Space, Place, and Database

Layers of Digital Cartography

by

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Abstract:

This paper addresses the changes in cartography since digitization and widespread popular dissemination. Cybercartography, an emergent system of maps, mapmaking tools, and mapmakers, forces a rethinking of spatial representations. The implicit distinction in digital media enables a new type of map user or neo-geographer that creates layers of expressions based on subjective experience. This paper argues that the neo-geographer signifies a new cartographic behavior that affords a complex subjectivity. This behavior is further exhibited in the practice of navigable maps and virtual globes which lead the way to a paradigmatic change in the way we represent and interact with space. It is divided into three parts: Part I addresses the role of digitization in maps and lays out framework and vocabulary. Part II examines layers of spatial representations in historical context. Part III opens room for future study in the quickly developing inhabitable cartographic spaces of virtual globes and virtual worlds.

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INTRODUCTION

> The real voyage of discovery consists not in seeking new landscapes, but in having new eyes, in seeing the universe with the eyes of another, of hundreds of others, in seeing the hundreds of universes that each of them sees.
>
> --Marcel Proust

This quote from Marcel Proust unexpectedly and precisely illustrates this essay on the state of digital cartography. We are well within a transitional phase from analog to digital, a change that bears heavily upon our experiences of space and identity. With no earthly frontiers left to discover, we are given the opportunity to represent space with new eyes, layering lived and human spaces atop satellite depictions of the Earth's surface. As technology enables changes in our methods of representing space, how then does it change our ways of seeing and being in space? Cybercartography, the art of cartography composed of digital, networked information, reveals glimpses of this emergent ontology by allowing us to see metaphorically "the universe with the eyes of hundreds of others." Metaphor is unavoidable in a discussion about maps: maps are metaphors to begin with—abstract, scaled, models of space that connect real space to paper.

Cybercartography refers to a range of contemporary, paperless, digital technologies that facilitate the measurement and representation of space. This range spans from high-end and professional tools like ESRI's ArcGIS to amateur and consumer-end tools like Google Earth. Another component of digital technology includes positioning devices, or GPS, that enable theoretically constant localization, emplacement within the digital map. These tools, spatial detection and representation devices combined create the bulk of what will be referred to as cybercartography. These tools are not only instantiations of rapidly developing cartographic apparatus but reflect a sort of convergence of real and digital information spaces. While resembling the paper map in form and symbology, the digital map is comprised of fundamentally different material which allows for radically different cartographic behavior.

The most important behavioral disparity between paper and digital maps, I argue, is the storage of data within an accessible, controllable database. It is the open database that encourages individual expressions and representations of space which shift the debate about space away from accuracy towards agency. For the amateur map user/maker unlike the professional geographer, precision and accuracy are not necessary qualities for spatial representation; usually "close enough" will suffice. The amateur consumer is more concerned, then, with how the data is used rather than if the data is a perfect representation of space as it is. This concern represents the *neo-geographer*, the changing relationship between the human and cartography. This term implies a new level of agency, knowledge, and input into the creation of the map. It does not, however, claim that the amateur map user fulfils the role of the geographer, engineer, or other professionals who require representations of space that stress accuracy and precision. The neo-geographer makes use of technology only recently limited to the professional domain. Unlike the urban planner or erosion specialist, our use of digital maps reflects lived experience.

Maps and Media:

Lisa Gitelman offers an expansive definition of media that is well suited for this conversation about digital maps in her introduction to *New Media 1740-1915*. She recommends thinking of media as structures of communication that include "both technological forms and their associated protocols.[1]" This widening of the term accounts simultaneously for format, content, and usage as distinct properties often condensed within a definition of media. For a study of digital cartography, particularly one within a Media Studies context, this perspective enables a nuanced investigation. We are able to shift focus away from a purely technical or developmental history of GPS or an explicit look at map usage to think of cybercartography as both the technology and protocols

1 Gitelman, Lisa. (2004). Introduction. From Lisa Gitelman and Geoffrey B. Pingree (eds.), New Media 1740-1915. Cambridge, MA: MIT Press. p.9

associated with spatial data. Gitelman explains that even "information", or seemingly neutral communications, can not "be considered "free of" or apart from the media that help to define it.[2]" This shift in emphasis places unprecedented onus upon the display of information in an overall understanding of a medium. For digital maps, then, we refocus our attention to include not only the technologies that create the maps but also ways these tools are used and what is being created.

