetic feel that reminds you, every time you use the app[lication], how everything is connected" (Bar-Zeev, 7/24/2006). Earth Viewer was understandable and looked amazing to untrained, non-expert eyes. As geographical ways of seeing, hyperlocality and accessible aerial imagery were technically more available and comprehensible to non-expert consumers than ever before.

Keyhole Inc.

Earth Viewer had to be appealing and comprehensible to common consumers who had never seen anything like it before to satisfy its creators and Silicon Valley venture capitalists. Even with Earth Viewer's spectacle, Keyhole had real difficulty as a company. It made aerial imagery more accessible and easier to understand, but the company was small, unknown and the actual uses of Earth Viewer for its consumer/users were not developed. Keyhole needed to create new users to achieve critical mass and the growth rate it required as a private company. In practice, the company had serious trouble, forcing it to experiment with a number of businesses strategies (Hanke, 10/11/2007). The case of Keyhole illustrates how a new geographical way of seeing, even a visually spectacular one like Earth Viewer, did not prosper in the private sector

without proven a business strategy. Keyhole's new mapping technology, though more complex and powerful, was not simply "adopted" in a march of cartographic or technological progress.

Keyhole's original business plan was a consumer-oriented partnership with the then-recently merged Excite@Home internet cable service. The plan was to supply a Keyhole digital globe as an add-on to cable subscriptions (Hanke, 10/11/2007). In addition to cable fees, Keyhole programmers built in a way to generate revenue through geo-targeted advertising if necessary. Thus, behind the slick graphics rendering, Earth Viewer was a three-dimensional, geographic search engine that could serve geographically-targeted ads (Bar-Zeev, 4/18/2006). Even with these plans in place, Keyhole had the misfortune of incorporating in 2001, just as venture capital dried up in the dot-com bust. Their planned business partner, Excite@Home, went bankrupt later that year. Keyhole had originally launched with a venture capital investment from SONY, but, in the style of boom-era Silicon Valley firms, had burned through that money in a matter of months. Desperate to pay the bills, Keyhole existed hand-to-mouth for two years, using a number of strategies to cobble together funds. They revamped Earth Viewer as a licensed tool for real estate developers. The company got a small amount of capital from NVIDIA, a graphics card manufacturer, with the idea that applications like Earth Viewer would necessitate PCs with dedicated graphics cards. Keyhole licensed a Japanese version of Earth Viewer. Hanke even asked employees to take all or part of their salaries in company shares and he and McClendon invested nearly all of their own personal savings in the company (Hanke, 10/11/2007). Why was Hanke willing to go so such lengths? He was convinced a consumer virtual globe "was going to happen" and

that if Keyhole didn't do it, someone else would (Hanke, 10/11/2007; 3/31/2010a). Despite his confidence, the fact the Keyhole held on by mere threads for so long shows just how easily it could have disappeared entirely.

In 2003, Keyhole's luck began to change. Hanke brokered a deal with CNN so that the news channel would use Earth Viewer to show parts of the world with an onscreen attribution to Keyhole, but with little actual revenue paid for the service. The Iraq war and a number of disasters around the world in early 2003 ensured CNN screen-time (Hanke, 10/11/2007). More significantly, Keyhole got into the same kind mapping as its namesake KEYHOLE. Hanke bought Keyhole Inc. breathing room by securing venture capital from In-Q-Tel, a venture capital firm backed by the Central Intelligence Agency. In-Q-Tel incorporated in 1999 with a mission to invest in companies "developing cutting-edge information technologies that serve United States national security interests" (In-Q-Tel, 6/25/2003). In-Q-Tel's investment opened the door to contracts with a number of defense and intelligence agencies and Keyhole's easy-to-use software quickly became popular in the intelligence world. Within two weeks of the final deal, the U.S. Government's central mapping division, the National Imagery and Mapping Agency (NIMA[26]) was using Earth Viewer in the Pentagon for the war in Iraq (In-Q-Tel, 6/25/2003). Back at Keyhole, employees were struggling to meet the new demand. "Keyhole was always scrambling to please our biggest customer, the Agency, which used our cool interface to view their own top secret data" (Thierry, 7/17/2008). Keyhole had found a way to survive.

In-Q-Tel's investment not only probably saved Keyhole from bankruptcy, it shows how state projects have a continued role in mapping, even when parts of the

[26] NIMA changed its name to the National Geospatial-Intelligence Agency (NGA) in November 2003.

mapping are outsourced to a private company. That Keyhole's Earth Viewer, which was built for consumer access, lent itself to government mapping so well is indicative of the historical role of hyperlocality and aerial imagery in service to the state. Earth Viewer lacked a clear consumer purpose, a well-known brand, and a consumer base. State-backed capital and contracts allowed Keyhole to continue and gave it a purpose similar to that of mapmaking initiatives going back hundreds of years. To do something else, however, and create a mass of consumer user-subjects, Keyhole needed something more.

Geeks: Google enters the field

Google's October 2004 acquisition of Keyhole formed the basis for a mapping that differed significantly from Keyhole's government contracts and much of the geospatial industry of the time. Google had immense amounts of capital and brought it to bear through a different way of thinking about data and a different kind of business plan. Unlike most mapping or GIS firms at the time, Google approached geographic information not as unique and central, but as simply another form of data in its mission to "organize the world's information" and make access to that information through Google ubiquitous (Google Inc., 2011a). Google makes its money by advertising beside its free services, such as the Google internet search engine. To fit Keyhole into this strategy, Google simply extended the rationale of its search business to include geographic space. Now Keyhole's combination of hyperlocality and aerial imagery was available without cost and part of Google's ubiquitous brand. This combination meant that the users of Google geo services represented a much broader cross-section of society than Keyhole

Inc.'s government contracts, the top secret CORONA program or maps for national elites.

Local search: Why Google got into geo

Google is a company built around an internet search engine. It makes money by "serving" targeted advertisements to users based on search results, a user's search history, surfing habits, and his or her use of other Google services such as Gmail. Consequently, Google's ad targeting covers a very wide range of specific niche interests and needs. This strategy of many highly-targeted ads is very different from blunt mass-advertising for mass audiences, such as television or radio advertising (Battelle, 2005). One kind of niche market is geographically local searches such as a search for "pizza in Chapel Hill, NC" instead of just a search for "pizza." This kind of searching, known in the IT industry as "local search," is thought to be a vast potential market for internet advertising by small local businesses. Currently, this advertising sector is the domain of classified sites such as Craigslist.org, newspapers and resource-intensive phone book listing services. Google, Yahoo!, Microsoft and other search services have been trying to create an effective local search for years, but the "problem" of local search is still mostly understood as "unsolved" (Battelle, 2005; Mills, 6/20/2006; Google 1/O, 2009).

In 2003 and 2004, competition for local search among internet search engines heated up. Experts estimated that the local internet search market was worth $50 million in 2004 but projected it would be worth $3.4 Billion by 2010 (Olsen, 3/17/2004; Donoghue, 4/20/2005). At the same time, Google was making moves to become a publically traded company and needed to appear to be full of potential for its initial

public offering on the stock market. Local search and its geographically-targeted advertising offered a clear avenue of growth for Google's capital accumulation that played into the company's existing strength in effective targeted advertising. In March 2004, the company launched Google Local, a specialized search service meant to search for local results and that served some local ads (Olsen, 3/37/2004). In practice, Google Local was far from perfect both in the quality and format of its results. Other search engines integrated maps into their local search service, most notably AOL's MapQuest.[27] Despite their slow, hard-to-read design, MapQuest's maps were the most popular means for cartographically plotting locations online at the time, including from Google's own local search results. Watching the advertising dollars go to MapQuest and wanting a better way to visualize local searches, Google's executives turned to creating their own kind of map. Lacking an in-house way to make a map service, Google acquired two companies in October 2004 that formed the technical basis of Google geo services, Where 2 Technologies and Keyhole Inc.

The nuts and bolts of mapping local search

Google's acquisition of Keyhole merged Earth Viewer's visual, geographic hyperlocality with Google's own local search, a very powerful combination. Together, Google Maps and Google Earth allowed users a searchable, hyperlocal, globally-situated geographical vision with which Google could serve ads in a topically and visually geographic way. Keyhole also offered Google experience and contacts in geospatial industries that Google previously lacked.

[27] MapQuest began as a cartographic firm named Cartographic Services in the 1960s and rebranded itself with the current name in the 1990s (Davis, 4/26/2011).

From the perspective of Keyhole employees, Google's acquisition meant some big changes. Google's personnel dwarfed Keyhole's 30 or so employees, and the persistent danger of bankruptcy disappeared. As soon as Google took control, it cut the price for a yearly Earth Viewer license from $69.95 to $29.95 and with the eventual launch of Google Earth, the basic version became free (Hines, 10/27/2004). Google allowed the former Keyhole staff to stick together as they worked on Google Maps and Google Earth, and Google continued Keyhole's relationships with U.S. Government agencies. In-Q-Tel at least partially divested from Google in 2005 for over $2.2 million, but the government is still Google's largest client for premium versions of Google Earth (Insider & Form 144 Filings – In-Q-Tel Inc., 12/3/2005; Google I/O, 2009).

The other company that Google acquired in October 2004, Where 2 Technologies, was a tiny Sydney-based startup company entirely composed of two Danish brothers, Lars and Jens Rasmussen. They created a smooth, fast interface for displaying complex geographic information within a web browser instead of a stand-alone program like Earth Viewer or ESRI's ArcGIS. Both were engineers laid off in the midst of the dot-com bust and they began to collaborate on Jens' idea for a web-based map service. On a shoestring budget, they created a way to plot a dynamic map on a single webpage using the JavaScript scripting language and an Ajax[28] technique to present the JavaScript on a webpage. It worked by loading 256x256 pixel square image tiles into a map frame, including beyond the view-frame of the browser (fig. 3.3). That way, a user could pan around the map, a "slippy map", without reloading the whole page for every minor adjustment as industry-leader MapQuest required at the time. The Rasmussen brothers

[28] AJAX is an abbreviation for asynchronous JavaScript and XML, a set of related web development techniques.

also introduced better graphic design than MapQuest. Inspired by Danish roadmaps, they created a now-familiar visual style in which roads are shown as fat colored lines with anti-aliased text inside them, making both the roads and text easier to read on a computer screen (Wallace, 3/27/3009). At the time, MapQuest and most other web mapping services used narrow lines with hard-to-read text labels beside or on top of them. The Rasmussens' JavaScript code and design were and still are the basis for Google Maps. Utilizing the Rasmussens' mapping interface, a user could employ Keyhole's aerial imagery and Google local search functions in a web browser on any internet-connected computer. It did not involve a separate program requiring installation and the inevitable system conflicts. Furthermore, the map interface itself was easy to use and visually stunning. The Rasmussens joined the geographic logics and visions of Keyhole with Google's web-based logics and capital accumulation strategy.

"Well I think we should get it all"

When Google Maps launched on February 8, 2005 using the Rasmussen's JavaScript Ajax interface it had no aerial imagery or a "satellite" view. Still, it made waves with a smooth user interface and close integration with Google's search engine (Kane, 2/8/2005; Donoghue, 4/20/2005, Andrew LePera, 5/31/2005; Francica, 12/1/2005). Google made another splash when it added satellite imagery in early April 2005 (Kawamoto, 4/5/2005). Other services had offered aerial imagery but with less geographic coverage and press fanfare. Microsoft's TerraServer included black and white aerial photography (Festa, Paul, 6/23/1998). NASA offered a digital globe called WorldWind (Randolf, 5/17/2007). MapQuest had offered aerial imagery for a time, but

discontinued the service when usage dropped (Balint, 7/11/2005). Why didn't these services draw attention and force the competition to adapt the way Google did?

Google Maps was a game changer in web mapping due to its targeted advertising strategy. This was realized not only through Google Maps' superior user interface but also through a huge investment and better geographical data coverage. Together, these factors very effectively delivered hyperlocal views and aerial imagery to masses of internet users. Unlike its early competitors, Google Maps plugged directly into Google's search services. Google Maps was a natural extension of Google's core business, search, and its mission "to organize the world's information and make it universally accessible and useful" (Google Inc., 2011a). Furthermore, geographic data not only served users' information demands, it also allowed Google to better target its ads. Similar to finding targets in aerial photographs and situating them on a global geodetic map, Google's hyperlocal, mapping advertising strategy involved a global scope in as much detail as possible. To be less than ubiquitous and global lessens the whole concept of the service.

This concept of a web mapping service was apparent in how Google managed geographic data acquisition around the time of Google Earth's launch. As the head of Google's new Geo division, one of John Hanke's tasks in 2004-5 was licensing aerial imagery from GIS data vendors to use in Google Maps and Google Earth. Keyhole had always been severely limited in what imagery it could afford to offer. Google carried over Keyhole's data licenses for access to some data, but that wasn't going to be enough for the ubiquitous vision of Google Maps or Earth. Hanke approached Google co-founder Sergey Brin with a data acquisition proposal for a number of major cities around the world and offhandedly mentioned that there was a lot more data available. Brin asked

"well how much do they have?" and when he saw a chart of global coverage he replied "well, I think we should get it all" (Hanke, 10/11/2007). This was unheard of in the industry and pleasantly surprised the data vendors. Google did get it all, for roughly $10 million, the largest single transaction Hanke had ever overseen to date (Hanke, 10/11/2007; Hanke et al. 8/27/2009). Such a large investment and risk fits directly into Google's strategy with maps. Local areas and the value of visually constructing hyperlocal, high resolution views of them are not limited to major cities. Only by licensing as much data as was available could Google make hyperlocal geographic searches fit the logic of its bread and butter business, the multitude of niche markets for advertising.

The combination of accessible aerial imagery for broad swaths the Earth and an easy to-use interface opened web mapping to a broader population than ever before. Unlike state-oriented cartographies, Cold War intelligence and Keyhole's trials, Google succeeded in creating genuinely consumer-centered mapping services using hyperlocal searching and aerial imagery through its targeted advertising business plan.

Mashing it up

Google's spokespeople, such as Senior Vice-President of Social Business Vic Gundotra, talk about how Google "believes" in the power of the internet when it is open and malleable[29] (Gundotra, 5/28/2008). Since its earliest days in the Stanford computer science department, Google has used open-source operating systems such as Linux on its servers. However, for years, Google did not cater to independent software developers

[29] Google's business strategy is, to a degree, based on an open internet in ways that I will describe in more detail in the next chapter.

creating third-party web applications (apps) with its services. The current proliferation of such apps on Google services did not come from within Google itself. Outsiders pushed and forced Google to adapt to their practices, re-orienting the company and forming the basis for supplemental apps not only for maps, but for many of Google's other services as well. Even though relatively few people make apps, they bring additional geographic information to the geo services that was unavailable before, adding to the hyperlocal individualization of both the creator and other users through web mapping practices. As additional contextualizing information, Google moved to take advantage of this new source of data by embracing early mashup/apps, yet enclosing how apps could be made and using their data to further its own capital accumulation.

Google gets hacked

In the late 1990's and early 2000's a community of geo/web-savvy enthusiasts formed around mapping, online services, GIS, and ever-cheaper GPS devices. A playful bunch, they described themselves at times as "hackers" or "geowankers," and many of the techniques they developed as "mapping hacks." In this context, "hack" has a positive connotation as something creative and to be respected.[30]

> Among people who write code…the term *hack* refers to a "quick-and-dirty" solution to a problem, or a clever way to get something done. And the term *hacker* is taken very much as a compliment, referring to someone as being *creative*, having the technical chops to get things done. (Erle et al., 2005, xxii)

[30] This conception of "hacker" is in contrast to a "cracker," a person who breaks into computer networks.

The map hacking community of the period was built on an ethos of do-it-yourself technical fixes and a dedication to open source, open data and open standards descended from sources like Linux and cyberpunk subculture (Erle et al., 2005, Wherecamp 2009; 2010). At the time, most geohacking required a willingness to get into and write code for geotechnologies and web services. Strictly speaking, the first internet-based map mashup combining data from independent sources on a web service probably happened somewhere in this community of map hacking and experimentation.

When Google maps launched in February 2005, it drew mixed reactions from the geohacking crowd. Some feared that Google's huge resources and hype would drown out their own work on open source geo and GIS (Walsh, 4/22/2009). Nevertheless, Google Maps itself was "eminently hackable" (Butterfield, quoted in Terdiman, 5/16/2005). Technically, Google Maps was composed of lines of Ajax JavaScript code developed by the Rasmussen brothers. When a user loaded the Google Maps page or ran a maps search, their web browser loaded the JavaScript code, the code took search queries to Google, received geographic data from Google's servers in reply and assembled that data into a map that appeared in the user's web browser window. As lines of code in a popular scripting language loaded into a browser every time Google Maps is used, it was very easy for any user with basic programming experience to copy the code, paste it into their own website and reverse engineer it. Not long after the launch of Google Maps, its product manager, Bret Taylor, sent an email to another Googler wondering how long it would be before someone hacked Google Maps into their own website. In fact, someone already had, and the news got round to Google the next day (Taylor, 6/29/2005).

The hacker who happened to do so was Paul Rademacher. His map hack, soon to be called a map mashup, was not the first map hack, but it was the first recorded hack of Google Maps. That hack, Housingmaps.com, along with a few other map mashups it inspired, such as Chicagocrime.org, got the ball rolling for geoweb applications and pushed Google to adapt to them. Housingmaps.com mashes Google Maps and the popular classifieds site Craigslist.org together by plotting Craigslist.org apartment and real estate listings into a Google Maps interface[31](http://housingmaps.com). Rademacher created this map mashup without any prior cartographic, mapping, GIS or even geohacking experience. At the time of Google Maps' launch, he was a recent Ph.D. in computer science from UNC-Chapel Hill working in feature film animation at Dreamworks. He had recently moved to the Bay Area and was frustrated with the limited ways of visualizing apartments listed on Craigslist. The only images were photographs of the inside of apartments and it was very difficult to know the neighborhood without visiting every location. He dreamed of creating a map that would plot all of the apartments he would be interested in. When he saw Google Maps using JavaScript that was easy to hack, he saw a way to make that map. Over the course of a few days in his free time, Rademacher copied Google's code and reverse engineered it so that it would query Google's geo servers and plot a map using a copy of Craigslist's apartment listing data hosted on his own server. Once he got it working, he built a basic design around it on his website and posted a request on Craigslist for people to beta-test it (Rademacher, 4/2/2010).

[31] In fact, a geo-hacker, Mikel Maron, had already plotted Craiglist listings on a stitched-together aerial imagery collage of San Francisco, but it was a proof-of-concept hack that few people heard about and that didn't develop further (Maron, 2004).

Google's un-thought choice

News and accolades about Housingmaps spread from Craigslist like wildfire. The site was an immediate hit, becoming a popular topic on tech blogs and among the geohackers (Porter, 4/26/2005; Fox, 4/8/2005; Pegg, 4/14/2005; Walsh, 4/22/2005). Rademacher quickly registered the domain name "housingmaps.com" and moved the website there from his personal website. With no more self-promotion than his original requests for beta-testers on Craigslist, housingmaps.com generated 900,000 unique visitors by late 2005 (Macmanus, 10/11/2005). Those at Google learned of the Rademacher's hack before he even registered the Housingmaps domain name. A Google employee named Kevin Fox noted the map-hack on his personal blog and called it a "Google Maps mash-up." He commented that "I can only imagine the changes this site will have in the way people think about maps" (Fox, 4/8/2005). From him, news spread throughout Google to the Geo division and the heads of the company.

"Mashup" was not a very auspicious label for Housingmaps, though the term did carry a degree of hacker street-cred. The term had become popular amidst a confrontation that rocked the music industry the year before. Brian Burton, a DJ with the stage name Danger Mouse mixed the vocals from rapper Jay-Z's *Black Album* with music samples from the Beatles' *White Album* to create his own *Grey Album*. EMI, holder of the distribution rights for the *White Album*'s music, threatened Danger Mouse and his distributors with lawsuits to prevent distribution of the *Grey Album* and succeeded in forestalling commercial distribution of the album.[32] Danger Mouse's defenders argued

[32] In contrast to EMI, Jay-Z and his record label did not try to stop Danger Mouse. Jay-Z had released an a cappella version of his *Black Album* precisely so that DJs could mix with it. This sort of mixing and sampling is a long tradition in Hip-hop.

that the *Grey Album* constituted a new artistic work unto itself, a "mashup." EMI's legal threats generated significant protest, media coverage, and organized civil disobedience in form of non-commercial *Grey Album* downloads. EMI never actually took Danger Mouse to court, though it probably would have come out on top in a legal settlement (McConchie, 2008; Rimmer, 2007). The *Grey Album* remains available as a free download from a number of websites today. Music mashups continue to be a gray area of copyright law with recording companies asserting ownership with legal threats and in court. Some artists follow these restrictions in their work and others flout them citing fair use guidelines (Rezaine, 2010).[33]

When decision makers at Google learned of about the Housingmaps mashup, they faced a situation akin to EMI's standpoint. Google had the legal right and precedent to demand the closure of Housingmaps.com. It was an unauthorized case of copying and reverse-engineering code owned by Google for unauthorized access to its map data servers. Rademacher had hacked their service and used their servers without permission.[34] Furthermore, the map mashup accessed geographic data that Google was not licensed to share.[35] However, if they shut Housingmaps down, Google would likely face the criticism of Housingmaps' fans and from Google's own engineers who found the map mashup to be brilliant (Hanke, 3/31/2010a; Google Inc., 4/13/2005).

[33] Albums by Greg Gillis, better known by the moniker Girl Talk, may sample more than 300 unauthorized sources on a single album, but neither he, nor his label, Illegal Art, has been taken to court (Rezaie, 176, 2010).

[34] In an attempt to not provoke Google and Craiglist, Rademacher cited both websites on Housingmaps.com and designed his mashup so that it did not place a great strain on Craigslist's or Google's servers and resources.

[35] At the time, Google licensed all imagery, road data and other data from third-party data vendors, chief among them NAVTEQ.

Google's response at this point was as important as Rademacher's mashup itself. In actuality, those at Google didn't see it as a choice at all. Google didn't send Paul Rademacher a legal takedown notice, nor did Googlers ever really consider that possibility. Housingmaps.com fit directly into Google's discourse of "organizing the world's information." For that reason and the mashup's technical elegance, it generated a groundswell of excitement among engineers in Google's Geo division (Hanke, 3/31/2010a). It "blew our minds right off our shoulders" (Google Inc., 4/13/2005). This sort of data mixing had never occurred to people at Google or Keyhole, but they recognized it as a great opening for innovation (Hanke, 3/31/2010a). To further take advantage of these ideas, Google hired Rademacher not long thereafter.

Housingmaps.com was not alone. During the spring of 2005, hacks of Google maps sprouted throughout the internet. Perhaps the best known was Adrian Holovaty's chicagocrime.org, a mashup of Chicago crime data and Google maps (Holovaty, 7/1/2010). Those who made mashups began to create their own social connections and joined the existing geo-hackers in calling on Google to fully recognize and legitimize their maps (Wherecamp, 2009; 2010).

Enclosing the map mashup frontier

Map mashups like Housingmaps.com and Chicagocrime.org made decision makers at Google recognize the potential of mapping outside top-down driving directions and aerial photography. Geographic information had advertising and information aggregation value beyond local search in the form of people's self-made, often

hyperlocal, maps. Furthermore, Google was in the position to capitalize on the new cartographic ideas of people outside the company.

To these ends, Google established the Google Maps Application Programming Interface (API), an official way to make map mashups that incorporated them into the company's capital accumulation. This arrangement also formalized map mashups so that Google could maintain its licensing contracts for data with its GIS data vendors. The Google Maps API launched within three months of the creation of Housingmaps.com at the 2005 Where 2.0 conference.[36] A (maps) API is a standardized interface into a clone of a web mapping service, in this case Google Maps, which allows software developers to write code that interacts with the service as a mashup or geoweb application. The Google Maps API legitimized and standardized map mashups using its map service, as well as setting limits on what Google would allow developers to do with Google Maps. For example, the Google Maps API requires software developers to register an account with Google and to keep their apps available on the open web. The API can be used for commercial gain, but developers cannot force users to pay a fee to access a Google map mashup or geoweb app (Google Inc. 2011b). At the same time Google launched the API, it cut off access for those whose mashups simply copied and pasted the JavaScript code, such as Housingmaps. Doing so forced the mashup developers to use the API.

In addition launching the API at Where 2.0, Google began to use that conference and other venues to enframe and build a community of users, software developers and enthusiasts around Google geo services. It created an official Google Geo blog[37] and began to support existing enthusiast blogs such as Google Maps Mania (Clarke, 2011)

[36] Yahoo!, recognizing the potential, also launched a maps API at the same conference.
[37] The current incarnation is http://google-latlong.blogspot.com/

and the Google Earth Blog (Taylor, 7/20/2009). It created online forums frequented by Googlers and volunteers to help software developers with problems. Finally, it sponsored conferences and meetings dedicated to geo technologies including Where 2.0, Geoweb, Wherecamp and Google's own software developer events.

The formalization of mashups through the Google Maps API and Google's efforts to build a community met largely positive reactions from geo software developers and geohackers at the time. They were happy that Google saw potential in map hacking and was bringing many more users and developers into the geo technology/neogeography world. For Paul Rademacher, it certainly made Housingmaps a much less tenuous arrangement (Davis, 10/4/2005). However, even with these changes, some were concerned about the long-term and the graphic design limitations of Google Maps (Erle, 4/7/2006;). In subsequent years, as Google and its advertising strategy came to dominate web map services, a significant number of the original geohackers turned to an open-data, grassroots alternative, Open Street Map. In 2010, one veteran geohacker told me that he had wanted Google to create the maps API, but now, in the face of Google's influence, he kind of wishes he could go back in time and ask them not to (Wherecamp, 2010). Even without some of those original geohackers, the Google geo discourse continued to grow by encouraging new geo software developers (soon referred to as neogeographers) and thereby growing the community at large.

Conclusions

The historical conditions that led to the Google geo discourse were not a systematic march of technological or cartographic improvement. The technologies and

knowledges that eventually converge as Google geo services and map mashups were subject to social processes and situated political projects. For example, hyperlocality and accessible aerial imagery converged not only in web mapping but also in Cold War ballistic missile strategy. This history offers several insights into the ways of seeing at work in today's Google geo discourse.

First, nation-state projects were consistently important in historical mapmaking and remain so today. State programs helped initiate early mapping projects at the local level and eventually a truth-telling visual logic for the existence of the nation-state (Buisseret, 1992; Thongchai, 1994; Wood, 2010). During war-time, nation-states were quick to utilize aerial photography and, during the Cold War, hyperlocal geodetic mapping with rocketry and satellite technologies for accurate ICBMs. The national security projects of the state remain important in the Google geo discourse, if in under-stated, little-known ways. U.S. intelligence provided the capital that kept Keyhole Inc. afloat and continues to use Google geo services for geovisualization purposes.

Second, several parts of this history indicate the importance of tinkering and playful, creative activity in producing new geographical technologies and ways of seeing. Early balloon and kite-based aerial photography was a practice of enthusiasts' experimentation. Keyhole's virtual globe was in part inspired by popular culture and programmed like a video game. Much like early aerial photographers, the geohacker community that promoted early map mashups was and is composed partly of enthusiasts experimenting with new, creative mapping ideas.

Third, from its beginnings in 2005, the Google geo discourse had an individualized consumer orientation. Google's move into mapping for the local search

and advertising market reflects the hyperlocal logic of its geo services. Likewise, though Housingmaps was not the first map hack, it and others of that time achieved a critical mass that opened dynamic, customizable map*making* to a very broad consumer sphere. In time, Google further lowered the bar of expertise required to mash-up maps with services such as My Maps (now My Places). The speed and dedication with which Google moved to incorporate this mapping into its capital accumulation strategy indicates the undercurrent of consumerist ideas behind the playful tinkering and early mashups. Housingmaps.com is, after all, a map of web-era classified ads.

Chapter Four: Seeing the World through Google's Eyes

The best things in life are free
but you can keep'em for the birds and bees;
now give me money, (that's what I want)
that's what I want (that's what I want)…

The remixed chords of Barratt Strong's R&B hit "Money"[38] resound off the folding walls of the Moscone convention center in downtown San Francisco. The convention is Google I/O,[39] a spectacle, networking event and product launchpad put on by Google to entice software developers to use Google' services and to tell them about changes and updates. As one of the 3,000 attendees (Perez, 2008), I'm at I/O to better understand how Google works by talking to Googlers and software developers/neogeographers who use Google services. At the conference, Google's masterful public relations are on full display in pronouncements of Google's benevolent mission to organize information, foster technological innovation, promote freedom on the internet and include independent software developers in on the action. For these software developers and Google's users, some of the best things in life on the internet are free of charge. Of course, Google is a publicly-traded company and a closer look reveals the same ultimate priority as Barratt Strong professes. It's not that the points made by Googlers at I/O are patently untrue, but rather that each neatly fits into Google's capital accumulation strategy.