But what is a map? No definition can possibly include all of the nuance or implications that connect the artifact with practice. In theory, a map is an abstracted model of space to aid in understanding spatial relationships and better decision making[3]. However, no map is ever a neutral representation of objective space; there are always mediations of intentional and unintentional human intervention . In fact, many academic approaches to cartography avoid answering this question directly because of the semantic and theoretical puzzle it introduces. Defining "map" is difficult and many writers are inclined to avoid even positing the question.

A diversity in academic materials reflects a division that, while a reasonable organizational tactic, limits thinking about maps to one discipline's vocabulary and structure over another's. A discussion about digital maps, however, requires attention from multiple perspectives: technical, socio-political, cultural, to name a few. *A visual representation of spatial data*, our working definition for map, views all digital maps through the same lens, forces a rethinking of automatic assumptions about hierarchy and relocates the discourse about maps away from the map as artifact to the magnitude of data. This seemingly simple definition encompasses a extensive range of visual representations, from maps of place to three dimensional pictures of imaginary space. In cybercartography the key definitional word becomes representation, how the data is shaped, layered, and combined to create maps that depict more than territory or terrain.

2 Ibid. p.9

3 This definition comes primarily from Geography and Earth Sciences (MacEachren (1994), Kraak & Ormeling (1996)) but the Humanities tend to take a more critical view, stressing context. This structuralist approach was popular in the 1970s, exemplified by Norman J.W. Thrower in Maps & Man: An Examination of Cartography in Relation to Culture and Civilization, "the map is a sensitive indicator of the changing thought of man…"

At the same time, the addition of the word “spatial” confines the discussion to representations of space and removes the voluminous discussion about the visualization of non-spatial information. Visualizations, an important discussion during this transitory phase, are not within the scope this essay. Thinking of maps as visual representations of spatial data affords us room for comparisons of formerly disparate artifacts and foreground the importance of data and display in the art of cybercartography.

Digital maps are situated within the category of digital media thus conform to expectations laid forth by theories of digital media, as we shall see in Part I. Lev Manovich’s *The Language of New Media* does not directly mention digital maps, most likely because the book precedes the relevant cartographic developments, but the categories he defines work well to shape our discussion on the transformation cartography has undergone since digitization. Part I will address these changes by introducing vocabulary and parameters for cybercartographic discourse. This chapter outlines some of the major world events of the 20^{th} century that provoked the development of contemporary Geographical Information Systems (GIS) as well as provide an overview of the uses of these systems.

Part II is influenced by Michel de Certeau’s phenomenological approach to cultural studies, marked especially by a turn in focus towards map usage. In the spirit of de Certeau, Part II adapts theories of “lived space” to their representations in maps. This section looks directly at the relationship of the map to human spaces by exploring historical instantiations of maps of lived space. Focusing mainly on early Medieval European maps, the essay introduces maps that are predicated on human experience. I argue that the digital map enables a conflation of historical mapping styles through layerable, modulated information. Map users have become mapmakers, adding layers of connected rhizomatic information to terrain, producing highly personalized maps of experience.

The final section, Part III, introduces topics for continuing study including the growing geospatial web, or merging of information space with real space through the affordances of networks, as well as the curious similarities between digital depictions of real spaces to digital depictions of virtual spaces. The relatively nascent act of tagging data with geospatial coordinates is developing a subset of linked information that is conceptually attached not only to each other but to places in the real world. This structure organizes previously unmanageable data around a geographic metaphor while also providing a layer of digital information to the world. New technologies, currently in development, will enable a seamless link between real and digital spaces. This link is evinced by a trip through Second Life, a virtual world that shares many behavioral and communal characteristics of Google Earth, the popular digital globe.