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[38] Gordon, Berry and Janie Bradford. (1959). Money (That's What I Want) [recorded by Barratt Strong]. On *Let's Rock* (Single) Detroit, MI: Tamla.

[39] In industrial applications, I/O usually stands for input/output function. At the conference in 2010, a Google spokesperson stated that it stood for innovation/openness (Krazit, 5/19/2010).

This strategy is to become what Eric Schmidt calls "ubiquitous" (Schmidt, 7/7/2009). Google attempts to use that powerful market position to sell advertising, expand its advertising opportunities by growing the scope of the internet and by using the labor of people who are not on Google's payroll, known as crowdsourcing. Within this context, Google geo services can appear unprofitable and therefore contradictory at first glance. Googlers explain the purpose of the Google geo services without referring to revenue by citing the company's mission to "organize the world's information and make it universally accessible and useful" (Jones, 5/28/2008; Google Inc., 2011a). Materially however, the geo services are technological parts of Google's capital accumulation, which helps produce and reproduce the Google geo discourse. The structure and discursive character of these processes are apparent in the mapping that emerges out of this context.

Chapter roadmap

In this chapter, I examine how the strategy and material processes of Google's capital accumulation produce and delineate the mapping technologies and geographic ways of seeing at work in Google geo services. To do so, I first analyze Google through the surface-layer of the company's rhetoric and then through its deeper capital accumulation strategy of ubiquity in advertising, growing the internet and crowdsourcing. With this grounding, I move to examine the basis and ambitions of Google's geographic ubiquity. I follow Google as it acquires or elicits the production of geographic data, organizes that data, and visually presents the data for the purpose of hyperlocal consumer

mapping. Each step in the process helps illustrate the hand of Google's capital accumulation in its consumer techno-geographic ways of seeing and their limits.

The work of Herbert Marcuse, though pre-dating Google by several decades, begins to illuminate the processes by which Google's outwardly benevolent and impartial technologies shape the possibilities of its geo services. Marcuse writes of applied science that it "…rationally assumes the form of methodological construction; organization and handling of matter as the mere stuff of control, as instrumentality which lends itself to all purposes and ends…" (1964, 156). In actual practice, this apparent neutrality conceals an internal political *a priori* as technology is appropriated into the social programs of states and corporations that shape the science itself. "The technological *a priori* is a political *a priori* inasmuch as the transformation of nature involves that of man, and inasmuch the "man-made creations" issue from and re-enter a societal ensemble" (1964, 154). Even as science and technology are part of these programs, they retain the illusion of their neutrality, reinforcing their influence. In this way, social processes perpetuate and extend "not only through technology but *as* technology" (original italics, Marcuse 1964, 156-58).

Google geo services are visual geographic technologies that give the impression of technical impartiality and epistemological veracity even as the services are designed to suit Google's capital imperatives. These technologies materialize social, political processes such as Google's rhetoric and capital accumulation strategy.

In a similar vein, David Harvey writes that processes of social reproduction, most notably the material processes of capital accumulation of value, are key to people's understandings of space and time. Much like Marcuse's science and technology, these

socially-constructed definitions of space and time work "with the full force of objective facts" (Harvey, 1990, 418). Geographer Denis Cosgrove tethers landscapes to material social formations to show how geographic ways of seeing are multiple and socially produced. He describes how social relations in an emerging capitalist economy in Europe produced a landscape way of seeing. Through its visual and apparently objective qualities, it appeared to viewers as a real, truthful, mathematical and impartial view of the world. Powerful Venetians produced landscape as a way of seeing to address the imperatives of capitalist projects that apportioned and commodified land around Venice (Cosgrove, 1998). The means by which those Venetian nobles produced the landscape way of seeing were cutting edge Renaissance technologies such as geometry and surveying in conjunction with many laborers (Cosgrove, 1988). Cosgrove's landscapes are similar to Marcuse's view of technology in general in that the landscape technologies and therefore technologically-produced visions were limited from the outset by the relations of their production in that context.

Google's capital strategy and accumulation take the form of a technological *a priori* that is built into Google geo services and their ways of seeing. Consequently, Google's capital strategy and accumulation delimit and affect the Google geo discourse through the very technologies that constitute that discourse. Even as Google geo services appear an impartial mapping technology, they are necessarily shaped and limited by social and material conditions, including Google's rhetoric and capital strategy, which give the services purpose.

Google produces and uses geographic ways of seeing within its overall capital strategy through a sub-strategy I label the geography of ubiquity. Much as Google aims

to make Google Search ubiquitous on the internet, it is the ambition of Google's executives to make it possible through Google geo services to map anything for anyone who is located anywhere. Google uses this geographic strategy to accumulate and reinvest value and geographic information in ways that directly interface with its other information and mobile device services. These actions of its geographic ubiquity strategy help produce and reproduce the Google geo discourse as a consumer sphere and inherently shape what can and cannot be seen and done within that discourse.

Getting to know Google

A good place to begin to understand the context of Google is the way the company presents its purpose to the world. By the standards of publicly-traded companies, Google is quite successful at producing rhetoric to explain its purpose and actions in accessible ways. Google's rhetoric, such as its mission "to organize the worlds information…" was recognizable to almost everyone I spoke with, including people who don't work for Google (Google I/O, 2009; Where 2.0, 2010). Google employees and industry experts refer to this mentality as "googliness" (Battelle, 2005; Jarvis, 2009). It appeared to me throughout my research online, in the business literature, at industry conferences and in interviews at Google's headquarters (Wherecamp 5/22/2009; Google I/O, 2009; Allington, personal communication, 5/26/2008). Management gurus Joseph Pine and James Gilmore (1999) characterize this sort of internal (and external) rhetorical branding as a "script." Scripts are meant impart a cultural, discursive foundation for management and labor within a company as it undergoes inevitable shifts and changes. Scripts also provide a handy way for researchers to access the discourse within a

company and understand its cultural context, ambitions and tensions (Pine and Gilmore, 1999; Cheney et al. 2004; Ash and Thrift, 2004).

"Google's mission is to organize the world's information and make it universally accessible and useful" (Google Inc., 2011a). This mission statement and its unofficial motto, "don't be evil" exemplify Google's script. Google distributes this script widely in texts online, presentations, interviews and even legal filings (Google Inc., 2011a; Google Inc. 2011b; Gundotra, 5/28/2008; Schmidt, 11/13/2009; Allington, personal communication, 5/26/2008; Battelle, 2005). This outward engagement has the function of explaining the company's perspective on actions that people may find threatening or confusing. Why is Google providing such cutting-edge services for free? "Google's mission is to organize the world's information…" (Google Inc., 2011a). Should I be worried that they are collecting my personal information or becoming a monopoly? Google's unofficial motto is "don't be evil" (Google Inc., 2011b; Vaidhanathan, 2011).

What makes this script especially effective is that Google's script not a simple company line to tow when interacting with outsiders. Google employees and, tellingly, many of the neogeographers I spoke with, genuinely and positively believed in Google's mission and that it was making the world a better place (Battelle, 2005; Vise, 2005; Jarvis, 2009, Google Inc., 2011a; Google Inc., 2011c; Marks and Fox, 2/22/2008; Ratliff, 6/26/2007; Allington, personal communication, 5/26/2008; Marks, 5/22/2009; Pegg 5/28/2009; Coryat 5/27/2009; Barry Hunter, 5/27/2009; Where 2.0, 2010). They perceive Google's productive ordering and sharing of knowledge not just as neutral, but as a positive action because it allows users to make more informed decisions (Battelle, 2005; Jarvis, 2009; Marks, 5/22/2009). This ethical dimension to the mission is a descendant of

the geeky, hacker-informed idea that all "information wants to be free" (Brand, 1985). Furthermore, having something to believe in makes Google an attractive place to work (Pegg, 5/28/2009; Coombe, 4/2/2010; Golden, 5/28/2009; Marks, 5/22/2009). This is very important in Silicon Valley's cutthroat competition for top talent to engineer innovative technologies.

Taken on its own, Google's mission is powerful and alarming because it means that Google is a single, centralized information resource. It can define what does and does not qualify as real information by including something or not including it. To do so, Google pulls on the technological cloak of apparent neutrality by proclaiming itself a technologically innovative "engineering company" that constructs increasingly complex and ingenious algorithms for sorting and ranking information. This appearance of neutrality extends through Google's algorithms as they naturally and "organically" determine what is highly ranked in search results (Gundotra, 5/28/2008; Battelle, 2005; Garfield, 9/30/2011).

Google's capital accumulation

According its script, Google solves problems through a moral imperative to organize information and spur innovation. Profit is almost an afterthought. In fact, accumulating capital is at the very core of Google and its actions. Google's script is a way to explain the company's actions without getting into its complicated business practices. The company's strategy itself is what Google's executive chairman and former CEO, Eric Schmidt, refers to as an "economics of ubiquity" (Schmidt, 7/7/2009). In this section, I make clear how Google continues to make its ubiquity strategy profitable

through three processes that comprise and support its capital accumulation: Targeted advertising is Google's primary source of revenue. Growing the internet allows Google and its ubiquitous internet presence to grow. Crowdsourcing allows the company to accumulate capital by improving its services and innovating while paying very little for the labor. These three processes form the material basis for Google and the subsequent production of technological ways of seeing the world through its geo services.

An economics of ubiquity

Its rhetoric aside, Google's economic value should not be underestimated. Google collected $29.32 billion in revenue in 2010 through its strategy of achieving and maintaining "ubiquity" (Google Inc., 1/20/2011; Schmidt, 7/7/2009). As opposed to traditional media outlets and information vendors, this strategy centers on the networked nature of the internet and digital media's ability to create infinite flawless copies. Eric Schmidt argues that "internet distribution does not work if it is built on the economics of scarcity, [as traditional media does] but only works with ubiquity and abundance economics" (Cleland, 4/7/2009; Rowan, 6/30/2009).

His idea is to offer a useful internet service at no charge so that the service becomes a very popular, even standardized, way of doing things. Once that service is ubiquitous and essential to many people, the company that runs it will be able to find a way to make money from it. In addition, over time, the company must continue to innovate and improve that service lest another company surpass it. Google's internet search engine is emblematic of this approach. In a few short years, its search engine became the most popular on the internet even as Google's business plan took some time

to solidify (Vise and Malseed, 2005). Google continues to innovate and tweak its search engine as other companies improve their own competing services.

Ubiquity is not the same as profitability and connecting one to the other is not as straightforward as Schmidt makes it sound. In a previous job as Chief Technology Officer at Sun Microsystems, Schmidt used a focus on ubiquity to great effect in the mid-1990's, but the company still had a very rough time during the dot-com bust a few years later (Cnet News, 9/18/1996). In the current recession, Google has been successful in connecting ubiquity with continued, if slowing, growth through a single revenue stream (Google Inc., 1/20/2011).

Targeted advertising

That revenue stream is advertising. Between ninety-six and ninety-seven percent of Google's earned revenue comes from selling some form of advertising (Schmidt, 2009; Google Inc., 1/20/2011). The company uses the ubiquitous online presence of its free services to aim and serve highly-targeted advertisements to users. As media scholar Siva Vaidhyanathan (2011) points out, this means that Google's users and their actions online are in the unusual position of being Google's product, not its customers. Google's customers are the companies, organizations and people to whom Google sells advertising space.

The technological heart of this system is PageRank^{tm}, a secret, patented algorithm that drives Google's internet search engine to return relevant search results with targeted ads. Unlike traditional advertising, this strategy does not use broad demographic categories, Nielsen ratings or zip codes. It focuses on information about a user based on

his or her digital footprint to serve individually-tailored batches of ads, an unprecedented specificity in advertising. This individual focus may not include a user's name, but does include the user's IP addresses, search histories and browsing habits (Battelle, 2005; Vascellaro, 8/10/2010). In a further break from traditional advertising, advertisers only pay for ads that elicit a response from a user. Google charges the advertiser each time a user clicks on one of their ads, encouraging advertisers to create effective ads to more and more specific kinds of users. Most single user-clicks are worth only a few cents or less, but Google's ubiquity on the internet adds up to an extraordinary number of user-clicks (Battelle, 2005).

The specificity of Google's advertising allows it to take advantage of a very large number of very small, niche advertising markets. In the IT industry, this large number of small niches is referred to as "the long tail" (Battelle, 2005). The long tail illustrates a tension at the core of Google's capital accumulation that plugs directly into mapping. Google's services create a singular, standardized information platform for searching for information. However, to work effectively, Google must also narrow the focus to a user's interests and needs to serve ads that are relevant enough to the user that he or she will click on them. One innovative way to make ads relevant is to make them geographically specific, filling an advertising market niche centered on a particular place. Mapping allows for a general, standardized approach for understanding small, local places.

For example, when I enter a Google Maps search for "Chapel Hill hotel" the results include ads in the form of "related" text links above the search results (fig. 4.0). These ads may not only include ads for places to stay nearby but also restaurants or local

attractions. In this case, Google uses multiple types of contextual information about me to serve what it calculates to be the ads I am most likely to click on. This contextual information includes my Google search for "Chapel Hill hotel" my past search history and my internet browsing history.[40] Depending on the circumstances and the service in use, Google may also target ads based on the content of my Gmail account, my Google+ profile, information from photos on Picasa, videos on YouTube, blog posts on Blogger or my geographic location through the IP address on my computer or GPS/cell tower location of my smartphone (Battelle, 2005; Vascellaro, 8/10/2010).

Advertising and maps

When Google Maps and Google Earth launched in 2005, they did not include advertising. Google introduced ads later through 2005-2006 (Schutzberg, 3/31/2006). Today, the question of how to include advertising on maps remains a serious one for Google. How can Google maintain the look and trustworthiness of its geo services and still monetize them with advertising? As of this writing, Google places ads in Google Maps using same approach as its internet search results. In these results, advertisements, labeled as "sponsored links," are separate and may appear above, beside or below search results. Google refuses to serve paid advertisements as search results themselves (Battele, 2005; Vaidhyanathan, 2011). In Google Maps, the company usually seems to approach the map-image and the list of places on the left side of the map website as a form of search results by separating them from ads (fig. 4.0). Interestingly, judging from recent patent applications, Google may also be preparing to place ads directly within the images of its Street View service as virtual billboards (Zeman, 1/12/2010).

[40] Tracked through Google cookies and scripts embedded in Google-owned and third-party websites.

Neogeographers are concerned about how Google fits advertising into the geo services because it could change their geoweb applications. They fear a user experience degraded by "map clutter" in the form of ad placemarks or bubbles throughout the map image (On Privacy session at Wherecamp, 5/22/2009). The idea of placing ads on the map itself violated some neogeographers' sense of what a map should be and how it ought to look. For example, Schuyler Erle links this feeling directly to an epistemology and trust in maps: "Insofar as maps reflect our view of reality, putting indelible ads *on* a map is a far cry from putting some ads in a box on the side of a web page" (Erle, 4/7/2006).

Ironically, many geoweb apps already deploy advertising using Google, though usually not within the map itself. This is possible through Google's Ad Words advertising program in which the company acts as a middle-man by managing ads placed on third-party websites and paying the website owner part of the revenue that the ads generate. Many geo developers use Ad Words to monetize their geoweb apps. The ubiquity of Google's advertising, even on other people's websites, provides Google a huge stream of revenue. Nevertheless, to maintain growth, Google must also have new, green fields for advertising.

Growing the Internet

Google needs increasing amounts of information to organize and serve to users with its advertising. Not all information is on the internet and online information, while constantly growing in scale, isn't always growing in ways useful to Google. For example, much of the information uploaded on Facebook is not searchable by Google.

Consequently, Google finds itself in a bind. How can it grow when it can already serve most accessible information online to any user with highly targeted specificity? Google deals with this issue by making the internet larger and better connected to suit its own capital imperatives (Gundotra, 5/28/2008). A larger, more interlinked internet produces space for Google to expand into by creating more opportunities for Google's advertising. Growing the internet into your own image is no small ambition, and Google employs two methods to make it happen.

More content

Google's first method is to pull increasing amounts of information into its native medium of the internet, making Google search a richer resource. Google literally adds to the amount of information on the internet by fostering more use of its online services. To this end, Google creates or acquires platform services, such as Google Maps, Gmail, Google Books, Google Docs, Picasa, Blogger, YouTube and many others that host data online for free, but with advertising and/or data mining for targeting advertising. On their own, many of these services do not turn a profit, at least not at first. While it is better if a web service makes money, Google supports some unprofitable web services and continues to innovate to create new ones. Such services are a way to grow the total content of the internet and, via its ubiquitous online position, Google's capital accumulation (Gundotra, 5/28/2008).

Google geo services are part of this approach to growing the internet by adding a localized, geographic component in the form of a free, ubiquitous mapping. Originally, Google was interested in maps as a way to serve geographically localized web searches

with local classified-style advertising (Kane, 2005). With maps, Google extended the rationale of its internet search to geographic spaces using a multi-scalar hyperlocal way of seeing to organize localized, technical searches and advertising.

More places

Another way Google grows the internet by its own criteria is to make it easier to use Google wherever you happen to be. You can use Google Maps in unusual locations printed out on paper, on smartphones, tablet PCs, netbooks, full-blown laptops, GPS devices and built-in car navigation systems (Pegg, 3/7/2007). Google is even on working on a self-driving car (Thrun, 10/9/2010). Using these devices grows the internet and therein potential advertising in terms of the number of different places and situations in which someone can use Google's services.

Google geo services have been available to mobile device users from the time that Google entered the mobile device market. Unlike in-car GPS, using Google maps on a mobile device is not limited to driving, but also includes directions for pedestrians and mass transit. These maps on mobile devices open more opportunities for advertising. For example, in 2009, Google launched a program whereby businesses placed decals with square barcodes and a Google Maps **placemarks** on the businesses' front window (fig. 4.1). Passers-by could photograph the barcode with their smartphone and the phone would access a Google website listing reviews of the business, coupons and other information (Hayward and Kim, 12/7/2009).

Innovation

Creating ways to foster more content and locations and therein ways for Google to grow requires technological innovation. Google's executives are well aware that the company's continued growth depends on innovation and are willing to invest a great deal of value in developing new products or buying companies (and their ideas) for Google's portfolio. Google may be willing to invest tens of millions of dollars in a promising innovation before beginning to make a return (Hanke, 10/11/2007). Many of Google's competitors such as Microsoft, Apple and Facebook also require innovation to grow, further raising the stakes of being the company that actually delivers a new innovation to users.

The importance of innovation and the stakes of competition are most evident in Google's workforce. Among people I talked to in the field, there is a persistent belief that brilliant individuals or small groups have and will come up with groundbreaking technological ideas (Hanke, 3/31/2010a; Jones, 5/28/2008; Where 2.0, 2010). Google is constantly competing for top industry talent and working to keep them at Google through its famous amenities such as free food, laundry, massages, keynote speakers and much more. Google's architecture and organization structure these amenities and the work environment in ways to entice employees to stay at work. More time at work means that smart ideas are developed and shared at the company, becoming part of Google (Allington, personal communication, 5/26/2008). When non-employees create new, relevant technical innovations outside Google, the company often moves to acquire their company and the innovators in the process. When Google purchased Keyhole, most of Keyhole's employees and the board of directors assumed positions at Google. In another

example, Google hired Paul Rademacher, creator of the first Google map mashup, in part because that mashup was a brilliant idea and he might have more great ideas.

Crowdsourcing

As the case of Housingmaps made clear, Google's executives realize that the company cannot anticipate every possible use of it services, nor employ the staff required to personalize each service for each user. Instead of hiring paid employees to handle these massive tasks, Google gets users and independent software developers (including neogeographers) to contribute their labor. This strategy, known as crowdsourcing, brings people from outside a firm to add data, write reviews, moderate help forums and even build geoweb apps as 'productive consumers,' usually without formal compensation (Howe, 2008). When effective, it brings a whole new labor pool of participating subjects into a company's capital accumulation at almost no cost to the company. In fact, the term 'crowdsourcing' was originally coined as a pun on 'outsourcing' (Crampton, 2010).

Google crowdsources many aspects of its services including error-checking map data, feedback, writing product reviews, moderating help forums, using Google APIs and adding information to Google Docs, Google Spreadsheets, Blogger, YouTube and Picasa. Contributors participate for many reasons. Google's services may allow them to put their content online or create a map. In other cases, the positive, progressive feel of participating in Google's mission to share information helps justify this unpaid work, even as it directly benefits Google (Coryat, 5/27/2009; Hunter, 5/27/2009).

Google claims that the participation of contributors is a kind of democratic process because good data and innovations are adopted by other users, popularizing the

best ‘killer’ applications or best quality data. Despite the democratic rhetoric, most, and certainly the best geographic contributions to Google’s geo services are not made by average laymen users. The best self-made geographic data usually comes from dedicated enthusiast neogeographers. The best geoweb applications and mashups are from professional or semi-professional neogeographers who work as software developers. Such contributions are typically either part of a regular hobby or an entrepreneurial enterprise that uses Google’s services (Parsons, 3/31/2010; Coryat, 5/27/2009; Hunter, 5/27/2009; Pegg, 5/28/2009).

One clear example of multi-faceted crowdsourcing using Google Maps is KPBS’s 2007 wildfire map mashup. It is an example of both volunteered information and a mashup made by people outside Google. The mashup itself was made by the staff of KPBS, San Diego’s public radio station. Data for the map mashup came from phoned-in reports of wildfire locations by listeners. The wildfire mashup was clearly a beneficial service to local people fleeing wildfires and KPBS no doubt enjoyed higher listenership and web traffic. Google benefitted by allowing the station and listeners to invent and execute a new problem-solving application of its services with new data, as well as gaining a beautiful marketing example (Jones, 5/28/2008; Google Inc., 2010). In addition, the mashup, simply by functioning, used contributor’s labor to draw attention and web traffic to Google, generating ad revenue down the line at no additional cost to the company.

Crowdsourcing a community

Ever since the unsolicited successes of early map mashups like Paul Rademacher's housingmaps.com in 2005, Google has fostered a "community" of neogeographers who use its services, especially the Google Maps API (Fox, 5/22/2009; Coryat, 5/27/2009; Hunter, 5/27/2009). These neogeographers do three things that contribute to Google's overall capital accumulation. First, volunteer neogeographers help out the community and Google simply by participating. Often they answer technical questions on help-forums. Second, they build web applications and map mashups that use Google's services, such as the KPBS wildfire mashup, that increase Google's traffic. Third, neogeographers' projects serve as a sort of laboratory for new ideas and technological innovation that Google may choose to integrate into its core geo services (Charny, 3/7/2006).

Such an open model makes it easy for people with the right technical skills to participate, but it also means that Google must find ways to keep contributors using its services instead of competitors' services. To this end, Google helps organize and structure the community. For example, Google influences the market of mapmaking contracts with a Google qualified developer program for its geo services. The program certifies a certain degree of technical expertise and helps direct map-making business towards qualified neogeographers (Alami, 3/30/2010). Google also attracts new developers and strengthens ties with existing ones through contests on college campuses, exhibiting at conferences such as the AAG's national meeting and by holding its own developers conference, Google I/O. When I attended Google I/O 2009, several Googlers referred me to star members of the neogeographer community as potential interviewees.

John Coryat, one such star, moderates Google Maps help forums and creates technical fixes. Coryat's work with Google is unpaid. Instead it earns him status in the community which attracts some paying work. He also gets the appreciation of the Google Geo division, trips to Google developer events, previews of Google's new geo products, and a special, limited-edition Google sweatshirt with his name printed on it (Coryat, 5/27/2009).

As a whole, crowdsourcing plays an important part in Google's capital accumulation. Google capitalizes on the fruits of contributed labor, doing more work while adding little to its labor costs. Crowdsourced laborers, however, are also harder to control and easy to lose. As the remaining sections of this chapter will illustrate, Google structures the geo services and consequently ways of seeing to entice and retain both users and neogeographers.

The geography of ubiquity

Google aims to accrue value and information as a ubiquitous resource and Google's geo services are a geographic component of that overall project. I apply the term "geography of ubiquity" to signify Google's strategy with its geo services and as a way to conceptualize that strategy and related actions that help constitute the Google geo discourse. I use the term "ubiquity" because this geographic strategy is part of Eric Schmidt's economics of ubiquity (7/7/2009). Moreover, Google's geographic strategy also reflects an approach to networked information technology known as ubiquitous computing. This approach to socially engineering information technology attempts to make it so common and understated that it "disappears" into everyday life (Weiser,

1991). The idea of ubiquitous computing is to distribute wirelessly networked mini-processors to so many everyday objects that people no longer need centralized computing in PCs, laptops or even smartphones. Ideally, such devices would be as common, ordinary and disposable as paper is today. Drawing on Weiser, Gartner et al. (2007) describe the proliferation of consumer-grade web mapping technologies as a kind of "ubiquitous cartography." My own usage of Google's geography of ubiquity includes both the technologies of Gartner et al.'s ubiquitous cartography and the capital accumulation that shapes those technologies and the surrounding discourse.

Google's geography of ubiquity puts the company's general targeted advertising, growth of the internet and crowdsourcing into a geographic context. It is a strategy and ambition to be ubiquitous in three dimensions: to map anything, for anyone anywhere they are. First, it aims to map all geographic data and crowdsourced geographically-tagged data, anywhere in the world, as continuously as possible. This idea is clear not only in the company's mission statement, but also its drive to grow the amount of content on the web. Second, it aspires to make this geographical imagination available to anyone and everyone in the world, crossing "all borders," though that is currently limited to internet-connected computers and similar technologies (Google Inc., 2011c). Naturally, Google wants as many users clicking on ads as possible. Third, it intends to make Google's geographical imagination available not just "at your desk," but anywhere, through the use of wireless internet connections and mobile devices (Google Inc., 2011b). Examples include Google's investments in mobile devices and its Android mobile device operating system. More accessibility means more use of Google and more targeted ads.

The partial success of this strategy is apparent in Google geo services' hundreds of millions of users around the globe and the ways that other mapmakers mimic Google's cartographic design (Jones, 5/28/2008; Wallace, 2009). There are obvious technical and social limitations to the idea of geographic ubiquity, but by the rationale of Google's all-encompassing mission, these limits reinforce Google's prerogative to organize as much geographic information as possible. More fundamentally, these limits do not constrain capital's demands for growth.

The means and limits of the geography of ubiquity in part stem from the visual, technological linage described in Chapter Three. Mapping anything on a device anywhere on earth utilizes a hyperlocal logic that very local things can be plotted within a totalized global mapping system. Google reinforces this idea by providing visually continuous aerial imagery giving an impression that no place on Earth is unmapped. In this second half of the chapter, I go into greater depth as I illustrate how Google's capital accumulation, through its strategy of geographic ubiquity, produces and delimits consumer geographic ways of seeing with Google geo services.

Mapping for consumption

Google acquires, organizes and presents geographic information to facilitate consumptive mapping. Each step along this production processes contributes to individualized, consumer-oriented mapping and therein related advertising. Google's strategy of offering maps to users for free with advertising necessitates procuring geographic data as cheaply as possible. This approach creates problems with geographic data vendors, leading Google to turn to alternative resources for data such as government

agencies and crowdsourcing. Once it has the data in hand, Google structures its services to keep users coming back by making its services a regularly accessible resource for trustworthy and disposable maps. For the users, this all adds up to geo services that are thematically and structurally best suited for consumer applications.

Procuring geographic data

Digital geographic data is the spatial information presented by Google's geo services. It includes roads, transit stops, rivers, parks, landmarks, political boundaries, buildings, other points of interest, satellite imagery, elevation and the locations of search results. Technically speaking, most of this data is geographically structured "GIS" data created by a wide variety of government agencies and companies. As digital data, it is subject to intellectual property laws, though most government geographic data in the U.S. is in the public domain.

Unlike its internet search engine, Google itself supplies much of the underlying geographic data in its geo services. Procuring that geographic data in local detail around the world is expensive, and Google offers it to its users for free. Since this cost to users is non-negotiable in Google's drive for ubiquity, the company tries to procure data cheaply through sources such as public domain government data and crowdsourcing. This approach to geographic information shapes what geographic information is visible through Google's services, further indicates Google geo's close relationship with the state, and shows how it entices users to become something more by contributing their labor to the cause of mapping the world for Google.

Data vendors

Google does not own all the geographic data presented in Google geo services. The company licenses some data, such as some roads and imagery, from data vendors who collect, organize and license geographic data. For example, when Google Maps launched, it used licensed Navteq road data in the United States.[41] However, licensing data for Google geo services is an unstable arrangement for both parties due to their differing business models. Data vendors charge for geographic data, and Google, by offering use of geographic data for free, undercuts vendors' retail prices at a rate that they cannot match with their current business model. Why would users pay anything for Navteq's GPS navigation data when they can get it for free from Google? For its part, Google follows Eric Schmidt's strategy of ubiquity, not scarcity, as the economics of the internet (Cleland, 4/7/2009; Rowan, 6/30/2009). The value for Google isn't in the data itself, but in its use online and related advertising. Licensing data from vendors is expensive for Google. When it can obtain other, similar data at little or no cost, licensing from Navteq or a similar company is difficult to justify. Furthermore, licensing data, as opposed to owning it outright, complicates Google's ability to support third-party geoweb apps because the terms of the licensing contract can limit the use of the data by third parties.

Government data

In a turn away from data vendors, Google increasingly relies on governments. Government data is usually funded through taxes and it is often in the public domain,

[41] Navteq collects road data by driving roads and collecting GPS points and road attribute data.

making it a ripe, cheap source for Google. Google uses data from the many local governments, the U.S. census, the United States Geological Survey (USGS), the U.S. Forest Service and the U.S. Dept. of Agriculture (Lookingbill, 10/7/2009; Where 2.0, 2010). Despite its consumer orientation, Google's extensive use of government data further illustrates continued ties to the state.

Google urges local, state and national governments to share their geographic data with the company. Frequently, municipal geographic data in the U.S. is in the public domain, but local GIS offices are not used to sharing it all at once (Jones, 5/28/2009; Fee 10/7/2009). For example, I worked at a central Pennsylvania county GIS office in 2002. The head of that office once told me that he did not want to make local-taxpayer-funded county GIS data publically accessible en mass precisely because he did not want a marketing or advertising firm to come in and copy it all. Discussions on GIS forums and conversations at conferences lead me to believe that Google will sweeten the deal for local GIS departments by offering free licenses to Google's professional-grade Google Earth software (Fee, 10/7/2009; Shaw, 7/13/2010; Geoweb, 2010). GIS bloggers point out that Google's use of government data presents a political problem if Google is granted preferential treatment or access to taxpayer-funded geographic data.

On a broader scale, Google also partners with government agencies and other companies to acquire data. For example, Google has a partnership with the company GeoEye for exclusive rights to civilian-grade data from the GeoEye aerial imagery satellite launched in 2008. This $502 million remote-sensing satellite even has Google's name on its side (Siegler, 8/29/2008). In fact, that GeoEye satellite venture is also closely tied with the U.S. intelligence. The National Geospatial-Intelligence Agency

(NGA) paid $237 million into this satellite program (Brinton, 2/9/2009; Siegler, 8/29/2008). Nevertheless, even with these sorts of government partnerships, Google still needs more geographic data to grow.

Creating data

In pursuit of its strategy of geographic ubiquity, Google collects some of its own geographic data. This is most evident in Street View, Google's street-level 360º panoramic photo service. Street View had several small, city-scale precursors, but it is the first such service to include the entire United States and other countries, including some rural areas (MIT Media Lab Speech Interface Group. 1/1981; Mohl, 1982; Super High Street, 2006; Linden, 6/29/2005; Hanke et al. 8/27/2009). The result is a new kind of systematized geographic data. To assemble it, Google hires contractors drive roads in special cars to directly collect the data (Far, 2009; Hanke, et al. 8/27/2009). Google is willing to invest the significant capital that such a data-gathering operation requires for several reasons.

First, Street View augments aerial imagery with a photographic perspective more familiar to most users but previously unavailable in a digital, networked format. More and familiar perspectives help fit the concept of geographic ubiquity with photo-geographic comprehensiveness. Street-level photography of one or several major cities is not geographic ubiquity, and Google wants users to be able to see any street address with the service (Hanke, et al. 8/27/2009). Despite the claims, Street View does not include every road in the United States (Pabst, 5/31/2008).

A secondary reason for Google's investment in Street View data collection is that Street View cars collect much more data than just panoramic photographs. The cars collect location and road data with GPS, 3D shapes of roadside buildings with LIDAR[42] and information on local and home wireless networks (Taylor, 7/20/2009; Hansen, 7/21/2010). By driving Street View cars on major roads throughout the United States, Google assembled its own national road dataset to rival Navteq and other data vendors. Combined with governmental sources, this data allowed Google to stop licensing expensive U.S. road data from GIS data vendors entirely. The problem with the current government/Street View data amalgam is that it is unevenly accurate and quite old in some places (Fee, 10/7/2009; 10/26/2009; Batty, 10/13/2009; Miller, 7/28/2010). Google turns to another business tactic, crowdsourcing, to help fix these issues and add yet more data and content.

Crowdsourcing geographic data

Crowdsourcing allows Google to create, vet and fix data at a very low cost by externalizing the labor costs to those who contribute to a given crowdsourcing program. Google crowdsources geography data in three inter-related ways: geotagging, error-fixing and data creation. The volume and type of labor performed by contributors in these fields are so large that Google might not be able to perform it alone, even with additional employees. Even when you set aside geotagging, Google saw 500 million crowdsourced edits to its geographic data in 2009 (Jones, 3/31/2010). Unlike external mashups and web

[42] Similar to radar, LIDAR (Light Detection and Ranging) uses invisible lasers to construct 3 dimensional models of solid surfaces.

applications, these kinds of data-oriented crowdsourcing work directly for Google on its core service data and are hosted directly on its servers.

In theory, crowdsourced geographic information allows local people to more directly participate in mapping. Ideally, the information served to users by Google's geo services reflects local knowledges and priorities. Google spokespeople like to compare crowdsourcing in geo services to democracy, downplaying its dramatic cost-savings for the company. Google spokesman Michael T. Jones calls it "Mapping of the people, by the people, for the people**"** (Jones, 10/12/2009). In GIS fields, researchers of volunteered geographic information (VGI) argue that "This is putting mapping where it should be, which is the hands of local people who know an area well" (Goodchild, quoted in Helft, 11/16/2009; Goodchild 2007). While scholarly questions about the accuracy and technology of VGI abound, the purpose here is to investigate how Google's geographic crowdsourcing for business purposes impacts geographic ways of seeing through Google's geo services (Flanagin and Metzger, 2008; Elwood, 2010).

Geotagging

The most basic type of geographic crowdsourcing is linking content posted by internet users to Google geo services. Geo "tags" act as cartographic keywords or search terms by placing hyperlinks to websites or photos on particular locations on the map. Crowdsourcing contributors place these links in Google maps by "tagging" the destination with a geographic reference, such as a street address or GPS coordinates. Geotagging is less centrally structured than GIS datasets because it based on the internet technology of hyperlinking disparate objects. This quality of geotagging makes it very

easy for everyday users to begin participating in crowdsourcing. A low bar of entry encourages more people to participate, meaning more people's geo-located content is up and searchable on the web.

From Google's perspective, geotagging directly caters to the company's technological strength, internet search based on links, and its business of advertising. Furthermore, more geotags not only grow the internet, but also provide geographic information from the perspective of actual individual people through the map. For the contributors, they have the satisfaction of having their information up and locatable on the web.

Fixing geographic data

In a step beyond geotagging, Google also crowdsources error detection and correction of its street data. This kind of crowdsourcing works directly on geographic data as it is traditionally defined in the geospatial industry (Goodchild, 2007). In it, Google encourages people to point out and correct errors in geographic data, such as the location of street addresses, road connections, names and similar attributes (Fee, 10/26/2009; Batty, 11/5/2009). The dream, in the words of Michael T. Jones, is "If tomorrow every Web user in the USA took one minute to look at their neighborhood or workplace on Google Maps and make any necessary corrections, every Internet user would then have access to an up-to-the-minute national map for the first time in world history" (Jones, 10/12/2009). Google doesn't actually expect every web user to make corrections, but with a large enough pool of potentially-contributing users, enough corrections will be filed to sufficiently improve the dataset as whole (Jarvis, 2009).

Similar to geotagging, there is an emphasis here on localized geographic knowledges of individual people. The idea that they know the truth on the ground better than a data vendor with standardized, systematic geographic data is an indication of Google's intended users. It wants to provide information to match what other people like a given user have encountered at that location.

Building geographic data

Google's most complex geographic crowdsourcing initiative creates whole basemaps of streets and similar data. In some cases, geographic data, especially street data, can be difficult to come by due to expense, government restrictions or the absence of digital geographic data for an area. In such cases, Google uses crowdsourcing to create the geographic data piece by piece through a program called Google Map Maker. Google created this program by emulating the data-production of Open Street Map (OSM), an open-source, open-standards mapping service which is community-built by users, much like Wikipedia. Geohackers built OSM, a worldwide map service, street by street, using their own open-source system architecture and grassroots organizing. Google Map Maker also assembles basemaps street by street, but within Google's proprietary geo services. Google's program works through contributors who trace roads and other features on aerial photographs. Each addition or edit that an individual contributor makes is logged and moderated by other contributors and Google employees (Boulton, 2010). The quality of edits is ranked by the community, advancing the best and most prolific contributors to the top of the heap in a playful competition (Alami, 3/30/2010; Parsons, 3/31/2010). The productivity, game dynamics and friendly

competition of this community help attract new contributors and keep existing contributors involved.

The ideal Map Maker contributor is a local resident who knows the names of the streets and other features they trace. In practice, many contributors to the program are part of national diasporas located in other countries. These people know the local names of streets and places and have the computers and internet connections that allow the Google Map Maker program to work. For example, one of the most prolific contributors is a Pakistani man in Glasgow. He single-handedly traced most of the roads in his original home city of Lahore and many others elsewhere in Pakistan (Parsons, 3/31/2010; Helft11/16/2009).

Google Map Maker is a natural extension of the on-the-ground, first-person logic of geotagging and editing. Not only is crowdsourcing the production of basemaps very cheap compared to professional ground-truthing teams, the very production of data is by people who Google assumes to have a similar perspective and knowledge of a place as the users. In addition, the program is thought of as somewhat playful or a game, reinforcing contributors participation beyond the satisfaction of having helped assemble the map.

Structuring data for consumption

Once Google has geographic data, the company organizes it for viewing in its geo services to fit the drive for consumer ubiquity and thus capital accumulation. Google provides free access to what appears to be global coverage, but requires users to use Google services to access it. These services are networked and digital, making maps

cheap and disposable, and therein more accessible and consumer-oriented. Google reinforces the accessibility and centrality of their own geo services by attempting to set industry standards to fit their own services. Finally, Google organizes geographically-relevant data in terms of "place pages" and "placeranks," which serve its local search business of locally-targeted advertising.

Available only through Google

Google makes data available for free to prompt more people to use the service more often. For example, Google's inclusion of aerial imagery from an early stage helped attract new users and drove its competitors to offer it as well. However, Google prevents people from using its geographic data outside of its own services. Imagery data in Google Maps cannot be systematically downloaded for outside use. In 2005, Google forced a software developer to take down his web application that described how to download data and make it into a computer desktop image (Pegg, 6/9/2005). For those who contribute data these rules mean that data given to Google is subsequently only available through Google's services and cannot be extracted out again. Several people I talked to compared sharing your municipal or self-generated data with Google to putting that data down a "black hole" (Where 2.0 2010; Wherecamp, 2010). Geographic data goes into Google but it never comes out in a controllable form. Google's strategy is to make their services so ubiquitous that an ideal user wouldn't need any other sort of access to geographic data. You can make a map of anything, as long you do it through Google.

Cartographic sugar packets

Maps made with Google geo services, especially those used for navigation, are often single-use. Even if you print a Google map, disposing of one does not amount to much and you always have the option of going back to get another. This practice and concept of a map is very different from commercial paper maps that cost something to obtain and are worth holding on to, sometimes even irrationally. I still find it difficult to throw away tattered old AAA roadmaps but I regularly throw away printed Google maps of driving-directions. This cartographic equivalent to a single-serving sugar packet is possible through the way Google makes mapping so cheap, accessible and customized for the user. Individually-customized, single-route maps are not versatile or useful for your friends. Even if your friends could use your Google map with directions, they probably wouldn't need to because they could easily procure their own directly from Google.

Standardized mapping

As a centralized resource for mapping, Google standardizes geographic data in its services before individually customizing it. As with any standardization, especially one global in scope, those standards may not fit local knowledges very well. For example, Google Maps uses the Mercator projection. It is square, common and lends itself to navigation in long strait lines on the curvature of the earth, such as crossing oceans. This projection is terrible for learning global or regional geography, thematic mapping or mapping near the poles (Schulten, 2001; Crampton, 2010). As for Google geo services, it's not that many people use Google Maps for navigating long ocean-going voyages. Instead, Google and many other map services use the Mercator projection because it is a

convenient square shape that works well at local scales in most places and because the projection is already conventional in the young world of online mapping (Where 2.0, 2010). All other forms of mapping must be able to conform to this shape or they literally won't fit into Google Maps.

Another way that Google standardizes geographic information is the .kml data format. Google Earth is built around a data file format called .kml (Keyhole Markup Language). As geographic data formats go, .kml is simple, versatile and viewable in the popular, free Google Earth program. It does not require an obscure, expensive, professional GIS suite. Unlike most other GIS data formats, .kml files can contain a variety of data models including vector-line graphics or raster data such as digital photographs. All together, these qualities make .kml files easy to share, but so simple that they are difficult to work with in an analytical GIS context. Thus, .kml files are ideal for casual, non-expert users who want to create and share geographic information, but unsuitable for more professional GIS purposes, a clear reflection of Google's prioritization of non-expert users.

Placeranking placepages

Ultimately, Google's plan for monetizing Google geo services goes much farther than .kmls, disposable maps and adding advertisements to the margins of the website. Google continues to deploy their expertise for the same reason that Google originally got into mapping; an effective local geographic search with small business advertising. Google's approach is to reorganize and centralize geographic information so that any place may be searched for and rank-ordered by Google's search engine. Googlers refer

to this concept as a location's "placerank" (Hanke, 3/31/2010b). The ranking criteria could include aerial and street-level photos, street map data, mailing addresses, government population data, building plans, demographic marketing data and other data types (Slawski, 6/28/2007). Theoretically, anywhere on Earth could be ranked by these criteria and mixed with personal user data to provide an individualized ranking of places. For example, when searching for coffee shops, if you always click on Peet's Coffee locations and not Starbucks, eventually the placeranking would no longer display Starbucks locations to you (Parsons,3/31/2010).

Better local search and advertising through the concept of placeranking is apparent in what Google calls "place pages." These pages are a sort of hyperlinked, multimedia directory listing that includes all of the information of a phonebook listing and photographs, maps, user reviews and other links (Ron, 9/24/2009). Though any kind of place can have a place page, the format caters to the kinds of places that offer Google the greatest return in local advertising revenue, small businesses (Jones, 3/31/2010). It is not difficult to imagine how important ranking in a competitive local market could become to a small business. Even small changes to a place page or tweaks to Google's search algorithm could dramatically affect a business's rank in search results (Zook and Graham, 2007). The top search results are the ones users pay attention to.

Global maps for everyday consumers

To begin to understand the user experience, search for "Chapel Hill, NC" in Google Maps and look at the result (fig. 4.2). Google Maps' graphic design borrows Google's general minimalist design palette of very simple controls and childlike solid

primary and secondary colors atop an almost featureless white background. At first, Google Maps shows only basic, navigation-oriented features centered on Chapel Hill. To see more, you can zoom in and out as well as move the view extent in any compass direction as far as you like. Failing that, there are other visualization options, such as satellite photos, elevation, traffic and street-level photography. The satellite photos and roads in particular appear to continue on and on along any compass heading. If you can't find what you're looking for, there is always Google's heavy artillery, the search bar hanging over the map. The proposition is that ultimately no geography is missing because everything you can see is there somewhere, sitting atop the white background, organized in simple, friendly graphic design, ranked according to your individual demands.

Google technologically and cartographically designs its geo services to fit the imperatives and thus limitations of its capital strategy. Unsurprisingly, Google geo services and the geography of ubiquity are not in actuality for mapping anything, anywhere by anyone. Google geo services constitute a consumer-oriented way of seeing. To this end, Google utilizes hyperlocality and accessible aerial imagery in consumer-driven mapping. Employing these ways of seeing as part of Google's user/consumer-based capital accumulation technologically produces characteristics such as a local bias and a need to appear geographically authoritative. These characteristics affect the discourse, attributing a great authority in defining what is "there" and the power of influencing geographically-informed consumer choices. For example, look closer at Google Maps' Chapel Hill and the limits of this view become clearer. Depending on the

search, advertisements for businesses near Chapel Hill may appear. Mapped themes don't include Chapel Hill's north side gentrification or homelessness.

Keeping it real

One visualization strategy in Google geo services is to make the global patchwork of geographic data visually consistent enough for users to perceive it as a mirror-image of the "real" world. Google geo services, much like Google internet searches, provide a feel of a complete coverage. The geographic view gives the impression that everything is there and nothing is missing. Accessible aerial imagery and Street View panoramas are especially important in this regard because of the immense epistemological authority of photographs. Such images present an apparently objective, truthful visual perspective (Crary, 1989; Kirsch, 1997; Cosgrove, 2001). Unlike Google's roadmaps, photographs theoretically picture everything that is there. Google Maps does not show patches of missing photos or provide much metadata about the geographic data it presents. Instead, using a multi-scalar hyperlocal logic, the view seems to go everywhere, including a continuous graphic zoom in and out of Street View panoramic photos from a cartographic perspective. What this conceals are the complex social processes by which Google's capital strategy shapes what data Google displays, how Google acquires that data and how Google organizes it. Digital geographic data is inherently technological and thus plays a material role in producing and limiting the geo discourse. What this accomplishes is a geo service that appears comprehensive, but that is structured for supplying information for consumption and advertisements pertaining to that

consumption. Consequently, what may appear to the user as neutral, technological data about the world is the product of social and capitalistic processes.

Implicit in Google's concept of ubiquitous coverage is a tie to an empirical reality. Googlers I talked to adamantly opposed the idea of making Google Earth into a virtual world populated by avatars akin to Stephenson's Metaverse, Second Life or the World of Warcraft (Stephenson 1992; Coombe, 4/2/2010). To them, avatars and virtual worlds were "fake," and the purpose of Google Earth was to be as "real" as possible (Coombe, 4/2/2010; Rademacher, 4/2/2010). Debates in Google's geo division were not whether to add virtual objects but how to most faithfully represent the "real world" (Coombe, 4/2/2010; Bailly, 4/2/2010). These questions include whether to tint aerial photos to make them match their surrounding images or whether faces ought to be blurred in Street View. One Googler I spoke with strongly opposed blurring faces because he wanted to see who was there on the street and what they were wearing. He said that seeing the people allows him to identify cool neighborhoods (Coombe, 4/2/2010). To him, mapping people on the street is part of mapping the reality of a place.

Hyperlocal Consumers

Building on the idealized mirror-image look of Google geo services, a second characteristic of Google geo services is their local bias. The geo services can be zoomed out to a global scale, but most uses of the geo services are very localized. Even the small scale national or global[43] map mashups I look at often have local specificity down to a

[43] In cartography, geographic scale is calculated as a ratio, such as 1inch on the map equals 24,000 inches on the ground (1:24,000). Confusingly, "large" scale maps cover small, local areas, because they have a large ratio and "small" scale maps cover huge areas, such as whole nations or continents at a small ratio such as 1:5,000,000.

street address. This local bias is a reflection of the tension at the core of Google's capital accumulation, a standardized search of the entire internet that returns targeted results and ads. Google's hyperlocal way of seeing serves to represent a global scope yet serve local results to individual users. Global and national views in Google Maps and Google Earth are important for establishing context, especially as users zoom in to the local scale, but this function is secondary in most consumer applications. In this way, the hyperlocal way of seeing facilitates Google's capital accumulation, including its contradictions, in mapping.

Conclusions

Ways of seeing are the product of social, material contexts and processes. In this case, Google's capital strategy and accumulation take the form of a technology, geo services, through which subjects see the world in particular ways.

Google claims a very broad mapping imperative through a strategy of geographic ubiquity. This geographic strategy is a product of the company's script, strategy and capital accumulation. As a socially-shaped technology, Google geo services are not as impartial and ubiquitous as Google implies. The geographic ways of seeing that they technologically facilitate are limited by the very capital processes that produce them. The concept of neutrally mapping anything from anywhere by anyone makes for good rhetoric, but the very "ubiquity" of Google's capital strategy takes the form of a consumer mapping, which is not meant for everyone or everything. When these ideas are put into practice, Google's methods of procuring, structuring and offering data to users for consumer applications shapes the users' ways of seeing in noteworthy ways.

Google provides visually engaging geographic visions with little commitment and at a low price, allowing it to build huge non-expert user-base. The maps are digital and disposable, meaning a user can create as many customized maps as they like. Google draws in users through accessible graphics and photography with broad coverage and sweeping, immersive spectacles that zoom down to very local specificity. Enticing and accessible to consumers, the geo services generate advertising revenue and expand Google's overall scope by serving geographic information.

The geo services' low price also challenges Google to procure data as cheaply as possible. By focusing on cheap data for consumers, users pay for data through advertising targeted at them and taxes to fund government geographic data. Google also takes advantage of the services' power and playfulness to get users to contribute information and labor, crowdsourcing some of the work of creating and adding more data.

Within the maps, hyperlocal visions for users display a bias towards local-scale mapping. While zooming to a world-scale is a helpful context, most uses of the geo services are locally-scaled. This local bias is apparent in the lengths that Google will go to procure large volumes of cheap, local-scale geographic data for its geo services. The prioritization of local scales is also apparent in it the services' chief practical use, user navigation. Google Maps' driving directions, the internal structure of placeranking and place pages, the primacy of road and imagery data, and even the Mercator projection all serve individual consumer navigation applications and therein local, targeted advertising very well.

The socially-shaped technologies of Google geo services have social geographic effects. Google's strategy is one of geographic ubiquity, but it is as limited in practice as Google's overall mission organize the world's information. The features and biases of the geo services are reproduced not only for Google, but also in its hundreds of millions of users. The cartographic visions and actions of these subjects are affected and limited by Google, but as the next chapter makes clear, there is more to their subject positions than Google's technologies and capital accumulation.

Chapter Five: Google, Ergo Sum: The Subjects and Knowledges of the Google Geo Discourse

> "Technological strategies create a framework of activity, a field of play, but they do not determine every move… The "weaker players," those whose lives or work are structured by the technical mediations selected by management, are constantly solicited to operate in this range of unpredictable effects."
>
> -Feenberg (2002, 86-87)

Google geo services reach hundreds of millions of people (Jones, 3/31/2010), but not all these people have equal standing. The Google geo discourse includes different kinds of subject positions in its ways of seeing and mapping. Through these subjects, geographic ways of seeing extend throughout the discourse beyond the Google corporation. People who utilize Google's services and users who apply Google Maps in their everyday lives are more than cogs in the company's capital accumulation strategy. These subjects produce themselves and others as consumer mapping subjects with the Google geo discourse's geographical imagination. For these subjects, Google geo services serve as a way of knowing the world and through that, realizing their own positions, actions, and desires. "Google, ergo sum" (Bartholl, 1/29/2010).

This chapter examines three of those subject positions and related ways of seeing in depth. First are Googlers, subjects who are formal employees of Google. Second are neogeographers, those who work to make and edit maps and data using Google geo services, including geoweb applications. Third are users, subjects who use Google geo services, but not to create original data or remix data to create new kinds of maps for

others. Examining the differences between and knowledges of these subject positions reveals three important points about the nature, limits, and possibilities of the Google geo discourse.

First, as we saw in Chapter Four, Google exercises a great deal influence in defining the consumer basis and limits of the discourse. Its growth strategy of ubiquity on the web is an effective one for making consumer, advertising-oriented geographic information accessible and easy to use. To this end, Google effectively limits what subjects can do and see within the discourse to serve its advertising, consumer-based business strategy. Nevertheless, that ubiquity does not afford Google total control of the discourse. Neogeographers and users employ Google geo services to the extent that those services serve their own purposes, regardless of whether doing so serves Google. To an extent, Google encourages these actions because they constitute both technical innovation and make for greater use of its services. By leaving this frontier of innovation open, Google can at times reincorporate the creativity and actions of neogeographers into its capital accumulation.

Second, the geographic ways of seeing produced in this discourse hold several common themes. One key theme is the temporary nature of these maps and geoweb apps. As a technology 'on the cloud' Google changes its services with regular updates. In addition, many map mashups are proof-of concept experiments that stay online and functional for only a few days or months. Other, more developed geoweb apps may have a brief period of popularity, only to be forgotten when the next internet fad comes along. Another key theme is play, both as a geographic practice and a substantive theme in geoweb apps. Play serves as a way to interest neogeographers, attract users and keep

them all coming back. A yet another key theme is that of an individualized, hyperlocal geographic focus. Working across scales allows users to see geographies of their own personal lives and allows Google to tailor individually geographically-targeted batches of advertisements. Using the geo services' hyperlocal tools, users can know where they are anywhere in the world. For some, this kind of geographic specificity allows them to technologically optimize their personal geographic practices.

Third, these consumer characteristics and the existence of several subject positions indicate something larger. As a critical geographer, it is tempting to look for the possibility that Google geo services offer the realization of the dream of a democratic, participatory mapping. However, as a discourse built around advertising and that is focused on consumer applications such as play, this discourse does not realize that dream, nor is it meant to. Google geo services may at times be utilized in amazing, progressive, and participatory ways, but to apply a democratic framework to the discourse as a whole misses the point. Google geo services serve the company and individually-focused consumer users in the ways they are designed to. In the previous chapter, we saw how Google's capital accumulation strategy shapes and limits its geo services and geographic visions to fit that strategy. In this chapter, the full effects of that strategy on participating subjects become clear in a mapping discourse built for targeted advertising to consumers more so than citizenship.

Chapter roadmap

This chapter is organized around the subject positions and knowledges of Googlers, neogeographers and users. It begins with an explanation of the concept of a

subject, that concept in cartography and Feenberg's theory of technology, and a detailed introduction of the three subject positions examined in this chapter. The rest of the chapter breaks down the three subject positions. Googlers hold a powerful position in the discourse to make technological and cartographic decisions that are difficult for those in the other subject positions to change. Neogeographers are not formal employees, but they do create data, make geoweb applications, and maintain a network for sharing technical solutions and experiences. Neogeographers' mapping is subject to discursive limits due to both Google's formal terms of service and a neogeographer's reasons for mapping. As a result, their mapping has some common characteristics. These limits and characteristics also undercut claims within the Google geo discourse that it is democratic. Finally, users are those who utilize Google's geo services in basic ways and are thus individually targeted for advertising by Google. For Google's strategy to work, users must be able to trust and interpret the geographic information Google supplies. Much like the cartographic work of the neogeographers, their experiences are closely associated with play and geographic efficiency. Finally, for users, the existence of the services comes at the price of their geographic privacy.

Plotting subject positions

In his book *Foucault*, Deleuze describes a subject as an external "relation to oneself" in material and discursive relationships with the exterior world (Deleuze, 1988, 104). People become subjects based on relations with other people and things within a given discourse (Foucault, 1995). They perceive the world through a context of historical circumstances which influence not only how they see and interact with others and the

world, but also how they perceive and act as themselves. Multiple similar subjective perceptions and actions defined by those external relationships may be common, identifiable subject positions. As discussed in Chapter Two, Cosgrove describes how landscape became a way of seeing in the Italian Renaissance through visual geographic technologies, painting and early capitalistic land tenure. Through these social and environmental processes, elites became viewing subjects in a visually-empowered subject position (Cosgrove, 1988; 1998). As viewing subjects, they are part of material and social relationships as they use particular visual knowledges that come with limits and possibilities. In the context of mapping, Pickles notes the importance of recognizing different subject positions, for differing subjects can open contrasting future geographic possibilities (2003).

While the framework of three subject positions presented in this chapter is useful for understanding the Google geo discourse, it also comes with drawbacks. Adopting concepts and terms from the discourse such as "Googler," "neogeographer," and "user" and applying them to subject positions runs the risk of reproducing the structural biases, limitations and possibilities of these concepts. Furthermore, even among the most dedicated mapmakers, geographic technologies are not an entire way of life or separate from other social processes. Feenberg describes how technology structures the environments of subjects' daily lives. However, there is always more to people's lives and broader social processes than the technological subject positions he describes and those that I describe in this dissertation. Each of person's technological subject position is shot through with other kinds of social relations such as class, gender, race, citizenship, and sexuality. Every subject in the Google Geo discourse, whether Googler,

neogeographer, or user, also has other forms of subjectivity. Depending on their situation, this may have a greater or lesser effect on their position within the Google geo discourse.