Proust's adage above suggests that discovery will no longer be located in new landscapes but rather in an ability to envision and share visions with others. He is, perhaps, alluding to a need for imagination and human connectedness. There is great significance in his connecting the spatial metaphor of "landscapes" to the project of shared perspectives or *worldviews* as we turn towards the study of digital maps. Digitization has provided humankind with limitless space for discovery, representation, and mostly sharing with hundreds, if not millions of others.

PART I: DIGITAL MAPS

In 2006 Time Magazine featured *You* as its annual person of the year. In an introductory note, managing editor Richard Stengel writes, "…individuals are changing the nature of the information age… the creators and consumers of user-generated content are transforming art and politics and commerce [and] are the engaged citizens of a new digital democracy.[4]" The subsequent articles address the collaborative aspects of Web 2.0 and the customization capabilities of media applications like YouTube and various social networking sites. The overall tone of the issue reflects Stengel's optimism about new forms of democracy, with few acknowledgements to the digital divide (the inequity of computer distribution within the US and worldwide) and an almost nonexistent tone of mistrust so frequently lining mainstream coverage of new media. The issue says something that CMS has known since its inception, that Web 2.0 offers ways for individuals to network and participate in potentially radical and unprecedented ways[5]. Unfortunately aside from a brief nod to Google Maps under the "toolmakers" section, the issue fails to address cybercartography or the geospatial web in any substantial way. This oversight might be due to the fact that some of the more accessible geo tools have been released in the early months of 2007 or an underestimation of the importance of digital spatial tools. This essay assumes the former, for as we shall see, the implications of digital cartography has already begun to change the way connected people move in space.

This statement is both literal and figurative: literally we are now able to access real time navigational information in on-board automobile and pedestrian systems in increasing detail, figuratively we fly around digital globes and virtual places inducing a whole new set of spatial practice. This chapter addresses the literal aspects of changing cartography,

4 Stengel, Richard (2006) Now It's Your Turn (Editorial Note). Time Magazine, 168:26. Time Incorporated.

5 Henry Jenkins, director of the Comparative Media Studies program at MIT, writes about "convergence" in his 2006 book Convergence Culture. This book addresses the themes of participation and collaboration that are also the main focuses of the program. This is the context in which this paper was created.

focusing on what makes digital maps different from their paper predecessors. It serves as a contextual overview for the rest of the paper by introducing themes, history, and vocabulary of the changing experience of cartography. Moving from the general to the specific we will first discuss digital ideology, move through the important historical events of the 20th century which impacted cartographic technology and the creation of Global Information Systems (GIS), and end with a detailed discussion about emergent features and concerns of digital cartography. More than just a catchy word, cybercartography refers not only to the wide range of spatial tools available on the internet and in other digital forms but moreover to the process of creating and using these maps. Digitization has enabled a systematic change in not only the delivery of maps as a product but in practice as well. Cybercartography is the relationship between the cartographer (you) and the spatial data. We will return to this concept in detail throughout this chapter but let's begin by introducing a lexicon for digital media. Digital maps are like all other digital media, composed of digital information. This compositional quality is not only the most obvious difference between the digital and paper map but the source of the limitless possibilities of the new format.

General Tendencies of Digital Media:

Lev Manovich provides a solid vocabulary for digital media discourse in his book *The Language of New Media*. Although his project does not explicitly address cybercartography, the terminology and its informing principles are an excellent match for situating and analyzing the qualities of digital maps. Manovich presents what he calls "general tendencies" of new media: that they are represented numerically, that they are modular, automated, variable and that they posses layers that communicate to a computer and to a human simultaneously[6]. These terms are useful to the study of digital maps for these are the qualities that comprise the chasm between the paper, or analog, technology and the computerized. Perhaps it would behoove us to expand slightly on the meaning of these terms before proceeding. By numerical representation, Manovich is referring to

6 Manovich, Lev (2002). The Language of New Media. Cambridge, MA: MIT Press. pp. 27-47

binary machine language, 1s and 0s. This is essentially what digital means when reduced to its most basic level, these are the "digits" made reference to in the name.

Modularity is a slightly more abstract term which refers to the discrete quality of digital artifacts. "These elements are assembled into larger-scale objects but continue to retain their separate identities.[7]" This particular quality may cause debate among different disciplines for whom discrete has complex connotations but for our purposes will refer more or less to chunks of data that tend to stay together. For instance, a digital map of the United States is modular insofar as its data provides a starting point for creating maps or even altering it at the fundamental level but it will stay together as a cohesive data set. Another way to think about this at a simple level is that it can be saved and stored as a file rather than a very messy jumble of 1s and 0s but it is still made up of 1s and 0s that can not be reduced or altered.

Automation, or the processes completed by programmed computation, is not a necessary feature for all new media but is enabled by digitization and modularity according to Manovich. However, automation is essential for cybercartography. Without it, we would have to create our neighborhood from data every time we wanted to get directions from home to someplace new. Automation is what sets digital maps so far apart from their paper predecessors by enabling searchable databases that rely on modulated, cohesive representations of space. The program assembles spatial data to look like the place it's asked to: Building 14, Boston, Zimbabwe. Whatever is written or coded can be subsequently read as a map. Automation does not create this process but makes it possible to deal with the sheer volume of available spatial information. We will return to this possibility in a moment.

But first, to review Manovich's final two and most significant vocabulary terms: transcoding and variability. Transcoding, as Manovich deems it, is the process by which digital media can communicate simultaneously to a computer and to a human user. This

7 Ibid. p. 30

is colloquially understood as an *interface* and has great consequences for the digital map for without it we would only see screens of 1's and 0's. People read the transcoded interface as an image while the machine reads digits: this is a crucial boundary between our reality and the digital. This abstract distinction takes concrete definition in the digital image which appears to be part of the real that we perceive while simultaneously part of the complex universe of data and automation. As we begin our exploration of digital maps we see decay in this perceived boundary, a turn towards a more permeable membrane, through which digital information flows out and enhances our lived experience and humanity flows in, structuring and organizing data around a biological, evolutionary, and perceptually sound feature: global spatiality.

Variability is an essential term for this discourse: the ability for information to exist in many different ways. Variable information requires fixed data that can be mutated or translated into many different containers. One example might be to think of how voting can be presented spatially atop a terrain map, independently in graphs or charts, and most importantly represented in ways that alter its communicated message. The same data can be used in many ways, resulting in the most legible communication. Variability of data allows even the most complex statistical data the opportunity easy comprehension through presentation. This quality is essential to our discussion about maps because variable spatial data leads ultimately to personalized maps as users manipulate and shape information into creative representations. Data variability underlies the distinction between paper and digital maps, a theme we revisit throughout this essay.

The principle of variability exemplifies how, to Manovich, historical changes in media technologies are correlated with social change. If the logic of old media corresponded to the logic of industrial mass society, the logic of new media fits the logic of the post-industrial society, which privileges individuality over conformity. In an industrial mass society everyone was intended to enjoy the same goods-- and to share the same ideology. This was also the logic of media technology… "In a post-industrial society, every citizen can construct her own custom lifestyle and select her ideology from a large (but not infinite) number of choices[8]".