Applying this technological subject position framework necessarily oversimplifies the position of any one person in the Google geo discourse as a mass individuated subject. Nevertheless, these subject positions and the subjects that occupy them in this discourse have noteworthy characteristics and relationships between one another in terms of material mapping practices and geographic knowledges. The nature of these subject positions and their relationships are key to understanding popular manifestations of geographic knowledge situated within histories and current practices of mapping and technology.

Cartographic subject positions

Harley's classic studies of historical maps and power draw attention to the roles of people in the mapmaking process and how those subject positions were part of political processes (2001). He identifies two roles in map production during the Renaissance and Enlightenment periods. One is the "patron," the government agency or person who commissions a map. Harley describes at length how patrons were usually parts of aristocratic elites and governmental bureaucracies. Reflecting the patron's needs, period maps almost always served state functions such as imperial ventures, defense, surveying and land tenure. Harley also describes another role in this period, the mapmaker. While working on behalf of the patron, the mapmaker also shaped the social, political knowledge of the map in his or her own ways. Mapmakers followed

professional standards and conventions, such as geometrically standardized space. These practices shaped not only the look of maps, they also reflected the patron's political purposes at a deeper level (Harley, 2001, 40).

The subject positions Harley describes do not correspond with those in the Google geo discourse, but his work is an important starting point. The differences between the subject positions he describes and the Google geo discourse highlight some of the current subjects' important characteristics. For example, Harley's patron commissions the map at the outset based on their governmental concerns and the ability to pay for map production (Harley, 2001). In comparison, early versions of Keyhole's Earth Viewer, Where 2 Technologies' proto-Google Maps, and Street View originated as consumer products. Their creators had to find or build a popular consumer market. Potential users had to be enticed to use a service that they didn't know they "needed."

Another important breaking point from Harleys' subject positions is the role of geographic data. The information plotted in the maps Harley describes was originally collected by explorers and surveyors who served the same sort of patrons as the mapmakers. Google collects data from official sources such as governments and data vendors, and it also collects its own data using Street View cars. Furthermore, it encourages people to collect, add and use their own geographic data in Google's services in ways that can mix all of these kinds of data together.

Technological subject positions

To make that mixing of data possible, Google's services rely on complex, state of the art technologies. Not everyone has the same role in relation to those technologies.

Andrew Feenberg proposes an elegant theory of these differences in technological change that builds on both the logic of people's technological experiences and political economic processes described by Marx and Marcuse (Feenberg, 2002). His theory is based on two differing technological subject positions. One is a primary, masterful subject who has the capacity to approach the earth in terms of "raw materials" with which he or she designs increasingly efficient techniques to an end. He writes that these subjects have the impression of being apart from the world, allowing them to act upon it from without. Using this perspective, material resources, and labor, these frequently capitalistic subjects have the autonomy to design technologies in strategic ways to achieve their aims in the world (Feenberg, 1999; 2002).

The other is a secondary, subordinate subject position who encounters technologies in his or her own lifeworld. Most of the time, these secondary subjects live and labor in technologically constructed contexts. In these situations, they "strive to appropriate the technologies with which they are involved and adapt them to the meanings that illuminate their lives" (Feenberg, 1999, x). These uses may or may not be in line with the strategic aims of the masterful technological subject, but they are limited by the material structure of the technology itself. The materiality of the technology condenses the social processes that divide the two subject positions (Feenberg, 1999; 2002).

The technological subject positions of the Google geo discourse are not as straightforward as Feenberg's scheme. Much like Harley's cartographic subject positions, Feenberg's theory allows us to begin to understand the technologies at work in the Google geo discourse and the different kinds of positions people hold. Recognizing

these differences allows us to examine the geographic knowledges of different kinds of subjects.

The Google geo discourse's subject positions

In the Google Geo discourse, I encountered and identified three distinct subject positions that reflect elements of both Harley and Feenberg's ideas. These subject positions are manifestations of mapmaking and technological processes that correspond with particular forms of labor and ways of seeing that I examine in more depth through the rest of this chapter.

Googlers are formal, paid employees of Google, and they have the autonomy to make important decisions about the geo services as part of their work at the company. As examples of Feenberg's masterly subjects, they make technological and design choices that both allow the geo services to function and limit the options of other subjects further down the line. Googlers work behind the scenes to set technological defaults and manage data, but do not make each Google Map for each user. This means that their role in mapmaking is different from that of Harley's mapmaker or modern professional cartographers.

The second, neogeographers, are subjects who work outside the company to create new maps, geoweb applications or geographic data for popular use by using Google geo services. They often work in an unpaid, informal or leisurely manner. For example, a neogeographer may be a geo software developer who makes a living by making geoweb applications or an untrained student mapping farmers' markets using placemarks in My Places (formerly My Maps). Most of the time, neogeographers use or

tinker with Google geo services in their daily lives. They are subject to technological and cartographic choices made by those at Google. Some neogeographers also attempt to make strategic technological moves, such as running a business based on an original app. These neogeographers approach the world in terms of raw materials and increasingly efficient techniques toward their own capitalistic ends. Strategic intention or not, occasionally a neogeographer creates a technique that opens new kinds of possibilities beyond the existing discourse. The first map mashups were an example of this kind of event. As subjects who actually make maps and/or geoweb applications, neogeographers are somewhat similar to Harley's mapmaker who makes maps according to particular standards and practices. For neogeographers, these standards and practices only sometimes include GIS or cartographic training, but they are almost always subject to the limits imposed by Google.

The third subject position, users, includes people who use Google geo services, map mashups or similar applications, but who do not intentionally contribute geographic information or create new maps for others. Googlers and neogeographers regularly refer to the "end-user" or "user" of their creations and these users make up the vast majority of Google geo services usage (Jones, 5/28/2008; 3/31/2010). As people who encounter and attempt to use technology in their own lives, users are an example of Feenberg's secondary, subordinate subject position. They use Google geo services for purposes in their own situation, not Google's or their own capitalistic imperatives. They are unlike Harley's patron in that they do not commission a map from the very start of the production process. Instead, they encounter an already existing mapping service. This encounter with cartographic technologies in their everyday lives is important because the

strategies of Google and some neogeographers technologically and cartographically delimit the ways that users see the world.

With these three subject positions in mind, it is important to note the ease for some in shifting positions. ease for some in shifting between subject positions. Googlers and neogeographers may adopt the subject position of a user in everyday actions. Larry Page, CEO of Google and influential in the company's strategic direction, still gets driving directions as a user of Google Maps. The vast majority of users, however, can't go back to being Google's CEO.

In addition to shifting position, the line between neogeographers and users is not always a clear one. In my experience, there is a continuum of web-development expertise and interest. It ranges from users who have no interest in intentionally contributing data and/or who don't have web development experience to, on the other end, a professional cadre of neogeographers well known in the industry. The ease with which neogeographers can and do regularly shift to the position of a user further complicates the issue. For the purposes of this research, I differentiate between neogeographers and users based on whether they are intentionally creating geographic data[44] and/or new kinds of maps for purposes beyond their personal use. Someone who queries Google Maps for driving directions, modifies the route, adds some placemarks for destinations and saves it as a My Places map for their own personal use is a user of Google's services. If this person adapts that original map for more general usage by their friends and family, creates their own geoweb application using the Google Maps API or

[44] Google, in its efforts to organize information, improve its search, and better target ads, collects all kinds of data that users create unintentionally for themselves. An example of this data would be a web browsing history that includes driving directions.

creates data on Google's underlying basemap of street data with Google Map Maker, I identify them as a neogeographer.

I. Googlers

Those who work at Google occupy one of the most storied positions in Silicon Valley. Press accounts, the business literature, and industry gossip describe an almost utopian working environment with numerous on-site amenities and a positive, can-do atmosphere (Battelle, 2005; Vise and Malseed, 2005; Stross, 2008; Levy, 2011; Jarvis, 2009). My own trips to the Googleplex left me with an impression that resembled both the positive and negative aspects of Ross' humane workplace (2003). In such an environment, employees enjoy many workplace amenities, such as laundry and parties, flexible hours, an embrace of geeky subcultures, and a degree of self-direction and creativity in their work. All this adds up to great dedication to the company among employees. On the downside, such firms often do not pay as well as the competition and the absence of a union and middle management means that average employees can lack direction in their work, feel personal responsibility for the company's performance, and are in direct danger of layoffs when the firm isn't doing well (Ross, 2003).

Google's workforce

Google currently directly employs about 31,000 people and it carefully controls more detailed information about this workforce (Google Inc., 2011d). The company even considers federally-collected race and gender information about its workforce to be a trade secret and has successfully blocked Freedom of Information Act requests in court

on those grounds (Swift, 2/14/2010). Based on my own observations, Google's geo division is not that large within the company. On my visits to the Googleplex in Mountain View, CA, the geo division occupied most of a floor in one office building on the campus. That office was in large part employees who work on Google Earth. Google Maps' main office is in Sydney, Australia.

Google's offices are replete with amenities and playful emblems of geek culture. For example, in one of my visits to the Googleplex, the company's full-size replica Tyrannosaurs rex skeleton sported a pink tutu and Groucho Marx glasses (fig. 5.0). The company encourages employee's creativity for the sake of technological innovation. Many Googlers I talked to love their jobs and have adopted the vision outlined in Google's mission statement. Maintaining this atmosphere and image of a positive, creative environment is important to Google's continued success as a company. To compete, Google needs to attract and hold on to extremely smart, well-trained employees who can improve Google's existing services and innovate to create new ones.

Googlers from the geo division who I observed and interacted with usually appeared to be in their 20s and 30s and tended to be men. Managers and those who had been at Keyhole Inc. were somewhat older. Across ages, Google employees I talked to proved to be strikingly smart, articulate and earnest. They came to Google from around the world including California, North Carolina, Florida, Ontario, Australia, the United Kingdom, Israel, India, and Germany. Everyone I spoke with held at least a Bachelor's degree and many had earned advanced degrees including a number of Ph.Ds. The most common academic background was computer science, but I also talked to people who had specialized in other kinds of engineering, business, natural sciences and even history.

In this multidisciplinary environment, only one Googler I talked to had a degree in Geography or GIS.

Beyond academic training, many Googlers I talked to joined Google as a career move to a more satisfying field. The company recruits Ph.Ds. and other specialists across academic disciplines, other IT companies and government agencies. Google's geo division is no exception in this regard. Googlers I interacted with came from a variety of professional backgrounds including software development, IT startups, the geospatial industry, the videogames industry, the U.K.'s Ordinance Survey, Israeli intelligence mapping, and NASA. Several interviewees described how they chose Google instead academic pursuits or advancing in their previous job. They saw Google as the kind of place where they could accomplish significant things that would make a difference in people's lives (Coombe, 4/2/2010; Fox, 5/22/2009; Golden, 5/28/2009; Marks, 5/22/2009; Parsons, 3/31/2010; Rademacher, 3/4/2010; Ron, 3/31/2010).

The influence of Googlers

Googlers' labors of managing, updating and innovating Google's geo services are not small tasks. The geo services involve constant coding and data updates as well as longer term design projects to create new service offerings. Technologically speaking, Googlers are examples of Feenberg's primary subjects. Googlers approach the geo services' components as raw materials from which they build geo services that are increasingly efficient at advancing Google's core strategy of ubiquity. This is not to imply that management and workers at Google occupy the same subject position in terms

of labor.[45] Rather, Googlers are primary technological subjects because occupying that subject position is the purpose of their jobs within Google. Starting at a fundamental level, they build, maintain and develop Google's geo technologies.

As primary technological subjects, Googlers make important design choices that become hard-wired into Google's services and that are extremely difficult to change by outside neogeographers and users. For example, software developers at Google make changes to the core code of Google Earth and other geo services as Google updates the services. Others devise ways to better integrate Google search results with Google Maps and Google place pages. Managers and administrators make choices and work out contracts about which batches of aerial images to make available on the services or how to gather street data. Web designers make fundamental cartographic design decisions such as the color and label placement standards in Google Maps.

All of these tasks and others are the technological bits and pieces that together advance Google's strategy of ubiquity in its geo services. To make a map of any given place on Earth may involve Google Maps' core code, satellite imagery, place pages, and all of the design decisions that went into each. Furthermore, only Googlers can perform most of these actions. This serves to make those in that subject position influential not only at Google, but throughout the Google geo discourse. Their ability to shape and define the technologies of the discourse has social consequences. The very existence of the Googler subject position is a counterpoint to claims of democracy within the Google geo discourse (Jones, 5/28/2008; Katragadda, 8/28/2008). Googlers are not selected, much less elected, by neogeographers or users. They are hired by a private firm. The

[45] A study of labor relations at Google would be interesting, but that sizable topic does not fall under the purview of this research.

work Googlers do at Google lays the groundwork and sets the limits for the Google geo discourse in terms that are compatible with Google's capital imperatives.

II. Neogeographers

Far more people than just Googlers tinker with Google's geo services. Most of the people who develop maps and contribute content work outside the company. There are a variety of overlapping names to describe these mapmakers including software developers, programmers, web designers, geo geeks, geohackers, geowankers, and neogeographers (Wherecamp 2009; 2010; Erle et al. 2005; Turner, 2006). I use the term "neogeographer" because it encapsulates all of the names and categories listed above.[46] For a start, these subjects fit Turner's concept of neogeography as web-based, do-it-yourself mapping that is usually fun to do (Turner, 2006). I build on this concept to understand neogeographers in terms of the work they do in the Google geo discourse. I define neogeographers as subjects who are not Googlers and who intentionally labor to create maps and/or geoweb applications or contribute geographic data or content. In addition, the products of this labor are for consumption beyond their own personal use. On the continuum between neogeographers and users, a neogeographer could be a skilled, professional software developer who uses the Google Maps API to make geoweb applications. A neogeographer could also be someone new to mapping who plots and saves locations of their favorite restaurants in My Places to share with their friends. A user is someone who simply views Google Earth or gets his or her driving directions from Google Maps or similar individual map-use practices.

[46] Though neogeographers also work elsewhere on the geoweb, the neogeographers I describe in this research are working in the Google geo discourse.

Neogeographers are important in the Google geo discourse for their combined creativity and labor. Google encourages neogeographers as a way to crowdsource the production of data and new geographic innovations. To do so, the company sets limits on the actions of neogeographers rather than trying to directly control them. As a result, neogeographers can follow their own topical interests and ideas to where they perceive a need or market for a map. This process both expands Google's advertising opportunities and opens the possibility of new maps for Googlers, neogeographers and users alike.

Neogeographers at work

The labor neogeographers perform shows the possibilities neogeographers open and hints at the discursive limits they are part of. A neogeographer's labor reflects his or her purpose, degree of experience and integration with other geoweb discourses. Types of neogeographic labor range from basic web mapping using My Places to creating data with Google Map Maker to making geoweb apps with the Google Maps API to maintaining informal social networks of neogeographers.

Crowdsourcing neogeographers

The most basic type of neogeographic work is crowdsourcing data. In this process, neogeographers create data that ends up in Google's data banks and/or indexed by the Google search engine. To encourage wide usage, Google structures these activities so that they don't require geographic or computer science training. All a user needs to become a crowdsourcing neogeographer is a little time, basic experience using the internet, and motivation.

Crowdsourced data often isn't full-blown GIS-formatted data. May crowdsourced datasets are other kinds of data that include a geographic referent such as a street address that Google can use for local geographic searches. Google encourages people to add information about themselves or businesses they own or manage. For example, two neogeographers I corresponded with own a small Bed and Breakfast in a remote part of central Pennsylvania. They had no previous cartographic experience, only basic web design skills and limited time to dedicate to advertising on top of running their B&B and working other jobs. They learned that Google encouraged business proprietors to list and add information about their businesses on Google Maps in a Google Place Page. In this case, they put their B&B on the map, created a place page for it and added information and photographs to that page. Doing so created much more business and attracted people from farther away than their previous clientele (Handakas, 1/26/2010). Listing the B&B on Google Maps plugged it into Google's integrated information services and made the business visible on the web, which attracted more customers. From Google's perspective, they successfully encouraged the owners of the B&B to spend time adding and refining information about the B&B on Google's Place Page for it, contributing to the quantity and quality of information available from Google.

Another, more explicitly cartographic example of neogeographic work is the Google Map Maker program. It encourages contributors to trace and annotate features, such as roads or streams, on aerial images and add what they create to Google's master database of geographic data. Google also crowdsources quality control in Google Map Maker to neogeographers. In this "self-defined community" the best work is vetted

positively, providing positive feedback for the creator and encouraging them to participate more (Jones, 10/12/2009; 3/31/2010; Boulton, 2010).

Michael T. Jones, argues that this community of crowdsourcing constitutes a form of democratic mapping that rewards and encodes "local knowledge" and what local people think is important to map (10/12/2009; 3/31/2005). However, some neogeographers I spoke to questioned or rejected Google Map Maker. They asked why you would contribute data to Google's "black hole" because the company makes it impossible to pull geographic data back out of their services (Where 2.0, 2010; Wherecamp, 2010).

Making mashups, making apps

Many neogeographers are not content with creating data; they want to make their own maps. Google offers a range of services from basic mapping with placemarks in My Places to web development on everything from PC web browsers to smartphones. The final product may be a simple web map, a proof-of-concept map mashup, or a fully developed, polished geoweb app for consumer use.

The first and most influential map-mashing Google service is the Google Maps Application Programming Interface (API). The API itself is the engine for most map mashups and PC web browser-based geoweb apps. Technically, it is a set of online tools that allows neogeographers, usually software developers, to mash a separate, clone form of Google Maps with other datasets and embed the result into the neogeographer's own web page. Practically speaking, using the Google Maps API requires experience in software development or web design and agreeing to Google's terms. The initial Google

Maps API, launched in 2005, was such a success that Google now also offers a similar set of tools for developing location-based or geoweb applications on its mobile phone operating system, Android. Google also recently began to introduce some forms of pricing for use of the Maps API. It offers a subscription version called the Google Maps API Premier to neogeographers and business that includes additional services, technical support, and usage metrics. The cost for this premier version starts at $10,000 a year and goes up depending on the number times internet users visit the website in question (Lee, 2010; Google Inc., 2011e). Google has also announced that it will begin to charge a $4 fee to neogeographers and businesses who use the basic Google Maps API for every 1,000 user-visits beyond a monthly 25,000 user-visit quota. Google says that they may make exceptions for non-profit organizations (Paul, 10/27/2011; Google Inc., 2011e; Google Inc., 2011f).

Google recognizes the technical background required for working with these APIs as a limitation. In response, it tries through other services to make mapmaking simpler and accessible to more people. Doing so opens the geo services to new ideas and another way for Google to collect data for targeting ads. Google's most successful service in this regard is My Places (formerly My Maps), a set of basic mapmaking tools built directly into Google Maps that does not require any web design or coding. The service allows one to draw points, lines and polygons with labels or pictures, modify the symbology, collaborate with others, and post the map on the open web for anyone to see. For example, I occasionally use My Places for projects in classes I teach. Student groups take geographic information, such as the country of origin for different t-shirts at the

university store, and collaboratively assemble a map by putting placemarks in each of the respective countries.

My Places maps can also be effective in more complex cartographic ways. During a peak in protests in Syria in September 2011, protesters created My Places maps of events around the country on a regular basis. These simple maps show placemarks that link to videos of protests, fighting, and Syrian government atrocities in that area (fig. 5.1)("Syria – Friday 19/09/2011", 9/20/2011a; "Syria – Monday 16/09/2011", 9/20/2011b; "Syria – Wednesday 19/10/2011", 10/24/2011). In 2007, the Brian Lehrer Show radio show in New York collected reports from WNYC listeners on the station's website concerning the prices of specific basic foodstuffs in a segment entitled "Are You Being Gouged?" With those reports, the station created a "crowdsourced" map of the price disparities of quarts of non-organic whole milk, heads of iceberg lettuce and six-packs of Budweiser beer in stores throughout the city (Lehrer, 9/24/2007). The following month, San Diego's KPBS radio station used the same approach with a My Map to plot the locations of San Diego area wildfires and evacuation centers according reports phoned into the radio station by listeners. None of the staff at KPBS had cartographic or web-mapping experience. They chose to use Google My Maps because it was easy to use, and Google did not charge them or their listeners for access. In the words of one of the station's producers, "It's not like you have to be some super geek [to use My Maps]" (Google Inc., 2010).

Maintaining networks

For neogeographers, mashing maps may be easy to start, but sooner or later most will need assistance or advice from one of those "super geeks." Some neogeographers helpfully fill that role by participating and maintaining loose networks for trading ideas, gossip, troubleshooting and publicizing projects. These networks are very important for serious neogeographers because they maintain professional contacts and share technical solutions among neogeographers who are geographically and topically disparate. Participants tend to be more professionalized neogeographers, but a fair number of those I read and talked to in this research participate as a hobby.

The networks themselves work through blogs, online technical forums and regular conferences. Neogeography blogs, such as *Google Maps Mania*, *The Google Earth Blog* and others serve to publicize updates to Google's services and neogeographers' projects. Technical forums, such as the "Google Maps API 2" Google Group, are semi-official web resources for neogeographers who need help solving technical problems. A few Googlers help moderate these forums, but the best and most responsive people on these forums are other neogeographers (Google Maps API V2, 1/13/2010; Coryat, 5/27/2009; Hunter, 5/27/2009; Fox, 5/22/2009). Finally, conferences and similar events such as *Where 2.0*, *Google I/O* developer conferences and *Wherecamp* are opportunities for neogeographers to meet in person and trade ideas, experiences and technical solutions (Google I/O, 2008; 2009; Wherecamp, 2009; 2010; Where 2.0, 2010).

Networks of neogeographers online and at conferences are also important as areas where the Google geo discourse overlaps with other geoweb discourses such as Open Source geo initiatives and the traditional geospatial industry. Some Neogeographers

regularly straddle or jump between discourses as they shift web mapping platforms. A neogeographer may do an early proof-of-concept map mashup in Google Maps and take that concept to make a full-blown, carefully designed geoweb application in Open Street Map or a GIS package. As meeting places of two or more discourses, these networks are important for neogeographers and the maps they make. Conversations and presentations offer contrasting and at times competing concepts of how web mapping ought to work and what they as neogeographers can and can't do with it (Google I/O, 2008; 2009; Wherecamp, 2009; 2010; Where 2.0, 2010).

Neogeographic limits

The mapping possibilities of neogeographers in the Google geo discourse are both directly limited by Google's terms of service and indirectly limited by the circumstances of neogeographers themselves. These direct and indirect limits delineate the margins of the Google geo discourse for neogeographers and users. Occasionally, neogeographers push these limits in new, unanticipated ways that elicit a response from Google.

Google's house rules

Using any of Google's services requires one to consent to that service's Terms of Service. As parts of Google, these legal restrictions and related software are structured to advance Google's strategy of geographic ubiquity. While many users access Google, Google Maps and other services without examining the legal terms, neogeographers who ignore them run the risk of Google blocking or removing their map. In practice, it is difficult to tell how often Google resorts to such actions because takedowns are most

evident through the sudden absence of a site or app. For their part, Googlers certainly warned me about the dire consequences of violating Google's terms of service when I asked questions about them (Google I/O; 2009). With this possibility of a take-down, neogeographers must try to ensure that both their topic and their use of data are acceptable to Google. In practice, Google is not as strict about the content of maps as the terms of service imply. This discretion fits Google's general strategy of getting as much content up on the web as possible. Google is far more defensive about data handling practices such as forbidding people from downloading its geographic data. Using geographic data outside Google services, as many GIS programs do, cuts into Google's ubiquity. Furthermore, downloading geographic data would also create problems with Google's contracts that license geographic data from data vendors.

Content rules

Google expressly forbids mapping that facilitates "illegal activities" or activities Google does not want to be associated with. In its Terms of Service, Google describes illegal activities as mapping places to buy or sell illegal drugs or inciting violence (Google Inc., 2011f; 2011g). In practice, things are less clear. Google did not shut down one of the earliest and best known political map mashups which mapped the secret political prisons in Tunisia before the 2011 revolution (Gharbia, 9/29/2006). Participants in the Arab Spring protests also used Google services with the company's encouragement (fig 5.1)(Whitney, 2/16/2011; "Syria – Friday 19/09/2011", 9/20/2011a; "Syria – Monday 16/09/2011", 9/20/2011b; "Syria – Wednesday 19/10/2011", 10/24/2011). Closer to home and the U.S. laws that Google is directly subject to, there are a number of national-

and world-scale geoweb apps that show occupations and similar actions associated with the Occupy Wall Street movement ("Occupy Wall Street protests around the world", 10/18/2011; "Occupy Everywhere", 10/25/2011; Occupywallst.org, 11/2/2011). Thus far, there is no indication that Google is interfering with or blocking any of these kinds of maps, even at occupations at which police arrested protestors. In a more directly confrontational instance, Google did not restrict the tactical use of My Places and a Google Maps-based application named Sukey by student protestors to out-flank riot police on the streets of London in December 2010 (fig. 5.2)(Goldacre, 9/10/2010; Doctorow, 2/10/2011). Even with all of these cases, it is important to remember that it can be hard to know when Google blocks sites on legal grounds because, as blocked sites, they are hard to find on the web and may not appear at all. Nevertheless, it seems that Google allows protesters to use Google Maps more at the company's discretion than its legal terms.

Activities that Google does not want to be associated with are even less clear than legal limits. The Google maps API Terms of Service forbid displaying "adult content," or promoting "gambling, or the sale of tobacco or alcohol to persons under 21 years of age" and identifying "private information about individuals" (Google Inc., 2011f; 2011g). Furthermore, the terms state that Google will not review a neogeographer's work to tell him or her if it complies with Google's terms (Google Inc., 2011f). Ironically, there is no shortage of sexual imagery in the photo-geographic data Google supplies, though it can be taken down by user request (Haines, 9/21/2006; Crowther, 6/10/2010; Weaver, 3/24/2009; ABC News 9/13/2011). It is also unclear what qualifies as privacy for individual users. Presumably, Google does not want neogeographers doing

anything too egregious with users' private data because Google's use of people's information in its own business could be threatened. Despite these concerns, some kinds of individualized data, such as political donations, are common in geoweb apps (Clarke, 4/20/2011). In Britain, a neogeographer even created a map mashup of the home addresses of members of the ultra-right wing British National Party. He eventually modified the map to be less precise due to public criticism and his own doubts, not threats from Google (Butcher, 11/19/2008).

While Google must avoid alienating users, it is part of its capital strategy to make as much content available on the web as possible, including the work of neogeographers. Its Terms of Service and lax enforcement allow it to both maximize mapping within its services and pass the liability if there is trouble. This leaves neogeographers in the position of not knowing for sure what Google's response to a questionable case will be.

Data rules

In contrast to Google's discretionary enforcement of rules about content, it is very strict about access and use of its geographic data. Google employs both legal enforcement to protect its own data and sticky intellectual property terms that allow it to continue to use and distribute any data that people add to its services. Closely regulating data handling ensures that a neogeographer's own, situated work will serve Google's aims.

Fitting neogeographers' use of data to Google's ubiquity begins with the requirement in the Google Maps API Terms of Service that geoweb apps must be available on the open web. Neogeographers cannot charge users to access their app, nor

can the app be available only on an intranet that limits who can access it. These rules contribute to Google's strategy of expanding the amount of content available on the web.

As for the geographic data itself, Google absolutely forbids "scraping," downloading native geographic data from Google's geo services for use outside those services. For someone with a technical background, hacking into and scraping Google's geo data is not very difficult. However, if Google finds or suspects that someone is scraping data, its legal department swings into action very quickly. For example, in 2005, one blogging neogeographer posted a way to download multiple Google maps data files for a computer's desktop wallpaper. Though he was not redistributing the geodata itself, Google quickly sent him a cease and desist letter (Vawter, 7/2005). Among the Googlers that I spoke with, all were vigilant and careful to warn about improper use of Google's data, but I saw no indication that Google dedicated any employees entirely to this function (Fox, 5/22/2009; Marks, 5/22/2009; Pegg, 5/28/2009; Coombe, 4/2/2010; Google I/O 2008; 2009)

Google's rules to keep data within its own services also extend to data that neogeographers contribute. In a map mashup, Google retains the legal rights over the data it provides, the software code of its service and it claims "perpetual, irrevocable, worldwide, royalty-free, and non-exclusive license to reproduce, adapt, modify, translate, publish, publicly perform, publicly display and distribute any content which you [the neogeographer] submit, post or display on or through, the services" (Google Inc., 2011g). In short, Google does fully not own or hold the copyright to data submitted or used with its services, but it does claim many of the same functional rights as an owner. This arrangement allows Google to use the data in its ubiquitous services, even if the

neogeographer no longer works with Google. In the IT industry of internet firms with APIs, these are common terms. However, they are exclusive and controlling compared to open software and open data initiatives such as Open Street Map. Such open software and data projects allow neogeographers to rework the core code and data, but also require that the work be sharable and often non-commercial.

The nature of these content and data restrictions makes the subject position of a neogeographer a precarious one. Google's terms of service allow neogeographers space to create data and maps, but only to the extent that it serves Google's ultimate strategy. If there is a problem with a geoweb app, Google, not the neogeographer, holds the trump cards.

What makes neogeographic work worthwhile

Given Google's rules, why do neogeographers bother mashing maps with Google's services? Nearly all the neogeographers I encountered, from professional software developers to users of My Places, clearly enjoyed making maps or contributing to them. For many, this pleasure of mapping is the main reward. Others make it into a part-time or full-time job by creating geoweb apps as a contractor or monetizing a geoweb app. A few have social and political aims. While these reasons to do neogeographic labor open people to doing mapping, they also act as indirect limits on the discourse. Neogeographers' actions are usually limited to circumstances of mapping for individualized purposes such as pleasure, advertising revenue or charitable giving

produced on fixed-term contracts or independently creating and sustaining a consumer application.

Pleasure

Many neogeographers receive no financial compensation for their work. Google Map Maker and My Places don't even have the infrastructure to make such a relationship possible. For many of the neogeographers I encountered, even at industry conferences, making money isn't the point. They are neogeographers because they enjoy mapping and/or because programs like Google Map Maker provide them the opportunity to participate in a project larger than themselves. From this perspective, Google provides cheap, ubiquitous, and easy-to-use resources to make maps. One prominent neogeographer even directly quoted Google's mission "to organize the world's information…" to help explain his sense of purpose (Coryat, 5/27/2009). Other neogeographers describe the satisfaction they achieve in creating a working application and adding data to it. For example, Barry Hunter is a highly-regarded neogeographer who carefully and intentionally only does mapping projects as a leisurely side interest. He makes a living as a software developer on non-geographic projects. When I asked him why he doesn't do paying geographic software development, he said that making geographic projects for pay would probably ruin his passion for mapping (Hunter, 5/27/2009; Shearer, 3/5/2006).

Contracts

Many other neogeographers do mix the pleasure of mapping with paying work. One popular strategy is to work as a freelance geo software developer, making geoweb applications for clients on a limited contractual basis. Clients offering contracts are often a business or organization in need of a map or geoweb app but who don't have the resources, interest in or need for a full-time staff member. Examples include real estate firms and media companies such as HBO (Musser, 5/1/2006). A neogeographer on a contract can make a far more complex and visually appealing map using the Google Maps API than an untrained employee can using My Places. Neogeographers find work through their professional connections, social media, their resume of existing online projects and other, similar means. Much like other freelance work, whether or not a neogeographer can make a living on contracts depends on their connections, the quality of their work and luck. Some band together in a group or corporation to attract large or multiple contracts (Musser, 5/1/2006; Clarke, 8/26/2009). Google encourages this market of neogeographers through their "Qualified Developer Program." The program tests neogeographic chops in exchange for a Google seal of approval on a resume and an entry on Google's list of approved developers for its geo services. Qualification involves a combination of factors including neogeographic experience, participation in the community, professional references and an exam (Kirkwood, 2/18/2010; Alami, personal communication, 3/30/2010).

Monetized geoweb apps

Instead of doing multiple contracts, some neogeographers prefer to build a business around one or a few geoweb applications on websites or smartphones. One neogeographer I interviewed, Leonardo Hochberg, created and runs a social media Facebook-style website centered on mapping jogging routes. He created the website from the ground up and continues to manage it as a small business (5/22/2009). Another example is Jim Preston's Winequesters geoweb application for smartphones that maps California wineries and reviews of them (4/3/2010). Most of these geoweb apps make money through advertising. Frequently, neogeographers use Google's AdSense program. It places Google-served advertising on third-party websites and splits the revenue with the websites' owner. While there are some success stories, building and maintaining a sufficient user base for this kind of application is very difficult (Mills, 4/19/2006).

Monetized geoweb apps also face serious structural constraints. Since the underlying code, such as the Google Maps API, and often the data are owned by other parties, it is difficult if not impossible obtain patent protection for a geoweb app. The app is at the mercy of the data's owners and technical changes to Google's services over time. These combined issues also make it difficult to attract investors, limiting the scale of such businesses (Mills, 4/19/2006; Howell, 9/2/2006). In fact, these kinds of limits were part of the reason why Paul Rademacher chose to work for Google instead of on his own after the great success of Housingmaps.com (Rademacher, 10/5/2005).

Advocacy, service-delivery, and politics

Not all neogeographers are motivated by just play and/or pay. In the broad ocean of geoweb apps, there is a small current of neogeographic work around other social aims. Many of these neogeographers split their time between Google's services and open platforms such as Open Street Map (Wherecamp 2009; 2010; Where 2.0, 2010). Most outwardly political geoweb apps perform some kind of advocacy, often in connection with a non-governmental organization. One of the earliest and best-known cases is the Tunisian Prison Map mentioned earlier (Gharbia, 9/29/2006). Other examples include a geoweb app from the CATO institute of botched police raids (fig. 5.3) and an app funded by the The Heinz Endowments of the environmental impact of hydrofracking for natural gas (Radley and Laslo, 1/1/2006; Clarke, 3/4/2011). A few maps are published by governments to publicize and thus advocate for public programs such as renewable energy stations (Clarke, 9/28/2009). The primacy of advocacy among such maps is a further indication of the individualizing, consumer orientation of the discourse. The geoweb apps provide visual, geographic reasons to support, donate or sign a petition.

Advocacy apps overlap another occasional theme behind geoweb apps: service delivery. These apps involve informing or delivering a user some kind of service and may be publically or privately funded or some combination of the two. For example, some geoweb apps report and map locations that require public services, such as potholes (Clarke, 10/1/2008). In another example, New York City's transit agency puts some of their data online and encourages neogeographers to create apps with it (Metropolitan Transit Authority of the State of New York. 12/7/2011). Though some of these cases are examples of governments using geoweb apps, service delivery is the kind of

governmental action (and map) that most resembles private consumption by individuals such as motorists or transit users.

In addition to advocacy and services, there are a few cases in which political movements use geoweb apps tactically. In January 2010, a march opposing internet censorship in Turkey traced its progress in real time using placemarks in a geoweb app (Salisbury, 1/25/2010). Later that year, protestors opposing tuition hikes in the U.K. used the purpose-designed Sukey geoweb application on smartphones to navigate around police and their "kettling" crowd-control methods (fig. 5.2)(Goldacre, 9/10/2010; Doctorow, 2/10/2011). Significantly, even in these collaborative cases, editing the map required individual protesters to contribute to the map as individual editors with their own smart phones or other devices.

The direct and indirect limits on the neogeographers' subject position have consequences for them, users and the ways of seeing for all concerned. Google's terms of service as well as neogeographers' leisurely and capitalistic reasons for mapping produce consumer-oriented maps. Even maps made for political advocacy often have an individual orientation similar to a consumer focus. The maps are cheap, easy to access, fun and/or useful to individual non-experts such as people on California wine tours or protesters with personal smartphones.

Transgressing the discursive limits

The limits of the Google geo discourse for neogeographers are far from permanent. The discourse itself is less than a decade old and legal, technical and economic constraints can shift. At times, neogeographers break out and work outside the

existing Google geo discourse, transgressing Google's limits. When this happens, Google must crack down and enforce the limits or incorporate these new ideas into its own strategy, expanding the discourse as a whole. If Google fails to do so, they could lose neogeographers to other parts of the Geoweb and Google's capital accumulation strategy in geo services could fail.

Map mashups first came about through such a transgression. Paul Rademacher was not following standard, accepted practices when he created Housingmaps and Google could have shut him down. Instead, those at Google recognized in Housingmaps a new avenue with which to pursue capital accumulation. The company institutionalized map mashups by creating the Google Maps API. In another case, Google recognized the productivity of self-made street map data that geohackers and neogeographers had invented for Open Street Map. Again, Google saw a way to follow their mission and reduce expenditures on data by expanding the Google geo discourse to incorporate and encourage crowdsourcing the production of street data. They launched the Google Map Maker program.

These cases indicate how neogeographers are very important to new mapping possibilities and how Google takes advantage of their work to create new ways to accumulate and reinvest capital and information. In the Google geo discourse, neogeographers usually occupy a secondary technological subject position. They encounter and use geo technologies as part of their own lives. However, neogeographers possess or can learn the technical skills to make new maps. Consequently, some of their maps can constitute masterful, strategic technological development itself, placing that neogeographer in a primary technological subject position. These mapping techniques

develop their own secondary subjects. For its part, these sorts of developments are a threat and an opportunity for Google. Google must retain the ability to delimit the discourse, lest it no longer serve Google's purposes. As mashups and crowdsourced map editing make clear, if Google handles these cases carefully, they allow the company to benefit from neogeographers' innovative labor.

Neogeographic knowledges

Neogeographers, in concert with Google's geo services, produce geographic knowledges that reflect and inform their motivations and limits. The effects of this process are maps for consumers that don't just reflect Google's actions and priorities, but also those of neogeographers. Short-lived maps, play and efficiency are noteworthy characteristics among these maps that show the influence of their consumer orientation.

A limited lifespan

An important aspect of mashups and geoweb applications is that they often have short service lives or are temporary from the start. Technically, map mashups are often "quick n' dirty" experiments meant to test a technical concept (Marks and Fox, 2/22/2008). Such experiments are not usually meant to support large volumes of use and often serve as a prototype for a fully-developed geoweb app on a web browser or smartphone.

The current technological environment for geoweb apps creates incentives for applications to be light and temporary. A neogeographer cannot save their mashup or app in a single file or folder because the app relies on dynamic geo services that pull data

from multiple sources online. All the sources must continue to work for the app to be functional. However, operating systems, especially on smartphones, may see several major updates per year, creating compatibility problems for long-standing applications. On another front, Google also updates its geographic data regularly. This architecture and periodic changes make long term functionality or even archiving difficult. As a result, even carefully developed web geoweb apps are usually small and disposable compared to large traditional computer programs such as Microsoft Word, Adobe Acrobat or ESRI ArcGIS desktop. Andy Woodruff's Ohio is a Piano app is an example of this kind of short-term map. Its sole concept is that clicking on one of Ohio's 88 counties plays a tone from one of the 88 keys on a piano (fig. 5.4)(Woodruff, 7/30/2009). The map is good for a quick laugh, but it would not have been worth developing if it took a long time to do so.

The lifespan of a geoweb app is also limited by the circumstances of its creator. A neogeographer working on My Places for pleasure will only do so as long as they don't get bored. Contracts for creating geoweb apps only extend of for a limited time. Maintaining an application as the data and Google's code update requires another limited contract. Alternatively, a few monetized geoweb app businesses, such as Winequesters, may survive their infancy, but neogeographers must eventually rework the application's code or start afresh. A clear example of these stresses was Dartmaps, a map mashup that plotted the real-time locations of buses in Dublin's mass transit system. At its launch, the site was well-regarded and featured in a special exhibition of map mashups hosted by New York's Museum of Modern Art in 2008. In time, the neogeographer behind the mashup "mothballed" it citing time constraints (Pegg, 3/1/2008; McMackers, 2/22/2008).

Finally, even if a neogeographer does put in the time and effort, a geoweb app may disappear from users' attention because something else new and more interesting came up in the constantly shifting world of internet fads.

Together, these factors mean that even a well-designed, promising geoweb application will likely be a flash in the pan, good for finding a house to buy, a few hours' entertainment or for promoting a feature film. Such a temporary nature would not work for traditional archival or administrative mapping uses, but it suits limited consumer functions.

Play

A second common characteristic of geoweb apps is an emphasis on play. In this regard, geoweb apps resemble other kinds of popular digital maps, such as video games (Perkins, 2009). Many apps are meant to be pleasurable and entertaining to use on top of the enjoyment that neogeographers get from building them. In keeping with their temporary tendencies, map play fits better with consumer use and advertising than institutional forms of mapping.

Play takes several forms in geoweb apps. At a basic level, many geoweb apps have playful or leisurely themes. I repeatedly encountered people in my own daily life who make simple maps of their recent travels and vacations. Many other geoweb apps cater to travelers and leisure-seekers. For example, Lotsa Fun Maps was a basic geoweb app of travel reviews of sites in the Southwest United States (Lotsa Fun Maps, 2/20/2010). LocalNext was a web and smartphone app that mapped things to do in New York such as concerts, sporting events and arts fairs (LocalNext, 1/13/2010). The Atlas

Obscura is a well-developed website that maps unique roadside oddities throughout the United States (Foer and Thuras, 2/27/2010).

In a further step, some geoweb applications take advantage of gaming mechanics and the geo services' graphic interface to create apps that users can play. Games entice users to play with and spend time with an app, perhaps even returning to it if they can save their progress and compete with other users. In this way, neogeographers can build a more stable user-base for their app's advertising revenue. There are a number of driving game geoweb apps that allow the user to drive or race cars on top of Google Maps or in Street View (Clarke, 3/26/2008; 3/23/2010; 6/16/2011). The online game Cybernations is a Risk-style Google Maps-based strategy game in which users can compete with other human players on the web (Pegg, 5/27/2006).

Neogeographers working on a contractual basis also make playful geoweb apps as part of larger advertising campaigns. *The Sopranos*, *Lost*, *24*, British Airways, and Adidas have all used geoweb apps as promotional materials (Pegg, 2/17/2006; Olson, 8/31/2006). The clearest successful case of such an app promoted a new edition of Monopoly with a monopoly-style geoweb app game. It allowed users to play a massive multiplayer online form of monopoly on Google Maps for several months. That game had over 1.4 million active, registered players before it officially concluded (Jurgens, 12/2009; Modine, 9/9/2009).

Efficiency

Not all geoweb applications are leisurely or unserious. Another popular form centers on making individuals' everyday geographic practices faster and easier, such as

minimizing the distance traveled or comparing bits of geographic information remotely to facilitate a user's course of action. Google's hyperlocal services, which include GPS-style turn-by-turn navigation, allow neogeographers to create geoweb applications that make their users more geographically efficient in some way. Housingmaps is an early example of this genre. It allows people to see where multiple rental listings are without visiting each. Others allow users to compare the performance of neighboring school districts, navigate the most direct or quickest route, optimize the direction a satellite dish is facing, or calculate the cost of a taxi ride (Clarke, 12/5/2010; 12/11/2009; Pegg, 10/16/2006). Among neogeographers, these sorts of apps indicate an interest in using maps to resolve everyday perceived problems on an individual, local, consumer level. On their own, these sorts of map apps will not improve schools or solve systemic traffic problems; they only technologically facilitate their users' choices.

Neogeographic democracy?

High-profile neogeographers and Googlers regularly use the term "democracy" to describe neogeographic work with crowdsourcing, map mashups and geoweb apps. They perceive neogeographers' ability to make maps and the participation of large numbers of people in crowdsourcing programs such as Google Map Maker as a democratic alternative to expert-led GIS and institutional mapping (Bar-Zeev, 7/3/2007; Turner, 2006; Parsons, 8/15/2005; 3/31/2010; Jones, 5/28/2008; 3/31/2010). This line of thought assumes that everyone has equal power, knowledge and access to make maps, making for democratic subject positions. For many who hold these ideas, learning to make maps likely was an empowering experience, and the Google geo discourse has expanded the

number of people who make maps by thousands if not tens of thousands (Jones, 5/28/2008). Nevertheless, equating this discourse with inclusive democracy is a false premise. As we have seen, the structure of consumer mapping even influences the small genre of web mapping for political purposes through advocacy and protest tactics. Political geoweb applications may involve web mapping in democratic politics, but this does not make the relationships, knowledges and technologies of mapping in the Google geo discourse democratic. Among all of the playful and efficiency-seeking geoweb applications, social and political geoweb apps must still work within the limits of individualized consumer mapping.

On a deeper level, calling neogeographic maps democratic overlooks or conflates the position of consumer users compared to technologically privileged neogeographers and Googlers. It does not account for the digital divide of the costs of new technology, training and recognizing the need and utility of web mapping in the first place. For example, one prominent Googler with a GIS background states: "The democratization of Geographic Information in this way is the result of two things, firstly a simple, slick API for developers and secondly and most importantly of all, the making available of a consistent source of commercial geographic information at no cost to the developer or user" (Parsons, 8/15/2005). Even in a statement proclaiming democracy, he feels the need to differentiate two groups of people: neogeographic "developers" and users. The conditions of the neogeographer's subject position do open mapping to more people, especially those with a technical background, but that in itself does not make it as democratic as the rhetoric would imply. Not everyone is a neogeographer, much less a Googler, or even, with the digital divide, a user.

III. Users

What is Google Earth actually useful for? This question came up in 2010 as part of a discussion about Google Earth and open source alternatives on *Slashdot*, a technology news aggregator and discussion forum. Responding commenters described a range of uses including driving directions, planning hiking trips, assisting pilots, learning about geography and, in the words of one commenter, "as a toy" (Open Source Alternatives to Google Earth?, 3/24/2010). These uses are very different from Google Earth's or Google Maps' ultimate function for Google.

This difference shows yet another important subject position in play throughout the Google geo discourse: users. Software developers in the IT industry in general constantly refer to "users" as the people at the consumer, receiving end of the IT industry who utilize hardware and software. Google's executive management also regularly talks about users. "Focus on the user and all else will follow," for the ultimate purpose of Google's strategy of ubiquity is to collect revenue from users clicking on ads (Google Inc., 2011c). In talking about users, Google executive chairman Eric Schmidt even stated "I actually think most people don't want Google to answer their questions. They want Google to tell them what they should be doing next" (Holman, 8/14/2010). Given this concept, I employ the term "user" to denote the subject position of someone who utilizes Google's geo services, but on a basic, individual level. Users do not intentionally contribute data to Google's geo services or make map mashups or apps for broader consumption. They are part of Google's and neogeographers' technological initiatives as the people who use a map, generate advertising revenue and unintentionally supply data

for targeting ads. For example, they may use Google Maps to get driving directions or search for a business, but they are not using or creating maps for use by anyone other than themselves.

While Googlers and neogeographers have immense influence in structuring the user subject position, users don't tend to approach the discourse from that perspective. They don't self-consciously say to themselves "I'm a user." Instead, users encounter Google geo services in their daily lives and apply them in that context as secondary technological subjects. Many Google users, myself included, use Google so often that we think of it in terms of ourselves: my default home page or my go-to source of for driving directions. Taking a step back from this can be unsettling, as cyberpunk author William Gibson makes clear:

> Google is not ours. Which feels confusing, because we are its unpaid content-providers, in one way or another. We generate product for Google, our every search a minuscule contribution. Google is made of us, a sort of coral reef of human minds and their products. And still we balk at Mr. Schmidt's claim that we want Google to tell us what to do next. (Gibson, 8/31/2010)

The extent to which Google feels like it is yours or mine is a testament to the success of Google's individually targeted and customized services. Those services respond to our individual queries or consumer desires and, thanks to Google's strategy of ubiquity, in seemingly boundless and readily accessible ways.

Targeted individualization is part of Google's pursuit of making everyone a Google user, even people who don't know that they "need" its services. Google's ad-based strategy allows it to attract and retain loyal users through a popular and familiar experience, consumption. Compared to the trained and paying users of professional GIS

software packages, Google's user base is far larger and less sophisticated. In theory, anyone on the internet can use Google Maps. In practice, Google geo services facilitate a wide assortment of mapping topics and purposes, though nearly all of them retain the framework of consumption.

As mapping subjects in a consumer discourse, users enjoy a privileged position compared to people outside the discourse. On a basic level, users must be on the privileged side of the digital divide to have access to computers or smart devices with a connection to the internet and the technical experience to fully utilize those devices and map services. Users who share a device to access Google, such as in a library or even a household, are harder for Google to customize services for and target ads at. This is because that shared device has a mixed digital footprint. On another level, the most valuable users for ad targeting are those who have the income to spend. While some geoweb apps and thus relevant advertising involve staples such as milk or housing, many geoweb apps cater to those with discretionary income by focusing on travel, restaurants or other entertainment. Users occupy a valuable and privileged position of potential consumers who must be engaged lest the users lose interest and Google and neogeographers lose that advertising revenue and usage.

Enticing users with play

Unlike a professional GIS package, a consumer-grade mapping service must be easy to understand and entice users to come back again and again. Google accomplishes this by designing its map services to be elegantly simple and imbued with a sense of play.

The playful aspects of the Google geo discourse serve to both teach users a way of seeing and generate continued usage of the services.

Google's general design guidelines prioritize speed and simplicity. These are the principles behind the look of the quick-loading, mostly white google.com homepage (Mayer, 5/29/2008; Google Inc., 2009). In Google Maps, simple text ads still allow the bandwidth-taxing map service to be quick-loading. The single, simple Google Search bar on top retains its position as an easy and familiar way to find things in the map. This centrality of the search function allows users who do not know geography very well to use their experience with the Google search engine in a geographic context (Bailly, 4/2/2010; Coombe, 4/2/2010). It also allows Google to target ads not only based on what the map is showing, but to also based on what the user is searching for or has searched for in the past.

The user-experience of Google Earth also illustrates how designers combine Google's stripped-down style with elements of play. The default data view in Google Earth is a collage of aerial images rendered using the same techniques as late 1990's 3D video games (Bailly, 4/2/2010). Though it comes with the cultural authority of photography and a view from above, it offers an unusual perspective that has more in common with top-down view video games than most people's daily lives. Upon opening Google Earth, the program displays a geographic spectacle by zooming into the world (fig. 3.2), before centering on the United States or a given set of coordinates. This spectacle is captivating and situates the user by focusing on something familiar within this unusual perspective. Many people re-affirm this way of seeing by looking at their

home, a site of personal familiarity, the first time they use an aerial photo-enabled map service (Jones, 3/31/2010).

After the initial spectacle, the geo services are a geographic world to learn about and play in. Similar to a toy, Google's cartographic design uses bright colors and a simple interface. On Google Earth or Google Maps, users are alone and face no external threats. They cannot break things or hurt themselves. Taking advantage of this, Google invites users to further playfully identify with actions and things in the maps. Google Earth offers a basic flight simulator that allows users to fly through and crash into Google Earth's 3D landscapes. Street View uses a yellow person icon, "pegman," to help users identify with the picture's location within the bird's eye view of the map. Google also does things periodically to remind users of its playfulness. On St. Patrick's Day 2008, the Street View pegman became a leprechaun (Lafon and Szybalski, 11/15/2008). On April Fool's day 2007, a Googler created a mashup that allowed users to add a sinkhole, Godzilla, a blur, a brontosaurus, a massive fault line or a giant bug to a location of the user's choice (fig. 5.5) (Schwartz, 4/2/2007). Neogeographers also facilitate and participate in user play. A large part of this play comes through playful geoweb applications. Neogeographers who participate in crowdsourcing projects also create playful content in the services that add to users' experiences. For example, they build and add three-dimensional models of buildings and landmarks, such as Walt Disney World and Chapel Hill's old well in Google Earth (fig. 5.6)(Taylor, 6/4/2008). They also identify and mark interesting features in the services, such as landforms that look like faces (fig. 5.7)(Pegg, 10/27/2006).

These examples may seem cute or silly but they are a first step in users understanding how to see with this geographic data. To fully utilize the geo services, users must move beyond simply viewing a spectacle to knowing what they see.

Seeing and knowing

Veracity

A key objective for users is to see with enough confidence that they can use the geo services for both playful and practical functions. To sustain users' trust, Google must maintain a reliable public reputation for showing what is actually there. For users, this can provide a sort of geographic epistemological security, knowing that something is there because they can see it through Google geo services. For example, in the words of former President G. W. Bush, "One of the things I've used on the Google is to pull up maps… you get the satellite, and you can - like, I kinda like to look at the ranch. It remind[s] me of where I wanna be sometimes" (Schwartz, 10/24/2006).

The need for this veracity may seem obvious given Google's mission and other services, but Google must deal with periodic challenges to its geographic information to maintain the trust of users. To do so, the company uses the same technocratic logic as it does when it claims its search results are "unbiased and objective" because they are product of a technology, the PageRank^{tm} algorithm (Battelle, 2005). Such an approach gives the impression that Google geo services are objective geographic truth-tellers, even as they reflect choices made by Google's management for Google's capitalistic imperatives.

For example, only months after Google Maps' launch in 2005, Hurricane Katrina devastated New Orleans and the nearby Gulf Coast, a watershed event in both the usage of Google geo services and Google's form of geographic truth. Volunteers from Google, NOAA, NASA and others organizations updated Google Maps' and Google Earth's default images with post-storm imagery as quickly as possible. A year later in September 2006, Google replaced the post-storm imagery with higher-resolution pre-storm imagery as part of a regular update to its data servers. In response, there was a public outcry that culminated with U.S. Congressmen accusing Google of "airbrushing history" (Broache, 4/2/2007). Google was unprepared for the controversy. Following Google's technological modus operandi, they had simply updated the imagery with better quality, if older, data (Hanke, 4/2/2007). However, in this case, users' emotional and political perceptions and experiences of New Orleans at the time were too strong to accept the new, pre-storm information Google supplied. In response, Google made the post-storm imagery available again, a tactic of update and fix that the company has used repeatedly since then in other, similar major cases such as of mislabeled or missing towns and incorrectly drawn international borders (Batty, 11/5/2009; Clarke, 9/24/2010; Taylor, 4/30/2007; Geens, 3/11/2010).

Unlike the case of Hurricane Katrina, most instances of incorrect geographic information in Google geo services are minor errors in street data which lead to bad directions. These sorts of errors are less likely to attract attention than natural disaster imagery and thus less likely to be fixed. Google offers ways to report and correct issues, but unless someone complains, the error is likely to remain in the data. It is not clear if persistent minor errors cause many users to abandon Google's geo services. Expert

observers expected and found a serious degradation in Google's data quality when Google ended their relationship with the street data vendor TeleAtlas and began to use only Google's own street data in the United States. (Batty, 10/7/2009; 10/13/2009; 11/5/2009; Fee, 10/7/2009; 10/26/2009). However, according to estimates from Quantcast, traffic on maps.google.com did not drop but rather showed a typical usage pattern for that time of year and a general growth trend (Quantcast, 12/1/2010).

Seeing through exception

To know geography with Google's geo services, users must do more than trust the validity of Google's data. They also must be able interpret the information Google provides. Yet again, play is a vital part of the process of producing user subjects. In a discourse so dedicated to identifying what is there on the ground, places were Google's services are ambiguous, confusing or meant to be secret help facilitate users' ways of seeing. Finding, examining, noting contextual details, identifying, labeling and arguing about what appears on a map or in an image gets users to think about what might be represented in the map or image and how to eliminate ridiculous and erroneous possibilities.

For several years after the launch of Google Maps and Earth in 2005, tabloid magazines provided lots of reader-submitted images from Google's geo services with sensational explanations. Frequently, users picked up these stories to argue about and ridicule on internet comment forums. For example, in August 2009, *The Sun* ran an image from Google Maps that a reader suggested showed the Loch Ness monster (fig. 5.8)(Lazzeri and Whelan, 8/26/2009). On the irreverent news aggregator Fark.com, users

discussed the image at some length. No one on the forum seemed to seriously believe that the image pictured the Loch Ness monster. Many commenters made silly or sarcastic remarks that served to demonstrate that they knew how to interpret the image better than *The Sun*'s readers and editors. This derision even took cartographic forms as commenters manipulated the image to show President Obama's birth certificate instead of the "monster." The banter also created a discussion about what actually appeared in the image. Rocks? A current? Reflection on the water? Most commenters seemed to settle on a boat with a wake (An Amazing Image on Google Earth Could Be the Elusive Proof that the Loch Ness Monster Exists, 8/26/2009).

A better-known case featured an image of what users and at least one tabloid claimed to be a missile in flight over Colorado (fig. 5.9). At a glance, the image shows a missile-like object composed of a pointed white tube and small white fins. In a discussion forum on Digg.com, users pointed out that the object was rather long for a cruise missile at that scale in Google Maps. It also had wide, black wings that were easy to overlook. These points cast doubts on the missile theory, which users further reinforced by posting links to Wikipedia about contrails and further discussion about exactly what model of aircraft it was (Cruise Missile Caught on Google Maps Flying over Utah, 10/27/2007). The whole arc of the discussion illustrates a process of users examining an image and carefully sharing points and methods to better know what appears in it.

Users seeing and knowing with the kind of confidence displayed in these examples inspires a snarky interest in the technologies and politics of how Google (and by extension the geospatial industry and the government) processes data. For example,

an image humorously described in the *New York Times* as "the stairway to heaven in Brooklyn" is a lens-flare that shows the limits of Google's Street View camera technology (Wortham, 8/4/2009). On the topic of secrecy, *The Register*, a U.K. technology news site, ran a series of stories between 2005 and 2009 showing various partially secret military sites in Google Maps imagery (Haines, 10/14/2005; 1/17/2006; 9/21/2006; 3/2/2009). The site also ran humorous contests in which users searched for "black helicopters" or tried to identify objects in Google's imagery of a military site (Haines, 10/14/2005; 1/17/2006). These sorts of games are entertaining and remind users how Google's information is part of political processes.

The issues of secrecy and censorship are among the few ways that the state is a formal consideration to Google geo service users. As the stories and contests in *The Register* make clear, there is a certain thrill for some users in using Google Maps to look at government sites, particularly those that are closed to the public. However, the novelty of looking at closed government sites seems more related to users' access to new geographic technologies than actual interest in the sites. By now, "revealing" stories in *The Register*, tabloids and other news sites are more likely to run stories about Street View and tracking smartphones than Google Maps images of military installations (Foresman, 4/22/2011). Even as the novelty of Google Maps fades into everyday life, censorship remains an issue. Some users perceive it as Google bending to or resisting the will of government agencies (Haines, 3/2/2009). In reality, imagery is censored for both government and private reasons and may happen at any point in the data commodity chain. Consequently, Google's collage of different data sources makes for wildly inconsistent degrees of censorship. Nevertheless, the popular concept of censorship is

that of a government tool to control what people see and know. Users' perception of government involvement may center on censorship, even if a government isn't actually involved.

Personalized geographic efficiency

Given the common themes of modern state mapping, such as military actions, resource management and demographics, it is no surprise that these are not common topics among Google geo's users. They are consumer users with individual concerns. Seeing and knowing with Google services allows users to employ GPS turn-by-turn navigation on smartphones, Street View and other Google geo services to improve their own geographic efficiency. This efficiency may be identifying the quickest route, spending less time lost or calculating the time and cost of a taxi compared to mass transit or walking.

Much like enticing consumers with spectacle and play, the Google's geo services and many neogeographers' geoweb apps employ hyperlocal ways of seeing to link users with powerful, broad-scale geographic technologies. This navigational hyperlocality allows a very precise, individualized efficiency to be calculated and cartographically visualized. On the users part, this also involves a degree of privilege. Becoming more efficient by using Google Maps or a geoweb app requires a time investment to learn and use the tool. Ironically, those who may most need the time savings of targeted geographic efficiency may not have the time to take advantage of such services.

On the most basic level, a user can manually enter their criteria and Google Maps will calculate the shortest or quickest route and other characteristics of a journey. Google

tries to streamline the process of entering the criteria by making geographic suggestions based on information it has about the user. Google's ideal is to have a service that "will be so good it will be very hard for people to watch or consume something that has not in some sense been tailored for them" (Holman, 8/14/2010). Geographically, this means more than calculating the shortest route. For example, in an ideal case, a user's phone would remind them to stop by the grocery store on their evening commute because they are low on milk at home and will be driving right past the store. The advertising possibilities for such cases are enormous. Theoretically, a user in such a situation could see an advertisement or even a coupon for a particular brand of milk available at that store. In the near term, Google intends to serve customized results to users based on a combination of the user's intention, history and the user's friends' histories (Parsons, 3/31/2010). This would mean that one's experience of Google Maps would be customized not only by stated search terms, preferences, locations, and web surfing history (as Google already does) but also by similar data from people the user knows. In the words of Eric Schmidt, "If I look at enough of your messaging and your location, and use artificial intelligence…we can predict where you are going to go" (Holman, 8/14/2010).

The technological valorization of individual geographic efficiency renders it most useful at a very local scale, reproducing the map services' consumer focus. In addition to a local-scale bias, such ubiquitous access to mapping services may hint at a fear of being lost without Google.

Individually optimized navigation

Wayfinding in Google Maps works by serving very specific geographic information to each user from an unseen reserve of data on a remote Google server. This allows Google Maps to be much more specific and work at far more local scales than state or regional roadmaps. Using that individualized information, Google geographically optimizes a route. For example, Google Maps will calculate an optimized driving route based on the fastest route or routes without freeways. Optimization can also take other forms such as minimizing the number of restaurants to consider before finding the right one, understanding one's location in relation to dangers, and even playful games such as how to best run away from a zombies (Woodruff, 8/23/2010).

The emphasis on navigational efficiency is also apparent in the visual construction of the geo services. They are simple and quick-loading. The default "map" view in Google Maps is a view of roads, highways, towns, political boundaries, bodies of water, green spaces etc... Its design is descended from Danish roadmaps and its original idea was to help Google users find and get to local businesses, especially those that advertise on Google (Wallace, 2009; Kane, 2/8/2005).

As opposed large institutional mapping initiatives, the quantitative benefits of the very highest geographical efficiency for a single user are often tiny. Consequently, this is a qualitatively different kind of efficiency because it uses a hyperlocal way of seeing focused on the priorities of an individual consumer. The presumption is that the map service will help a user set aside personal habits and prejudices to technologically identify the most geographically efficient and desirable option. In concert with geoweb apps, Google's individually optimized navigation will locate the best jogging route *for*

you, the right apartment *for you*, the closest Indian restaurant *to you*, and the bar where *your* friends already are ("Lazy Geo," 5/23/2009). For example, the map application Crow's Flight on Android smartphones allows the user to define a street address in Google Maps and thereafter a compass application in the phone will orient toward that point and give a distance to it (Wang, 12/16/2009). This is a noteworthy break from the cartographic convention of the North Pole as the universal reference point and peoples' use of vision and memory to track landmarks in everyday navigation. Nevertheless, the system as a whole still depends on universal standardized geographic data, including a polar reference.

A fear of being lost?

Constant tracking and navigational efficiency also pose darker questions about the margins of ubiquity and the Google geo discourse. For those who have little confidence in their own sense of direction, GPS driving directions (and their limits) up the ante with both authoritative, real-time directions, and new ways of being lost on minor streets and roads (Yoffe, 7/11/2009). One Googler told me he consistently felt lost outside his mobile phone provider's coverage on a trip to Europe because he couldn't use Google Maps. He had this anxiety even though he had access to other, locally-produced maps (Friedman, personal communication, 5/28/2009).

His case is unusually clear and extreme, but it hints at something about the discourse beyond efficiency. Google's internet search engine and its map services act as epistemological references that refer back to each other. Does Google's view from above and users' geographic epistemological security impart a sense of a safety? For some

users, it may facilitate a fear of being lost, of not being geographically optimized, or even of disappearing from the map. Google's strategy of geographic ubiquity appears to serve geographic information to anyone who is anywhere. Conversely, if a user is accustomed to being within the discourse and suddenly stops receiving that information, where are they? In such a case, any local geographic information they come across also cannot be corroborated by Google. Since this anxiety would re-affirm the "need" for fully ubiquitous access to Google Maps, the account from the lost Googler is more a sales pitch than a coincidence. At another conference, a neogeographer I encountered even dreamed of creating a smartphone app with a meter on it that geographically rated one's safety on a scale from perfectly safe to imminent death (Lazy Geo, 5/23/2009). If such an application actually existed, it would function only as long as the batteries didn't die and it remained connected to the geographic data stream. Even the dream of such a geoweb app articulates a fear that may be conquered with the right kind of geographic efficiency.

User privacy

A final important aspect of the user subject position is privacy. By using Google's services, users knowingly and unknowingly give personal information to Google. Issues such as the nature of the information collected, services that default to opting-in vs. opting-out, how long Google stores personal information and who they share it with are all increasingly salient questions. Google argues that its methods are reasonable, in keeping with their mission, and necessary to continue to serve Google's individually customized services. More personal information for longer periods allows

Google better target ads. For those with qualms, the company points to the option of opting out of a given service on an individual basis, but fully opting out of Google is a difficult, blunt method for users and does nothing to change the structure of tracking. In fact, Google faces consistent, pointed criticism on this topic (Vaidhyanathan, 2011; Foresman, 2011; Vascellaro, 8/10/2010). Just how neogeographers and other independent software developers collect and handle personal information in their apps complicates the situation even further. Given this debate, there are two kinds of geographic user privacy that are particularly important to the subject position of users in the Google geo discourse: imagery and location.

Imagery

In many ways, Google's geographical imagery is its most far-reaching form of information organization. Through aerial or Street View imagery, Google may collect personal information, including images of private property, activities, and bodies, even if one has never been online. Needless to say, Google does not obtain consent to collect this imagery. While it is common for private companies to collect aerial imagery, Google's unprecedented Street View program has raised concerns around the world. Google justifies its actions by arguing that Street View data is only collected from public spaces. It is legal in the U.S. to collect such information in public spaces, though no one before has ever taken it to the systematic degree that Street View does. Other countries have rather different legal and cultural expectations of privacy. Street View alone caused public outcries in the United Kingdom and Japan and faced legal restrictions if not outright bans on the collection of imagery in Germany, Switzerland and Greece (Dolan

and Wrenn, 4/4/2009; Rosenblatt, 8/14/2008; Matyszczyk, 8/24/2009; 11/1/2010; McGee, 5/12/2009).

When aerial imagery or Street View comes to a new area, there are often news stories about its novelty and apprehension or even resistance among local residents. In time, both the novelty and criticism wear down and Google continues to collect and provide Street View imagery. People who confront Google about Street View have met mixed success. One Minnesota town successfully kept out Street View cars because it is located on private property (Pabst, 5/31/2008). Residents of an upper-class suburb in the U.K. literally blocked a Street View car from their neighborhood using a human chain in 2009 (Dolan and Wrenn, 4/4/2009). A Pennsylvania couple won a lawsuit in principle when a Street View car trespassed a driveway on their private property, but they were only awarded $1 for their trouble (Inskeep, 12/2/2010). Homeowners in Germany may by law ask to have their residences blurred (Matyszczyk, 11/1/2010). Despite the participants' intent, each of these cases of confronting Google brought more press attention and ridicule than if they had simply consented to Street View.

Locational privacy

As more users access Google geo services with mobile devices, another kind of privacy concern is emerging. Using mobile devices, Google increasingly tracks all the movements of its users. A wired, stationary IP address on the internet provides Google with some measure of location, but mobile devices can also be located using GPS signals, cell-tower signals and IP address-linked local wireless networks. Leaked memos between Google executives reveal that they think this sort of locational information is

"extremely valuable to Google" (Swift, 4/30/2011). Information about where users are is useful not only for targeting ads, but also in a host of other mobile services such as generating data for Google's traffic maps.

In early 2011, this issue reached a new degree of controversy when reports of user location tracking by iPhones and Android smartphones hit the technology press (Foresman, 4/22/2011). In addition to the phones' operating systems, neogeographers also employ and collect user location information in their geoweb applications as well. For users who carry their mobile phones everywhere they go, this kind of tracking represents an unprecedented precision in data about their everyday movements that is reported to multiple parties. Though Google claims that location-based mobile applications on Android phones require users to opt-in to locational tracking, it is not clear how aware users are that they are tracked. In theory, knowledgeable users could opt-out and suffer the loss of certain geo services.

The increasing public awareness of imagery and locational privacy fits right in with long-running criticisms of Google on the topic of privacy. This popular debate may herald the involvement of the state in the Google geo discourse through privacy regulation. In response to the 2011 iPhone and Android location tracking controversy, Senator Franken of Minnesota introduced legislation in the U.S. Senate to set strict limits on what geographic data devices can collect and how long companies may keep that data on record (Cheng, 6/16/2011).

Conclusions

Googlers, neogeographers, users. The knowledges and relationships between these subject positions indicate a great deal about the Google geo discourse. The circumstances of mapmaking by Googlers and neogeographers indicate how different it is from classical cartography. Furthermore, the importance of users is a sign of the geo services' consumer orientation. Google, in its pursuit of geographic ubiquity and advertising revenue, exercises no small amount of power in delimiting the geo discourse and organizing it around its enterprise. As subjects who work for the company, Googlers assist in this pursuit. Neogeographers hold a complex position of making maps that are limited by Google and their own priorities. However, a neogeographer occasionally creates something that pushes the margins and the rest of the discourse must adjust. Users encounter Google geo services in the context of their own lives and put them to use from their own situation.

In practice, these relationships make for a way of seeing with Google's geo services that has particular consumer characteristics. The maps themselves are mostly short-lived, temporary consumable goods. Play is a common phenomenon among all three subject positions and serves to keep subjects engaged and teach them how to see geographically. Geographic efficiency for individual consumers' needs is another common theme. Finally, the cartographic and technological basis of these subject positions calls into question claims of democratic mapmaking within the discourse. Though the Google geo discourse has opened mapping to more people and simplified that mapping to an unprecedented degree, there remain different orders of subjects and a focus on consumer priorities. As a consumer mapping discourse, it is not administered

by a democratic body or the state. Where the state does appear for these subjects it is more often a source of data, censorship, and protecting citizens' privacy rights.

As it stands, the Google geo discourse is structured around Google's capital accumulation and consumer users. Neogeographers in the Google geo discourse may have the means to occasionally restructure the discourse, but many are happy to work on the next 'killer app' for consumers and the rewards that popular geoweb apps bring. Those who are not content move to other, more open, yet obscure places in the geoweb.

Chapter Six: Conclusions

"How do you get to 104 NC 54?" Leaning out of his car window on the back streets of Carrboro, North Carolina, the young man interrupting my afternoon jog is clearly lost. In his hand, I see a smartphone displaying Google Maps directions on the screen. Though I've lived in Carrboro for years, the question is disconcerting. I don't recall places by their numeric street address, and NC 54 is a major road through Carrboro. Employing my own visual and practiced jogger's knowledge, I make an educated guess. "You mean Carrboro Plaza with the supermarket? Easy. Take the next right and go straight for a while, on through the light and into the parking lot." "But is that 104 NC 54?" he insists. "It's the strip mall with the supermarket on 54," I reply, "but I don't know the number." "Well, forget it." he says, and drives off.

It's not that either of our geographic knowledges are necessarily wrong, but rather that they are incompatible and mine isn't useful in the mind of the young man. He clearly trusts the authority of Google Maps with its individualized map and standardized, numeric street addresses, even if it leads him astray. The very geographic information that allows Google to maintain a huge, standardized, and yet locally detailed street index differed from my own local knowledge to the extent that I couldn't help him.

Popular geography

Google geo services are part of new, widely influential ways of seeing and understanding the world. Utilizing socially-situated technical characteristics, Google geo services are fast, hyperlocal, imagery-rich, apparently comprehensive and accessible in

many ways. These characteristics, both reflecting and reproducing Google's capital accumulation strategy, make the services at least seem ubiquitous. Google's drive to ubiquity is key to the company's capital accumulation in that it attracts many new people into using and making maps more often. As powerful and common ways of seeing the world, we must engage Google's geo services as an increasingly popular technological platform shaping a contemporary geographical imagination. Just as U.S. government policies and elementary education helped define a geographical imagination of names and capitals to many Americans in an earlier age (Schulten, 2001), Google geo services and others like them are affecting popular concepts of geography. They are used on tens of millions of web browsers and mobile devices, appear in popular media, allow many people to make effective maps, create expectations about the content and performance of maps, and are even influencing the visual style of non-Google cartographic designers (Wallace, 3/27/2009). As geographers, we must heed these popular visions, for they are shifting the conceptual ground under our feet.

In this shifting landscape of accessible maps, self-built geoweb apps, hundreds of millions of downloads, and Google's claims to ubiquity, not everyone has equal standing. Primary technological subjects, such as Googlers and some neogeographers, design, build, and reshape the geo services to more efficiently serve their masterful and often capitalistic purposes. In practice, this lays the groundwork for and defines some of the boundaries of the Google geo discourse. Secondary technological subjects encounter, use, and envision the world with these technologies from the context of their daily lives. These subjects have their own reasons for using the services and making maps. Their reasons often don't match the purposes of the primary subjects. Nevertheless, secondary

subjects' use of the geo services and viewing practices happen within a context of technologies designed by the primary subjects (Feenberg, 1999; 2002)

The nature of these social roles and the related geographical imagination are important for more reasons than simple fairness. Critical cartography and critical GIS make clear the social, political stakes of geographic information in governmental and hopefully democratic processes (Schuurman, 2000; Crampton, 2010). The Google geo discourse also has clear economic and personal dimensions to many of its individual users. It influences how we move through space and what we see, as the young man lost in Carrboro indicates. Finally, the technical and social limits of the discourse have a bearing on as-of-yet unimagined mapping possibilities, as was the case for Paul Rademacher and his first map mashup.

This study has engaged the popular discourse around Google geo services to better understand the circumstances that led to it, the nature of the services as part of Google, and the subjects and their knowledges within the discourse. Through this analysis, the themes of ubiquity, consumer-oriented mapping, and the state, outlined in Chapter One, have come into sharper focus.

Google's ubiquity

To follow the logic of Eric Schmidt, in a digital environment of infinite flawless copies, ubiquity, not scarcity, has value (Cleland, 4/7/2009; Rowan, 6/30/2009). When substantive content costs little, the company that best offers anything on the web and is available anywhere, anytime will become profitable. Such lofty thinking smacks of dot-com bubble entrepreneurial optimism, but those ideas, paired with targeted advertising,

have served Google very well since the company's founding. Search results and ads that display the right, relevant things, even things the user didn't anticipate, will create more clicks on advertisements and more revenue for Google. Though Schmidt's narrative may sound simple, a huge amount of engineering and design goes into making Google services as popular, common and everyday as they are. This outlay of capital pays off because targeting ads in each of its services uses the same general kind of technology as Google's greatest strength, a search engine. Google further multiplies the value of its services by using Google search to connect its services together. A recent example is Google's combination of Google+, the company's Facebook-style social-networking service, with its internet search engine. Searching Google may now return comments or images posted by a user or the user's friends as search results from the web (Singhal, 1/10/2012). Though very powerful, Google's ubiquity-oriented strategy relies on the continued growth of content on the web. More of the right content means more use of Google and more advertising-clicks. Therefore, Google encourages technical innovation and posting content on the web through services such as YouTube, Google+ and Google Maps.

Whether as an internet search engine, social network, or map service, Google connects a seemingly comprehensive store of data with individualized results and ads for each user. While partly built on technologies, innovations, and ways of seeing developed by the (Cold War) American state, this is significantly different from earlier mass-media and state-centered cartography. Users and neogeographers may customize their very own maps. Encouraging people to participate in Google geo services adds content to the web while also getting and keeping subjects engaged.

Seeing through Google geo services

Understanding this idea of ubiquity with specific customizability and advertising clarifies the foundations of the Google geo discourse's ways of seeing. Fundamentally, Google geo services reach so many people because they are designed to be popularly useful to consumer users. Compared to the technological, cartographic forebears in the Cold War and even the Renaissance, Google's strategy of ubiquity paired with advertising must be popular to succeed. Nobility don't buy many maps in the 21st century and the existing geospatial industry is a well-established, yet comparatively small market. Today's consumers are a far larger pool of users and advertising-clicks. However, geo services designed for consumer users must make the ways of seeing with those services accessible, easy, and engaging for user-subjects with little or no experience. Through hyperlocal visual shifts, inexperienced users can make a visual connection between apparently comprehensive global coverage and the individual local features they are interested in. Google backs up hyperlocality with extensive use of photography, including Street View imagery and aerial images. Accessible aerial imagery of so many places is yet another way of seeing that provides both huge amounts of geographic information and the epistemological authority of photographs (Crary, 1989; Cosgrove, 2001). The visual combination of hyperlocal views and accessible imagery provides a comprehensive looking and locally specific view that includes photographic information. Google geo services are a detailed, world-wide epistemological geographic authority. Seeing with Google Maps or Google Earth allows users to know with authority that what they're looking for is (or isn't) where they are

looking. The structure of that mapping practice shows how both Google's strategy of ubiquity and individualization as well as the actions of users are part of these ways of seeing. The Google geo discourse's technologies, subjects, and ways of seeing are shaped and limited by the very economic and cultural relationships that produce the discourse.

The limits and possibilities of the Google geo discourse are most apparent through its secondary technological subject positions. Most people reading and using Google's maps are users. Targeted advertising is more profitable when focused on users as consumers rather than just smaller markets of policy makers or GIS experts. Access to and the purpose of mapping for most of these consumer users is not a function of citizenship in the same way that political identity is foundational for maps in regional planning, the census, military strategy, or even indigenous mapping.

Users with individualized, consumer applications are unlikely to have formal cartographic or GIS training or to know the technical characteristics of mapping services and digital geographic data. What matters to them is that the map service works for their purposes. For many users, Google geo services are an amazing black box with hyperlocal, imagery-rich outputs which consequently have great epistemological authority. In many cases, the services really do offer the best geographic options, especially for long distance directions or very specific questions. As a relatively new technology to users, Google geo services may have a few minor errors that require local geographic knowledge, but ultimately they look generally trustworthy. This generally trustworthy quality allows the services to be good enough for consumer applications of geographic and navigational efficiency. It also allows Google to procure data that is

cheap, but possibly more error-prone because it is crowdsourced or old government data (Fee 10/7/2009; 10/26/2009). Some data are better than none at all, and a wrong turn due bad directions on a family vacation is not the same kind of problem as a wrong turn by a property surveyor or army division.

In addition to users, neogeographers work to create maps to suit their own secondary technological subject positions. Occasionally a neogeographer may also act as a primary technological subject by creating a new technology as part of a larger, often capitalistic, strategy. Through crowdsourcing, Google re-incorporates neogeographic labor into its capital accumulation. However, many neogeographers find the arrangement worthwhile because they enjoy the work, are using it for social or political ends, or because they have their own small business based on that Google geo service.

Though their maps and geoweb apps are not defined or determined by Google, they are built using Google's services and therefore share ways of seeing and characteristics with the rest of the discourse. For example, geographic efficiency and play are very common themes in third-party geoweb apps and Google's core services alike. Moreover, as consumer services, whole geoweb applications are often cheap and temporary. Even if they are good for more than one use, they may be forgotten in short order. To survive, Google and neogeographers find ways to keep users engaged through sheer practically, such as traffic maps, or through playful gaming mechanics such as the massive Monopoly-on-Google Maps application in 2009 (Jurgens, 12/2009; Modine, 9/9/2009). Alternatively, many neogeographers don't support applications for very long, meaning an application or mashup may go offline in a matter of weeks or months.

Occasionally, neogeographic tinkering will construct something that doesn't fit the current discourse and Google will be forced to react by either incorporating and encouraging it, as it did with mashups, or clamping down, as it does to those who download its geographic data. Given this limited range of action, many influential neogeographers have shifted from the Google geo discourse to other discourses with open-source code and open data.

The state, still in the picture

Due to Google geo services and other similar services, web users in general are becoming more aware of geospatial technologies. What where once secret or obscure military ways of seeing, such as satellite images and GPS, are now common knowledges. Even in this popular, consumer-oriented context, state agencies continue to have a complex role in the Google geo discourse. Hyperlocality and aerial imagery are no longer limited to state programs and contractors, yet governments still routinely use them for applications such as military reconnaissance and municipal services (Paglin, 2009). Government agencies also partner with technology companies through investments such as In-Q-Tel's venture capital, or partnerships, as with the GeoEye satellites (Brinton, 2/9/2009; Siegler, 8/29/2008). In at least some cases, the consumer mentality of Google's services turn back on the state as users and neogeographers demand public-domain data or use web applications to request public services such as graffiti removal or patching potholes (Clarke, 10/1/2008; Geospatial Revolution, 2010; Wherecamp, 2009; Where 2.0, 2010).

Broader public awareness of geotechnologies is also drawing the attention of politicians and regulators. Consumer mapping technologies are still new and novel enough that they may draw sufficient attention to prompt regulation. For example, Street View is already tightly regulated in a number of countries (Dolan and Wrenn, 4/4/2009; Rosenblatt, 8/14/2008; Matyszczyk, 8/24/2009; 11/1/2010; McGee, 5/12/2009). In the United States, there is a growing awareness of the issue of locational privacy involving both government and commercial location-tracking. This awareness is in part due to the prevalence of consumer geotechnologies, controversies around smartphones, and a recent U.S. Supreme Court finding on the use of GPS trackers by law enforcement (Denniston, 1/23/2012). In this environment, recent calls in the U.S. for regulating how companies such as Google may track users' locations through their phones show some promise (Foresman, 4/22/2011).

Maps, power and technology

The shifting roles of the state and the primacy of consumer considerations in the Google geo discourse some give indications about broader social processes. The Google geo discourse provides a new dimension for questions about democratic mapping and possible new kinds of maps. It also reflects larger trends involving web technology. Finally, there are openings for further research about mapping and the web that could work from this study.

What kind of mapping could it be?

From an early stage, scholars working on critical cartography and critical GIS have tried to identify and practice equitable, participatory, democratic forms of mapping and GIS (Pickles, 1995; Schuurman, 2000; Sheppard, 2005; Sieber, 2006). Google geo services were built for a different reason, Google's capital accumulation. The services themselves reflect Google's ubiquitous yet individualized strategy of targeted advertising. They are premised on an individual user's entry into the services with a Google account and a PC, smartphone, or similar device. The technology is not designed for multiple people to interact with it at once except through separate Google accounts on multiple devices. If everyone has a workstation and a login, collaboration is possible in some cases such as My Places and Google Map Maker. However, even in those cases, there is no easy, built-in way to work with groups or teams instead of individuals.

As such, the Google geo services take requests and serve huge numbers of individual users in participatory ways. Each user in part customizes his or her experience by choosing what to look at. Neogeographers take this another step by contributing data and creating maps for general consumption. Even people who don't use the internet may show up in Google's imagery. Much like capital itself, everyone is, as a matter of principle, a participant with Google.

Michael T. Jones claims this means that Google geo services are "Mapping of the people, by the people, for the people" (10/12/2009). That's very well for Google, but can the rest of us really say that Google geo services are democratic because people participate? Google is a company, not a representative government. There is no electoral aspect to the Google Geo division and most people don't have a vote in Google's

shareholder meetings. We, users of Google, are consumer users and neogeographers, not citizens in some "United States of Google" or even a "United States of the web."

Nevertheless, the forms of participation in Google geo services raise important considerations for practitioners of participatory mapping/GIS. Could such projects utilize the ways of seeing popularized by Google? Could participatory mapping initiatives learn from Google's simple, masterful user interfaces? To what extent are Google Map Maker and Open Street Map viable and equitable ways to build and run a participatory map service on a scale larger than a single community or region?

Google geo services are clearly useful in some participatory frameworks (Miller, 2006; Lehrer, 9/24/2007; Clarke, 10/1/2008; Google Inc., 2010a), but practitioners should never forget that participation and openness on Google's part is not its core purpose and that doing so comes with tradeoffs. Participation through edits, web apps and APIs is part of Google's current business strategy, and the company's ultimate objective is capital accumulation. Therefore, there are other, reflexive questions about working in the Google geo discourse for participatory mapmakers, neogeographers and users. What does participation mean in a given web context? Do participants adequately understand the technical characteristics and biases of ways of seeing such as types of image quality and hyperlocality's local tendencies? Would web-based participatory projects be too easily disposable? Do people have an equitable say in the process? Can people choose not to participate? Where does the data produced go? Does Google keep a copy of the data? Is it searchable on the web? Depending on the context of the project, these issues may be either minor or an insurmountable problem.

Wither web technologies?

The processes at play in the Google geo discourse also seem to be indicative of other, larger tends involving technology and the web. In the mid-late 00's Google Maps was at the forefront of technical innovation on the web. Map mashups and the Google Maps API played a large part in shifting Google Inc.'s overall strategy towards openness, APIs, and outside software developers in general. Since then, most Google geo services, including Google Earth and Google Maps, have gradually become useful but banal technologies connected to, but not on, the cutting edge of new internet technologies (Where 2.0, 2010; Wherecamp 2010). Current excitement, innovation, and venture capital seems more focused on sectors that may or may not be intrinsically geographic such as social networks and augmented reality (Wherecamp, 2010; Where 2.0, 2010).

On the longer timeframe of the last 60 years, information technologies are increasingly consumer-oriented with lower costs, less coding, more functions, more content, more ways to buy things, and more forms of advertising than previous decades. The prioritization of consumers is apparent in the recent shift toward cloud computing that uses web-connected corporate servers for computation and data storage.[47] As a result, web-hosted services can be faster, more efficient and support comparatively small, slow, and cheap mobile devices. Web-based network architectures also allow services such as Google Maps and Google Earth to include far more geographic data than could fit on a single PC, much less smartphone. This shift in computing architecture away from

[47] For example, Google Docs, a cloud computing web service, is hosted on a web server. Whereas, the older MS Word is hosted on users' PCs. Google Maps is hosted on a web server, but the traditional ESRI ArcGIS desktop suite is hosted on a user's PC. Other cloud computing platforms include Youtube, iCloud, Pandora, Netflix streaming, Dropbox, Gmail, and other webmail services.

independent PCs also has real effects for users and neogeographers beyond new, faster web services.

The issue of privacy is an important one. My Places maps are stored on Google's servers, not a neogeographers' computer, meaning a different set of rules for access by Google and law enforcement. Do people consent to Google sharing their data and maps? Do users and software developers really understand the terms of service for web applications and services? Very few people actually read the legal agreements that they enter into when using a service or app, and the increasing connectivity of wireless, web technologies ups the stakes for these agreements. For example, Google faced a public relations storm when it became well known that it was tracking the location of users' smartphones, even though every tracked user had technically agreed to those terms (Foresman, 4/22/2011).

Shifting to cloud web services also allow companies to centralize the management and access to data. If a company goes bankrupt or is shut down by the government, users could lose their data overnight. Centralized periodic updates by Google may not be compatible with all third-party web applications, causing the apps to break down. In this environment, it is possible for companies, such as Google, to provide API services that are functionally, but not legally open source code or open data. Unlike open frameworks, APIs are close enough to the company that it can pull back the reins if outside software developers get out of control in a way that doesn't serve the company. Google may also capitalize on the benefits of a service that is almost, but not quite, open because many fully open licenses restrict businesses. This precarious arrangement is further motivation

for neogeographers and other software developers to create light, temporary web applications.

Beyond the apps themselves, the shift to networked web technologies also correlates with a shift in business models for companies with a consumer user-base such as Google, Facebook, Netflix, and Apple. As opposed to users buying software and/or hardware and owning it as long as it works, web services are more likely to use advertising or renewable subscriptions. Hosting the data and services on central web servers removes a degree of user control, even over their own data. In the words of monologist Mike Daisey in speaking about his iPhone and similar devices "You probably think *you* own them. Why? Because you paid for them? Silly! The corporations would see it a different way. They would say the devices run on their networks, so they should control them…" (Daisey, 2/21/2012).

Google, of course, focuses on targeted advertising, an arrangement as confusing for many people as Apple's control of users' iPhones. To Google's credit, it is more dedicated to an open web than the corporately-controlled closed garden networks of Apple, Facebook and various internet service providers. For researchers, web-based advertising businesses call for close attention to the political economy and related subject positions of companies both at large and small scales. Small-scale developers may not seem like much compared to Google, but the ascendance of map mashups and geoweb apps since 2005 is an indication of how small-scale projects and priorities can have dramatic effects.

Future openings

I designed and carried out this research as an exploration and analysis of the social processes and geographic visions at play on the geoweb. In the years since I began this study, Open Street Map and a variety of other open geographic services and technologies have flowered on the geoweb, greatly expanding its social possibilities and reach. The context of these services is somewhat different from Google and is already rich ground for critical geographic research (Eckert, 2010). The Geoweb's increasing interconnections with social media is another new and relevant opening (Wilson, forthcoming).

One of the shortcomings of this research and other studies like it was that it didn't engage actual map usage as much as it could (Lee, 2010; Wood, 2010). Geographical imaginations were apparent in texts and interviews, but how those visions match with geographical practice and specific material spaces is an equally important question. Recent research may indicate useful methodological means for this kind of research practice on mapping (Brown and Laurier, 2005; Dodge et. al, 2009; Dalton and Mason-Deese, forthcoming).

Finally, the case of early map mashups, neogeographers and the changed discourse that they helped create is hopeful for those who want to make better, richer maps with more equitable subject positions. Through a critical awareness of web mapping, it seems that it would be possible through hands-on research to help facilitate more critically-aware web mapping ways of seeing.[48] More than a focus limited to open

[48] The work of the Hackitectura (Cobarrubias and Pickles, 2008), Sarah Elwood (2008; 2010), Lize Mogel and Alexis Bhagat (eds., 2007), Kanarinka (2006), the Counter-Cartographies Collective (Dalton and Mason-Deese, forthcoming), Grassroots Mapping (http://grassrootsmapping.org/), and the New Mappings Collaboratory (http://newmaps.as.uky.edu/) are possible models to work from.

standards or capital accumulation, it could more fully realize the greater possibilities of mapping and the web.

Appendix A: Glossary

Google geo alphabet soup

The lexicon of the Google geo discourse can seem arbitrary to outsiders. These are a number of terms that hold specific or technical meanings within the Google geo discourse and web mapping in general and that are immediately relevant to this dissertation.

Accessible Aerial Imagery: Remotely sensed images, usually photography, that are captured from a flying or space-based platform and that are technologically and somewhat socially available for popular use. *see Chapter One.*

Application / App / Web application / Web app: a generic term for any piece of software that works over the web to directly perform a task or tasks for a user. Web apps run through a web browser and/or utilize web programming languages, such as JavaScript coupled with Html. This definition is blurring as more devices are constantly online and as web browsers converge with operating systems, as is the case of Google Chrome, Android (Google's smartphone operating system), and iOS, the iPhone/iPad operating system. As a web map service, Google Maps is a web application. The term can also describe individual map mashups/geoweb apps.

Application Programing Interface (API): *see Google Maps Application Programming Interface*

Crowdsourcing / User-generated Content: An IT-industry term that refers to the use of time, labor and/or data from outside contributors (either voluntary or non-voluntary) by a company or organization. The term originated as a pun on "outsourcing." (Howe, 2008; Kleeman et al., 2008; Crampton, 2010.) *see Chapter Four.*

Distributed map: *see "map service."*

Geo software developer / Geo developer: A specific kind of sophisticated, usually professional, neogeographer. Software developers are people who build applications, programs, services, mashups, operating systems and any other kind of software. I add "geo" to specify people who work on geographic software. Many, but not all, neogeographers are geo software developers. Geo software developers in the Google geo discourse work outside Google on web applications, map mashups and even rival companies' geo services. Google does employ some software developers, but when Googlers say the word "developer," such as at the Google I/O "developers' conference," they are usually referring to software developers outside the company (Gundotra, 5/28/2008; Google I/O, 2008; Google I/O, 2009). Consequently, when I refer to 'geo software developers' or 'geo developers' in this dissertation, I am referring to geo software developers outside Google Inc.

Geohacker / Geohacking: Drawing on cyberpunk ideas, free and open source software (FOSS), and the open data movements, geohacking is a digital mapping practice that predates Google geo services (Erle et al., 2005; Wherecamp, 2009). In this context,

"hacking" has a positive connotation as a smart, creative technical solution to a problem or project. Since the ascendancy of Google in the geo services field, geohackers have built their own independent, mutually-supporting faction on the geoweb (Where 2.0, 2010; Wherecamp, 2010). Today, geohackers may occasionally act as neogeographers in the Google geo discourse, but they are more likely to be involved in independent open software and open data initiatives, such as Open Street Map.

Geoweb / Geospatial Web: Terms in the IT industry to collectively denote both geographic information and geo technologies on the web. The Google geo discourse is but one (large) part of the geoweb. The geoweb also includes competing services such as Bing! Maps, Open Source mapping initiatives, web-connected GISs and the independent, geo/map work of geo software developers, geohackers, neogeographers and other web mappers (Haklay et al., 2008; Crampton, 2010).

Geoweb Application / Geoweb App: A web application that uses web mapping, a location-based service or has a similar geographic dimension. Map Mashups are a form of geoweb application. *see "application," "geoweb," and "map mashup."*

Google Earth: Google's 3D virtual globe or "interactive digital atlas" service launched in 2005 (Birch, 11/29/2010). It was originally a program called Earth Viewer created at a company called Keyhole Inc. that Google bought in 2004. Much like Google Maps, Google Earth technically works as a distributed map whereby the service downloads data according to a user's demands. For years, it was only available as a stand-alone program

that had to be downloaded and installed. More recently, it became available as another viewing option within Google Maps alongside the "map" and "satellite" views. Google also licenses a professional-grade Google Earth with more interactive tools for a fee. Google most often licenses this professional Google Earth to companies and government agencies, including the U.S. military. *See Virtual Globe.*

Google Geo Division: The corporate branch of Google Inc. that manages Google geo services including Google Maps, Google Maps for mobile devices, Google Earth, Street View, the Google Maps API, etc… John Hanke is the director of Google's Geo Division.

Google geo services: Google's geographic or location-based services. The term includes not only Google Maps and Google Earth, but also other services such as Street View, the Google Maps API, Place Pages, and the work of managers, engineers and programmers who work in Google's Geo division. Not all of Google's geo services are map centered. Driving directions, for example, may be served to the user as a set of written directions instead of a map. My usage of the term "Google geo services" stems from the way Google employees lump these services together as "Geo" or part of Google's Geo Division (Google I/O, 2008; 2009; Fox, 5/22/2009; Coombe, 4/2/2010). Furthermore, my own usage, 'Google geo services' is more broadly cultural than "distributed map," "multimedia cartography" or "cybercartography" (Crampton, 2003; Cartwright et al., 2007; Taylor, 2005). I include social practices and knowledges in addition to the material technologies.

Google Maps: A distributed, web map service launched by Google in early 2005, Google Maps functions as a website within a user's web browser or as a web application on a mobile device. It is probably Google's best-known geo service. At times, Googlers refer to Google Maps as a "place browser", combining the logic of a web browser and mapping (Jones, 3/31/2010).

Google Maps Application Programming Interface (API): A means by which outside geo software developers can build map mashups or web applications on top of a Google Maps clone. Google launched the Google Maps API in reaction to early map mashup/hacks of its Google Maps service as a way to institutionalize map mashups. To use the Google Maps API, you must register with Google and agree to their terms of service. It looks very similar to the generic Google Maps, but it occasionally shows subtle differences from its parent service, usually in its data or interface. According to ProgrammableWeb, an independent resource which tracks mashup APIs, the Google Maps API is and has been the most popular mashup API on the internet for years among geo and non-geo APIs (ProgrammableWeb, 12/10/2010).

Google Map Maker: An initiative at Google that crowdsources the production and editing of Google's central, base dataset of geographic information such as streets, street addresses, parks and water features. Contributions to Google Map Maker are vetted by other volunteer contributors and by Googlers in some cases (Boulton, 2010). *see crowdsourcing, Chapter Four, Chapter Five.*

Googleplex: Google's corporate headquarters in Mountain View, CA. In the midst of Silicon Valley, Google's "campus" is famous for its amenities and employee benefits which include laundry services and free food. One informant tells me that the offices are set up that way so that Googlers have few reasons to leave (Allington, personal communication, 5/26/2008). The Googleplex is home to Google's Geo division, though the division also has major offices in Sydney Australia, the home base of Google Maps.
Googler: a Google employee, who by occupying that subject position has a masterly and influential technological position in the Google geo discourse. Google's founders and many of the people who work there self-consciously try to be unconventional (Page and Brin, 9/18/2004a; Page and Brin, 9/18/2004b; Fox, 5/22/2009; Allington, personal communication, 5/26/2008). They generally eschew business jargon such as "company," "employee" or "corporate culture" in referring to Google. Whenever possible, they use a version of the proper noun Google: "Google" for the company, "Googler" for an employee, "Googliness" for the corporate culture (Fox, 5/22/2009; Allington, personal communication, 5/26/2008; Pegg 5/28/2009). "Googler" has also gained some usage in the IT industry at large in referring to Google employees (Jarvis, 2009; Where 2.0, 2010). *see Chapter Five*.

Hyperlocal / Hyperlocality: a geographic way of seeing that uses mathematically-defined scales to precisely link the global scale to very local or individual scales. *see Chapter One.*

Map Mashup: an older term for a form of geoweb application. Mashups are usually created by a third party and combine a web mapping service and one or more sets of outside data. Beyond these general criteria, the definition of "map mashup" varies widely (Miller, 2006; McConchie, 2008; Clarke, 2010; Google I/O, 2008; 2009; Wherecamp, 2009/2010; Where 2.0, 2010). To neogeographers, the term 'mashup' connotes the hackerish idea of an admirable 'quick n' dirty' technical fix or innovation, as opposed to a more carefully designed app or service. A mashup may serve as a proof of concept or core function for a more complex application or website. In this dissertation, I more often use the term "geoweb application" or "geoweb app" because these terms include map mashups and other mapping services programs, such as smartphone applications that might not qualify as a map mashup. Furthermore, the term map mashup is gradually falling out use in favor of the more generic term "app." This shift reflects several general trends: First it is getting progressively easier to create a well-developed "app" that uses a map mashup concept, opening map mashing to more people with little background in web-mapping, much less cartography or GIS. Second, fully-developed web apps using maps are becoming more common in consumer usage beyond the lexicon of hackers and internet early-adopters who are more likely to know the term 'mashup.' Third, there is a growing portion of the web that uses closed-garden apps (as opposed to the open internet) such as the apps on the iPhone. To a large extent, mashups rely on an open internet and its multiple accessible data sources to function. *See Chapter Three.*

Map service / Web map service: "Map service" is Google's phrase to describe Google Maps (Google Inc., 2011h). It neatly fits Crampton's concept of a "distributed map"; a "strategy" for asynchronous, interactive mapmaking whereby digital data is sent from a database over a network to serve a user's "geographic-problem solving or visualization" demands (2003, 27-29). In Google's case, the network is the web, thus a web map service.

My Places (formerly My Maps): A very basic map-making service that allows one to build basic maps on top of the Google Maps service. It allows the map-maker to plot placemarks, lines and polygons as well as annotate them with basic text, pictures and hyperlinks. *See Chapter Five.*

Neogeographer: The subject position of someone who is not a formal Google employee, but who labors to contribute data and build maps for general consumption using geoweb services. In this dissertation I use the term "neogeographer" to refer to those who work with Google's geo services. *see Chapter Five.*

Neogeography: An umbrella term for geoweb/web mapping technologies and practices through Web 2.0-style social media as well as the body of knowledge around them (Haklay et al. 2008). *see Chapter Two.*

Placemark:  The generic icon for showing a location in Google Maps.

Street View: A Google service launched in 2007, Street View is a series of 360° panoramic images collected from roads, streets, lanes, alleys and other public thoroughfares. The images are linked to each other so a user may jump between images to 'move' up or down the street. Street View is available through Google Maps, Google Earth and links to other webpages, such as searching for a street address in Google's search engine. It is by far Google Geo's most controversial service, prompting public complaints in many places, at least one lawsuit, public guerilla art actions, restrictions by several foreign governments and two investigations by the U.S. government thus far (Inskeep, 12/2/2010; Bartholl, 2/15/2010; McGee, 5/12/2009; Hanchard, 11/13/2009; Temple, 10/27/2010; Albanesius, 11/10/2010).

User: A common, generic term in the IT industry that refers to the subject position of the 'end user' or consumer of a particular product. In this dissertation, I use the term to denote someone who uses Google geo services, but not in the actions of intentionally contributing data or creating new maps for purposes beyond their own personal use. *see Chapter Five.*

User-generated content: *see "crowdsourcing"*

Virtual Globe: A computer program or web application that displays a digital 3-dimensional view of the earth through a moveable perspective, akin to a traditional globe.

Examples include Google Earth and World Wind. Older examples include Microsoft's Virtual Earth and ESRI's ArcGlobe.

Volunteered Geographic Information (VGI): An academic term that pertains to crowdsourcing geographic data. It is far less common in the Google geo discourse than "crowdsourcing" or "user-generated content." (Goodchild, 2007; Elwood, 2008) *see "crowdsourcing"*

Web / World Wide Web: A term for the network of digital networks that is more broadly inclusive than "internet" and more specific than "online." For example, some web applications on smartphones use IT networks that don't technically use formal internet protocols and/or infrastructure. "Online" theoretically includes not only the world wide web but any digital network such as closed or separate networks for specific companies, organizations or governments.

Web application / Web app: *see "application."*

Web mapping service: *see "map service"*

Appendix B: Figures

Chapter Two Figures

fig. 2.0 Wherecamp 2010 at the Googleplex, Mountain View, CA. Photo by the author.

Chapter Three Figures

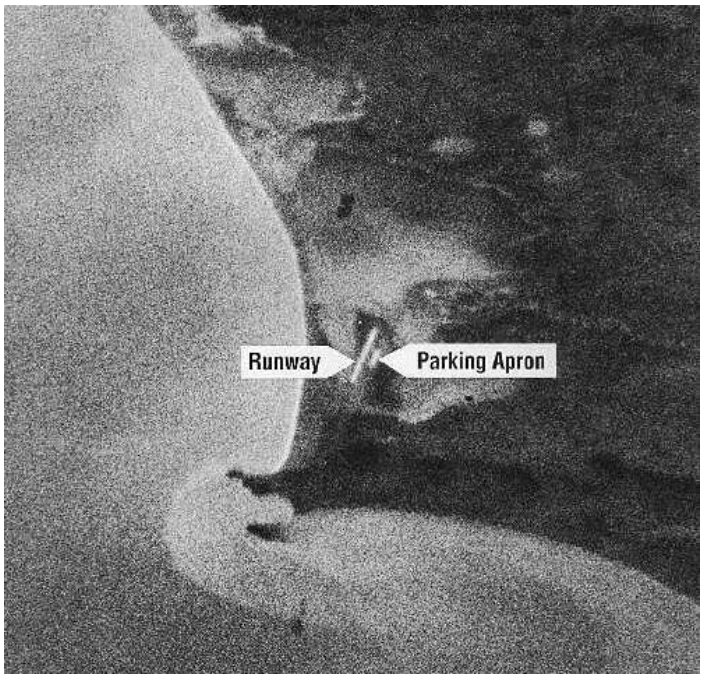

fig. 3.0 Soviet airbase photographed by the first CORONA mission in 1960. Public Domain, National Reconnaissance Office, U.S. Government.

Retrieved from the National Reconnaissance Office website (5/31/2012): http://www.nro.gov/history/csnr/corona/imagery.html

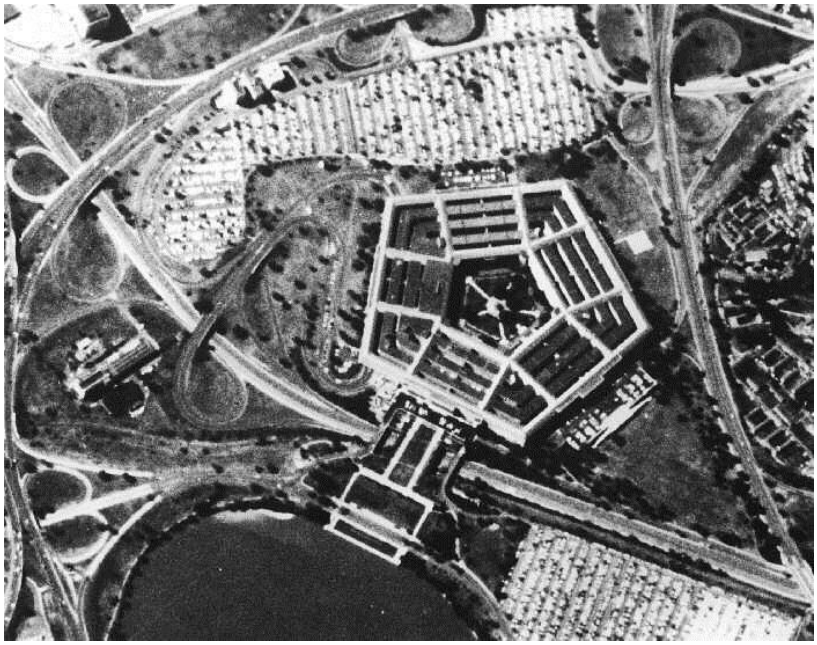

fig. 3.1 The Pentagon photographed by a CORONA satellite, 1967. Public Domain, National Reconnaissance Office, U.S. Government.

Retrieved from the National Reconnaissance Office website (5/31/2012): http://www.nro.gov/history/csnr/corona/imagery.html

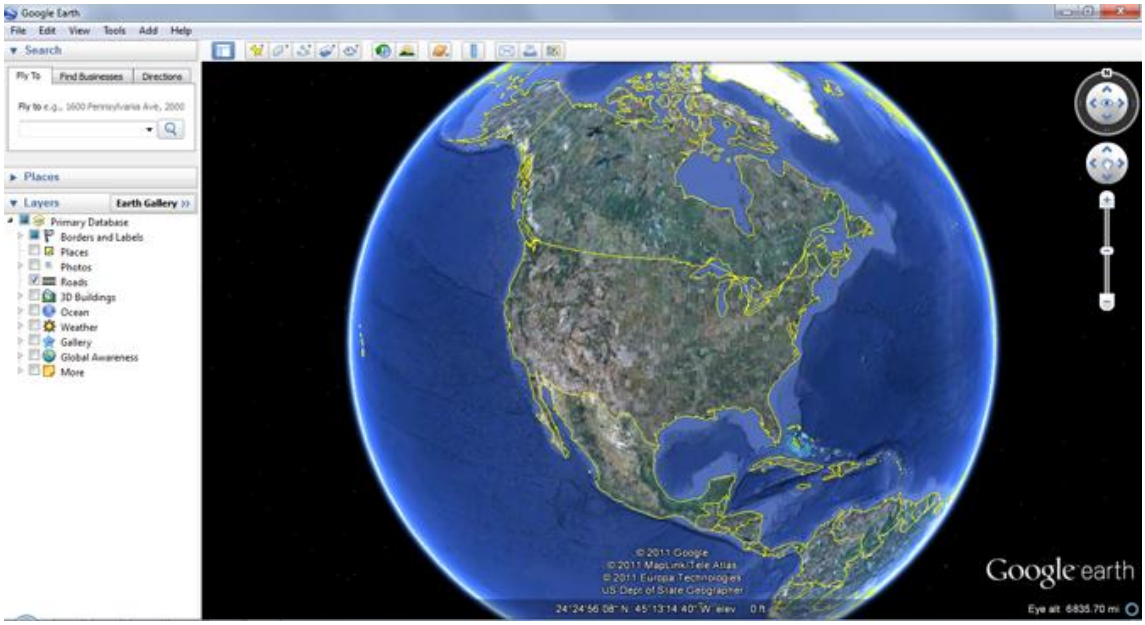

fig. 3.2 Default view of Google Earth (U.S.) upon starting the program. © 2011 Google © 2011 MapLink/TeleAtlas © 2011 Europa Technologies, U.S. Dept of State Geographer

Google, Inc. 2011. *Google Earth*. Virtual globe program, Google Inc. Cited 12/11/2011

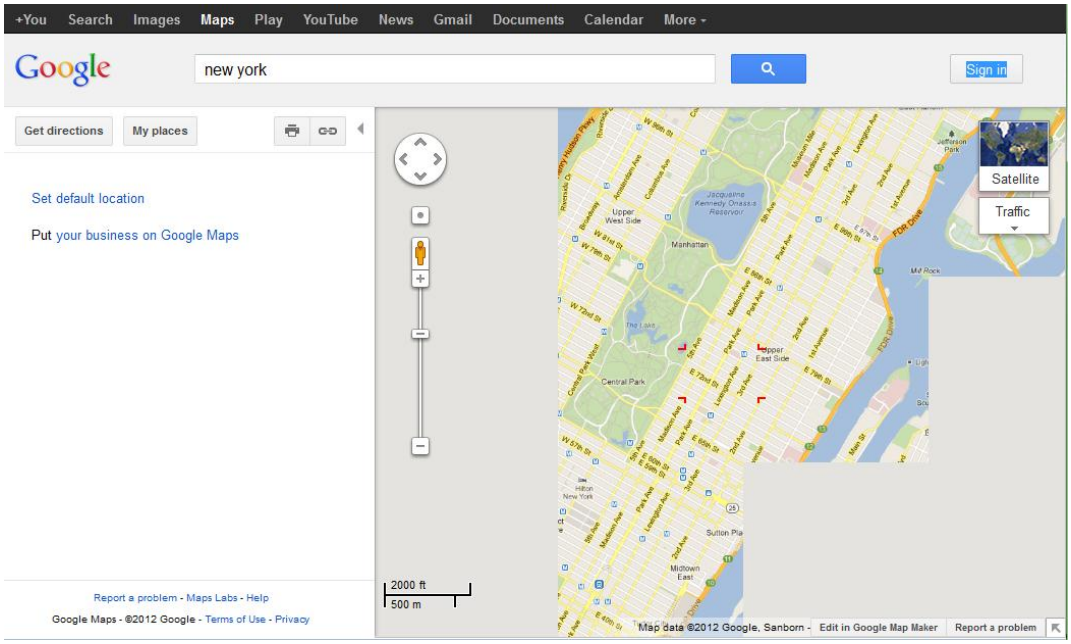

fig. 3.3 Google Maps in the midst of loading on a web browser. The gray squares are tiles that have not loaded yet. © 2011 Google © 2011 Sanborn

Google, Inc. 2012. *Google Maps*. Web mapping service, Google Inc. Cited 5/31/2012. http://maps.google.com/

Chapter Four Figures

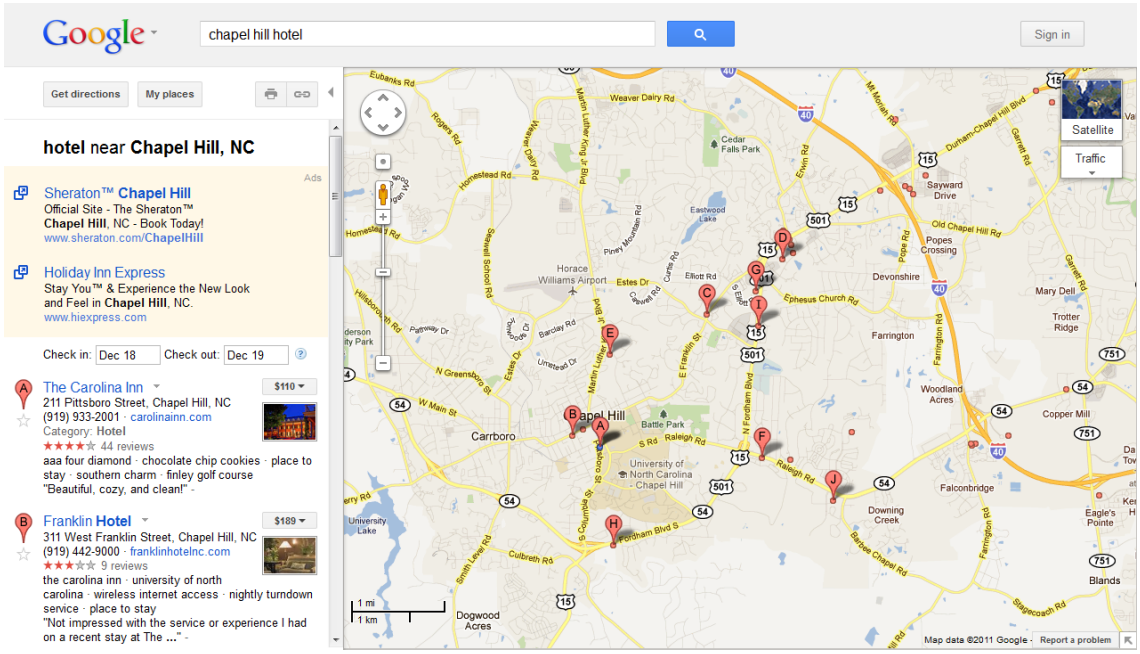

fig. 4.0 A search for "chapel hill hotel" in Google Maps © 2011 Google

Google, Inc. 2011. *Google Maps*. Web mapping service, Google Inc. Cited 12/11/2011. http://maps.google.com/

fig. 4.1 Google Maps vendor window sticker with a barcode. Photo by the author.

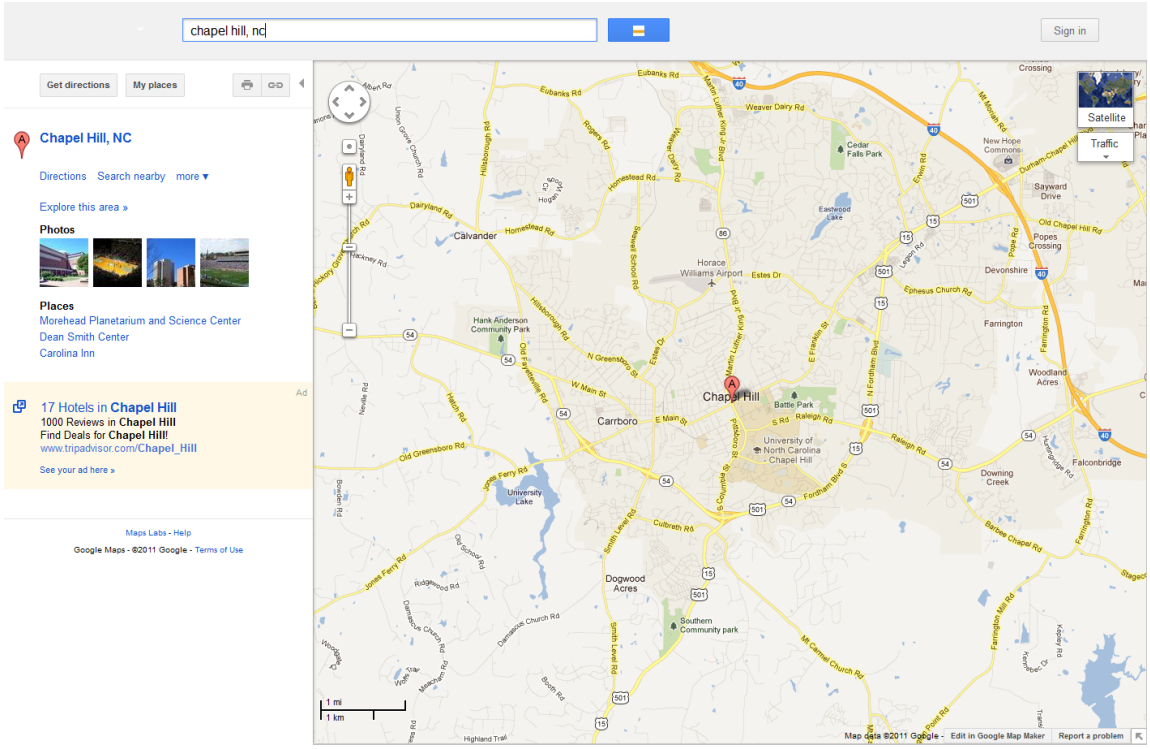

fig. 4.2 A search for "chapel hill, nc" in Google Maps. © 2011 Google

Google, Inc. 2011. *Google Maps*. Web mapping service, Google Inc. Cited 12/11/2011. http://maps.google.com/

Chapter Five Figures

fig. 5.0 The central green at the Googleplex, Mountain View, CA. Photo by the author, April 2010.

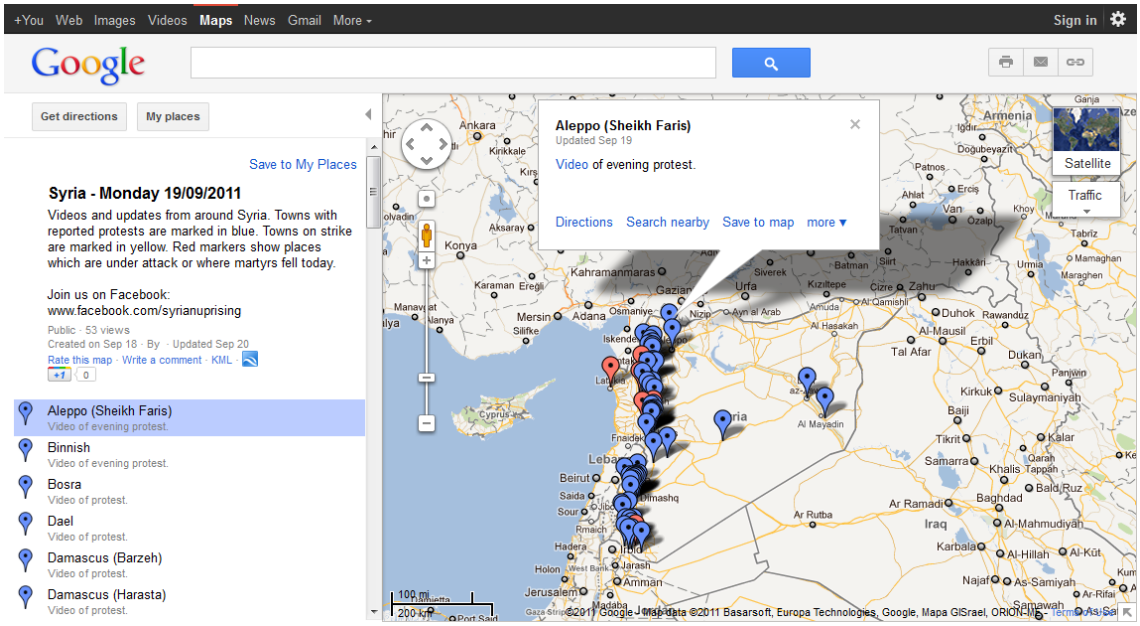

fig. 5.1 Syrian anti-government protests on Google Maps © 2011 Basarsoft © 2011 Europa Technologies © 2011 Google © 2011 Mapa GISrael © 2011 ORION Maps

"Syria – Friday 19/09/2011." 9/20/2011a. Anonymous Google My Places Map. Cited 11/2/2011.http://maps.google.com/maps/ms?msid=212070240894988529972.0004ad0c976a11b4b3d62&msa=0&ll=35.164828,38.660889&spn=5.73753,11.634521

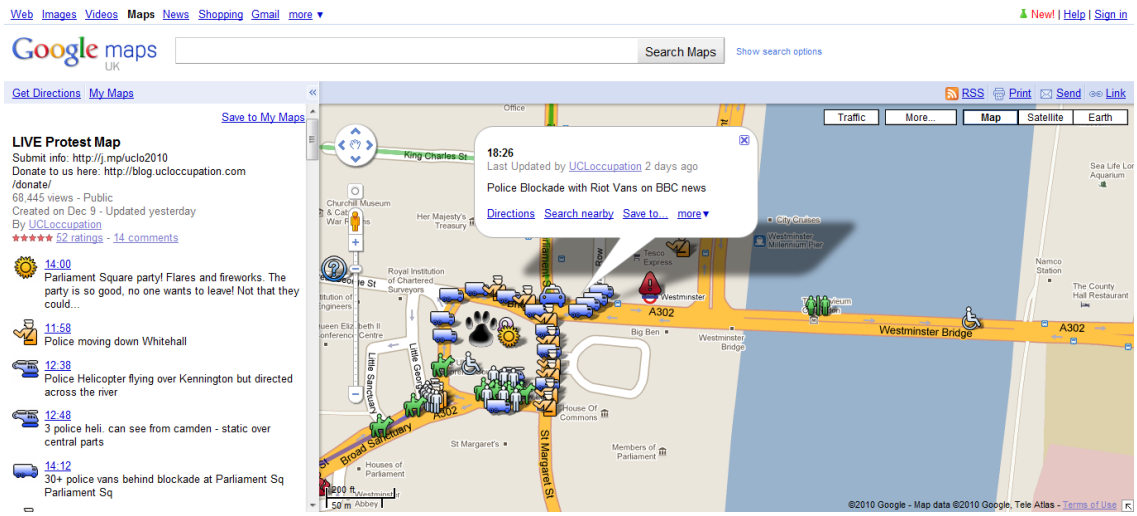

fig. 5.2 London student protests My Places map © 2010 Google, © 2010 Tele Atlas

LIVE Protest Map. (2010). Google My Places Map. Cited 12/9/2010 http://maps.google.co.uk/m/places?ll=51.506338,-0.126847&msid=113314616990789414427.000496f96fd6739e0982d&ie=UTF8&msa=0&spn=0.003599,0.009645&oi=nojs&z=17&hl=en#ipd:mode=home

fig. 5.3 Botched Paramilitary Police Raids map by Balko Radley and Lee Laslo © 2010 Cato Institute © 2010 Google © 2010 Tele Atlas © 2010 INEGI

Radley, Balko and Lee Laslo. 1/1/2006. Botched Paramilitary Police Raids. Website. CATO Institute. Cited 2/4/2010. http://www.cato.org/raidmap/

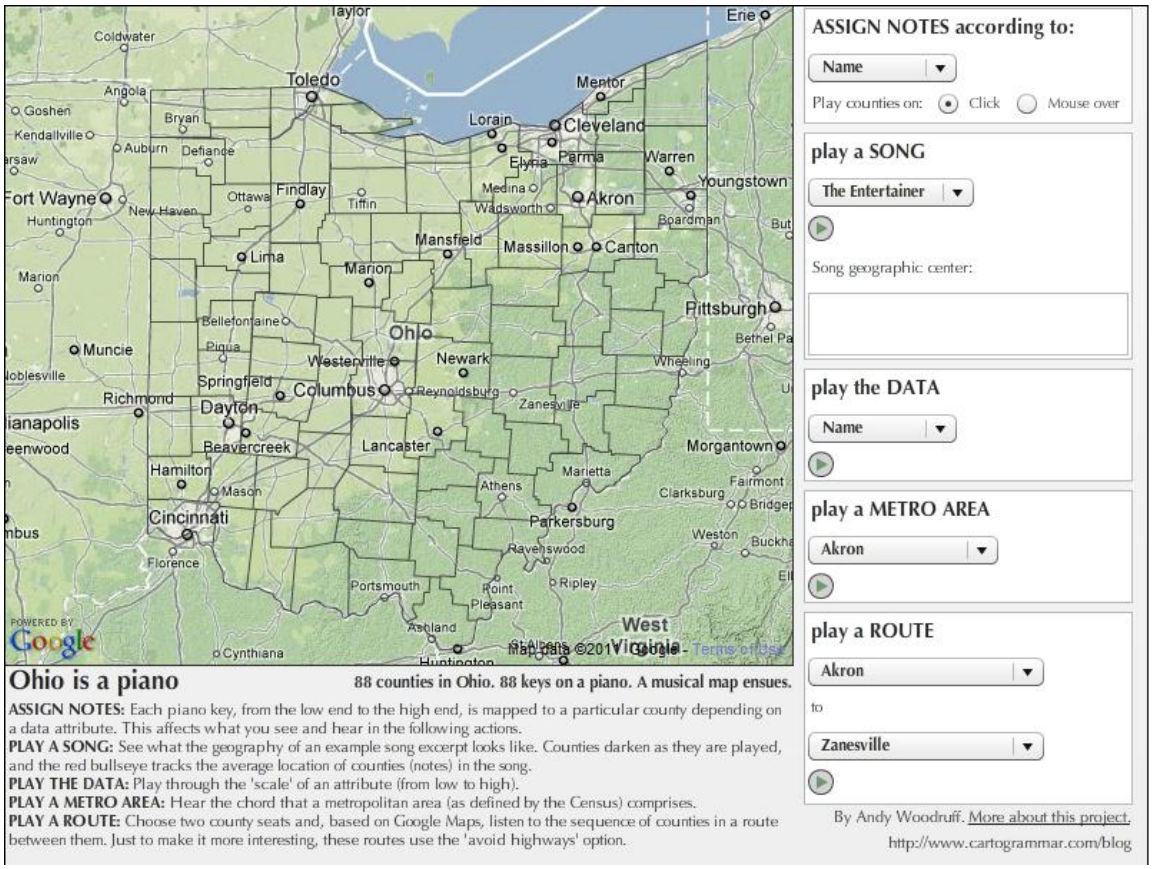

fig. 5.4 fig. 4 Ohio is a Piano geoweb application © 2011 Andy Woodruff © 2011 Google

Woodruff, Andy. (2009). The Music of Geography: Ohio is a Piano. *Cartogrammar Blog*. independent blog. Cited 2/25/2011. http://www.cartogrammar.com/blog/the-music-of-geography-ohio-is-a-piano/

fig 5.5 April fools map. © 2011 Google

Google, Inc. 2011. *Google Maps: Wishing You a Happy April Fools!*. Web mapping service, Google Inc. Cited 12/11/2011. http://gmaps-samples.googlecode.com/svn/trunk/maphaz/googlemaps.htm

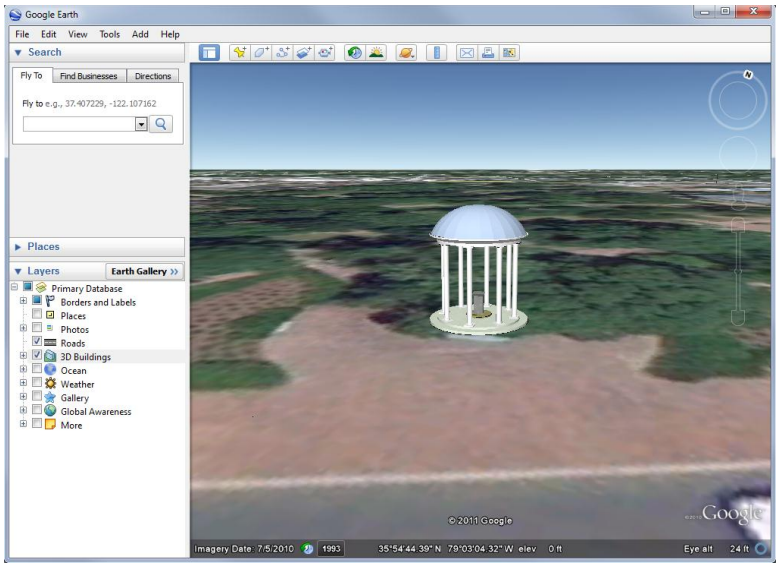

fig. 5.6 Three-dimensional model of the Old Well (UNC-Chapel Hill) in Google Earth. © 2011 Google

Google, Inc. 2011. *Google Earth*. virtual globe program, Google Inc. Cited 12/11/2011

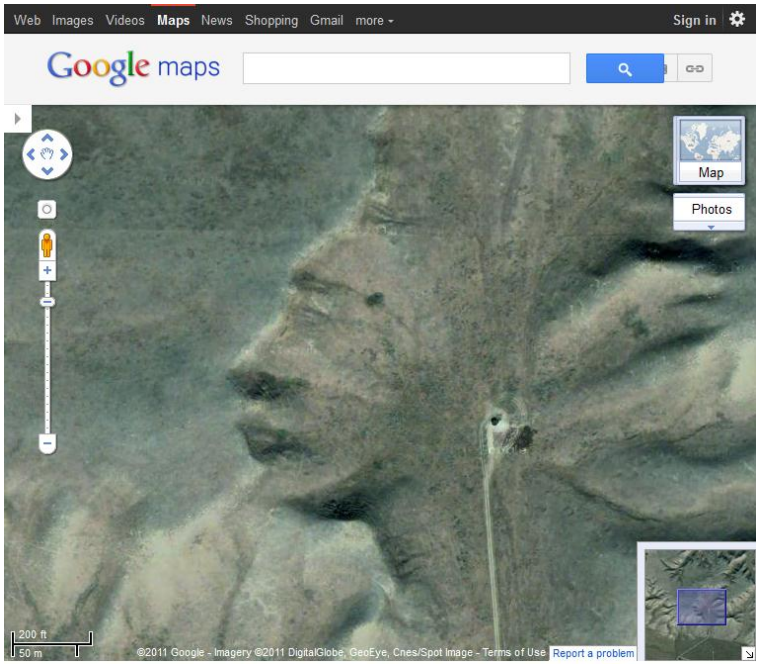

fig. 5.7 A face in the landscape. © 2011 Google © DigitalGlobe © GeoEye ©Cnes/Spot Image

Google, Inc. 2011. *Google Maps*. Web mapping service, Google Inc. Cited 12/11/2011. http://maps.google.com/maps?f=q&hl=en&q=Medicine+Hat&ie=UTF8&z=17&ll=50.01027,-110.111611&spn=0.003337,0.013561&t=h&om=1

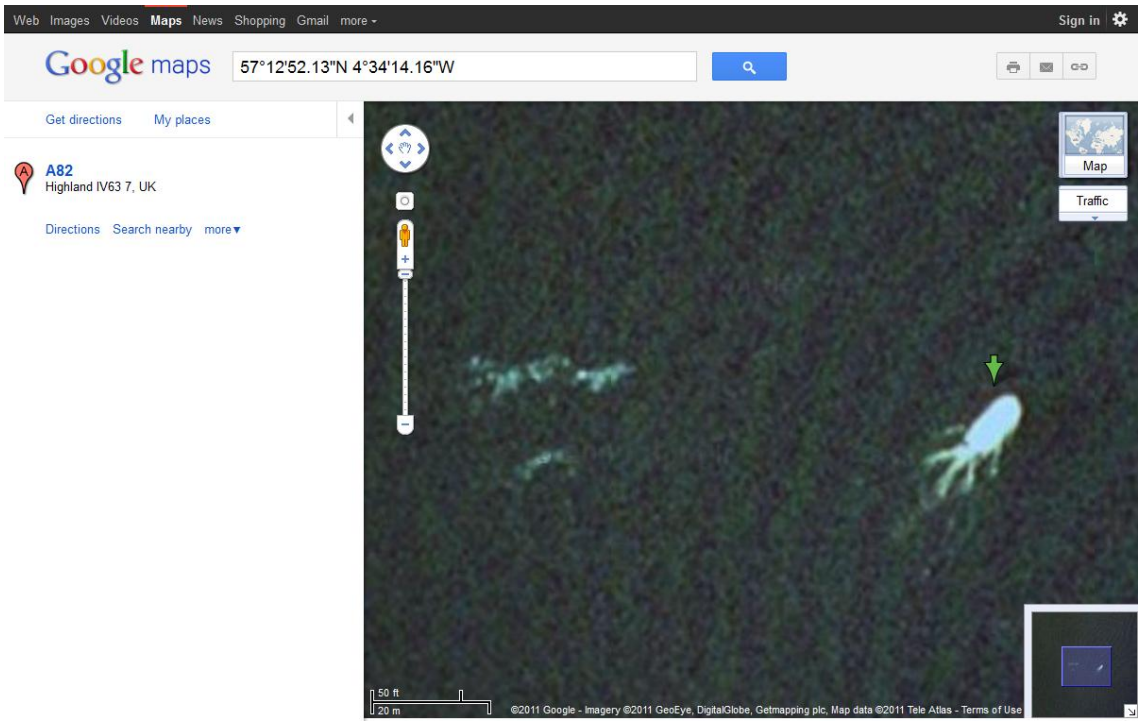

fig. 5.8 The Loch Ness monster? © Google © GeoEye © Digital Globe © Getmapping pic © Tele Atlas

Google, Inc. 2011. *Google Maps*. Web mapping service, Google Inc. Cited 12/11/2011. http://maps.google.com/maps?q=Latitude+57%C2%B012%2752.13%22N,+Longitude+4%C2%B034%2714.16%22W&oe=utf-8&rls=org.mozilla:en-US:official&client=firefox-a&um=1&ie=UTF-8&ei=LC7lTubHGcrq0QHerLyGBg&sa=X&oi=mode_link&ct=mode&cd=3&ved=0CA0Q_AUoAg

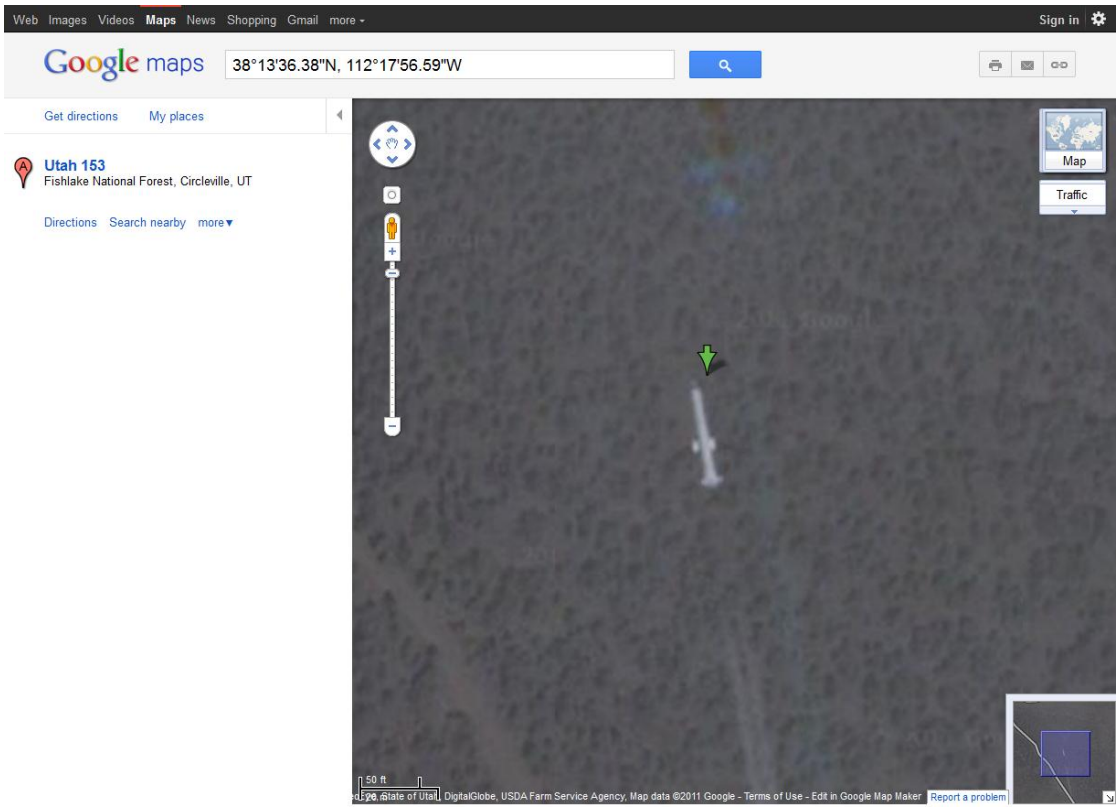

fig. 5.9 Missile? Plane? © Google © Digital Globe, USDA Farm Service Agency

Google, Inc. 2011. *Google Maps*. Web mapping service, Google Inc. Cited 12/11/2011. http://maps.google.com/maps?f=q&hl=en&q=38%C2%B013%2736.38%22N,+112%C2%B017%2756.59%22W&layer=&ie=UTF8&z=18&ll=38.22631,-112.298598&spn=0.002019,0.005332&t=k&om=1&iwloc=addr

Appendix C: List of Interviewees and Significant Personal Communications

Interviewees:

Name	Title/Role	Date	Location
Bailly, Francois	Google Earth software engineer, Google	4/2/2010	Googleplex
Caro-Bruce, Tim	Neogeographer, software engineer	5/22/2009	Wherecamp conference
Chopra, Aidan	Sketchup Evangelist, Google	3/30/2010	Where 2.0 conference
Chan, Newton	Software engineer, guru	5/22/2009	Wherecamp conference
Coombe, Greg	Google Earth software engineer, Google	4/2/2010	Googleplex
Coryat, John	Independent neogeographer, software engineer, Google technical forum moderator	5/27/2009	Google I/O conference
Barratt, John	Neogeographer, software engineer, Stateless Systems	4/3/2010	Wherecamp conference
Fox, Pamela	Geographic software engineer, Google	5/22/2009	Wherecamp conference
Golden, Keith	Geographic software engineer, Google	5/28/2009	Google I/O conference
Hackvan, Stig	Neogeographer, "Renaissance geek"	5/27/2009	Google I/O conference
Handakas, Marika	Small business owner, uses listings and ads on Google's services to attract business	1/26/2010	email interview
Hanke, John	Google Vice President of Product Management (Geo), Head of Google's Geo Division, former CEO of Keyhole Inc.	3/31/2010	Where 2.0 conference
Hochberg, Leonardo	Independent neogeographer, software developer, entrepreneur	5/22/2009	Wherecamp conference
Holovaty, Adrian	Neogeographer, entrepreneur, journalist creator of the early, influential map mashup chicagocrime.org	7/1/2010	phone interview

Hunter, Barry	Independent neogeographer, software engineer, Google technical forum moderator	5/27/2009	Google I/O conference
Kelso, Nathaniel	Neogeographer, journalist, cartographer at the Washington Post	3/30/2010	Where 2.0 conference
Marks, Mano	(Geographic) Developer Advocate geographic software engineer, Google	5/22/2009	Wherecamp conference
Levine, Suzanne	GIS professional, neogeographer, City & County of San Francisco	5/22/2009	Wherecamp conference
Lorenzini, Dave	Entrepreneur, Keyhole Inc. co-founder	3/31/2010	Where 2.0 conference
Lutz, Dale	Co-founder, VP of Development, Safe Software	7/29/2010	Geoweb conference
Miller, Alex	ESRI (Canada) Vice President	7/28/2010	Geoweb conference
Parsons, Ed	Geospatial Technologist, Google, formerly Chief Technology Officer at the UK's Ordinance Survey	3/31/2010	Where 2.0 conference
Pegg, Mike	Product marketing, Google, formerly the founding editor of Google Maps Mania an independent, influential blog about map mashups	5/28/2009	Google I/O conference
Preston, Jim	Independent neogeographer, software developer, entrepreneur	4/3/2010	Wherecamp conference
Rademacher, Paul	Software engineer, entrepreneur (recently left Google), geo manager, creator of the influential first map mashup housingmaps.com	3/4/2010, 4/2/2010	Googleplex and phone interview
Rasmussen, Lars	Software engineer (recently left Google where he was a Product Manager), Where 2 Technologies co-founder	5/28/2009	Google I/O conference
Stuart, David	Computer Engineer, IT Lab, ERDC (U.S. Army)	4/27/2009	Google I/O conference
Taylor, Frank	Independent neogeographer, blogger, founding editor of the independent, influential Google Earth Blog	7/20/2010	The Moon in Google Earth Product Launch
Wilson, Cameron	GIS manager, Canadian government	3/30/2010	Where 2.0 conference

Significant Personal Communication:

Name	Title/Role	Date	Location
Alami, Ossama	(Geographic) Developer Advocate, Google	3/30/2010	Where 2.0 conference
Allington, Ramsey	Senior Manager, Google	5/26/2008	Googleplex
Friedman, Jessie	Product marketing, Google	5/28/2009	Google I/O conference
Forrest, Brady	IT industry Journalist/Blogger, O'Reilly	5/29/2008	Google I/O conference
Enright, Kyle	Manager of Strategic Partnerships-Mobile, Google	5/28/2008	Google I/O conference
Gauge, John	Distinguished venture capitalist	4/3/2010	Wherecamp conference
Geary, Michael	Independent neogeographer, software engineer	5/29/2008	Google I/O conference
Kim, Taewoo	Independent neogeographer, software engineer, entrepreneur	5/28/2008	Google I/O
Michael T. Jones	Chief Technology Advocate, Google, Keyhole co-founder	3/31/2010	Where 2.0 conference
McClendon, Brian	Google Vice President of Engineering, Keyhole Inc. co-founder and angel investor	7/20/2010	The Moon in Google Earth Product Launch

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Figures 3.0 and 3.1 are images created by the National Reconnaissance Office (NRO) of the United States Government and posted on the NRO's official website at http://www.nro.gov/history/csnr/corona/imagery.html. I obtained a copy of the images from that website on 5/32/2012.

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Figures 3.2, 3.3, 4.0, 4.2, 5.1, 5.2, 5.5, 5.6, 5.7, 5.8, 5.9 are screenshot images of Google Maps on websites hosted by Google Inc. or screenshot images of Google Earth, a computer program distributed by Google Inc. Figures 5.3, 5.4 are screenshot images of Google Maps hosted on third party websites (I obtained the copyright permissions of these third parties separately. Their permissions appear with this document).

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fig. 5.4 Ohio is a Piano geoweb application © 2011 Andy Woodruff © 2011 Google

Woodruff, Andy. (2009). The Music of Geography: Ohio is a Piano. *Cartogrammar Blog*. independent blog. Cited 2/25/2011. http://www.cartogrammar.com/blog/the-music-of-geography-ohio-is-a-piano/

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5/29/2012

Robert Garber
Director of Marketing
Cato Institute
1000 Massachusetts Avenue, N.W.
Washington, D.C. 20001

Dear Mr. Garber:

This letter follows up on our telephone conversation on May 29th. I am completing a doctoral dissertation at the University of North Carolina at Chapel Hill entitled "Mashing-Up Maps: Google Geo Services and the Geography of Ubiquity." I would like your permission to reprint a screenshot image in my dissertation of the Botched Paramilitary Police Raids map on the CATO Institute web page at http://www.cato.org/raidmap/. If permission is granted, the image will always appear with attribution to the Cato Institute, the map's authors, and Google.

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Robert Garber

Date: June 1, 2012

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ddcraig@email.unc.edu
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5/29/2012

Andy Woodruff
224 Banks St. #2
Cambridge, MA 02138

Dear Mr. Woodruff:

This letter follows up on our recent emails. I am completing a doctoral dissertation at the University of North Carolina at Chapel Hill entitled "Mashing-Up Maps: Google Geo Services and the Geography of Ubiquity." I would like your permission to reprint a screenshot image in my dissertation of the Ohio is a Piano web page at http://www.cartogrammar.com/flash/piano/Piano.html. If permission is granted, the image will always appear with attribution to you and to Google.

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If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope.

Thank you again for all of your help.

Sincerely,

Craig M. Dalton

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Andy Woodruff

Date: 5/31/12

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