This is especially important for how we think about, use, and create maps. Our ability to simultaneously manipulate spatial data while depending on the objective accuracy of that data is a radical departure from how our ancestors thought about space and its imaged representation. Digitization has enabled paradigmatic change in the way we use spatial data and its representations. Geographical Information Systems (GIS) facilitate an unprecedented level of flexibility, personalization and immediacy by enabling the separation of a map's storage and presentation functions[9]. Paper maps were not only pictures of places but also the only storage mechanism for all sorts of spatial data. Computer databases liberate maps from this dependency allowing real time representations based on selective characteristics. What this allows in digital maps is twofold: the ability for storage of massive, virtually limitless amounts of data and the ability for dynamic and infinitely varied presentations.

In short, a database now replaces the job once held by the paper, skin, or stone that once preserved the information. Data in digital form represents corresponding relationships that are simultaneously more intractable yet variable in different ways than their tangible predecessors. Data in binary form (bits) can be treated as math and equated to solve complex statistical analysis. In this way it has an unprecedented level of flexibility of use. At the same time, each data corresponds to an exact geospatial location, a sort of permanence and objectivity that exceeds prior representational methods. We will return to the question of objectivity in the next chapter but for now it suffices to say that the relationship between spatial information and the map has changed, as has the relationship between spatial information and the claim of objective truth.

8 Ibid. p. 42

9 Kraak, Manno-Jan and Ferjan Ormeling. (1996) Cartography: Visualization of Spatial Data. Boston: Addison Wesley Longman Ltd.

One essential quality to bear in mind as we continue thinking about digital cartography and the database is how the separation of storage from presentation gives data a freedom unobtainable by paper representation. Text has an inherent level of fixity that marries data to artifact in a way that digital information dissolves. A 15th century map of Europe may contain an erroneous island off the coast of France that will always be part of that map, permanently embedded within the paper that is stored, once perhaps on a ship and now within a museum, but that data is inseparable from the paper that contains it. Digital information, however, is not fixed within an image or hierarchical system. In its most reduced binary form, spatial information is only a representation of a coordinate. It requires a programmer to create a program and a user to shape it, create meaning and context. These programs can be modulated and stored as maps of places which become base layers for the palimpsest of personal information to be added by people. In other words, representations of spatial coordinates are no longer permanently fixed on paper or stone; as data they are manipulable, controllable particles to be shaped by a program or programmer.

The ability to modulate and manipulate coordinates becomes most interesting when applied as layers to useful pictures of space; making maps of places that bespeak more than an abstracted picture of what is, but perhaps, what goes on. We return to this idea in greater semantic detail at the end of this chapter and then as theoretical and historical exploration in Part II. For now, we continue with a small step back to sketch the important technological developments of the 20th century. In order to better understand the cartographic apparatus as we experience it on a daily basis, it behooves us to examine its roots and the largely military aspirations that necessitated its development.

Scribbling on a Cave Wall: A brief history of cybercartographic technologies

The militaristic underpinnings of the Global Information Systems (GIS) may or may not impact directly upon their functioning or our individual reception. An exploration of the development of the digital cartographic apparatus shows a history motivated by a need for detailed depictions of “other” places.

This cursory look at the technological evolution of cybercartography shows an initial requirement for accurate global maps for strategic warfare and defense followed soon after by a way to systematize and utilize that information efficiently. This change in cartography, from the local to the global and from the static to the dynamic reflects a changing lived world where boundaries were not so much in dispute as ideology. A paradigmatic shift in warfare required a parallel change in maps, for both protecting the territory on Earth and exploration into space. Treating spatial information as data has been a part of the government/military consciousness for decades but the recent transfer of digital spatial technologies to the public market has led to unprecedented consumer use of maps and other spatial representations.

Cybercartographic tools are both the GIS that allow for satellite imaged digital globes as well as the Global Positioning Systems (GPS) that locate users upon the virtual globe by satellite positioning. Undoubtedly the orbiting satellite plays an indispensable role in the development of these technologies but the ideology upon which the system of cartographic representation is based extends back through history to, in the words of Google Earth product manager Jess Lee, to "cavemen scribbling on a cave wall.[10]" Although it would be impossible to include every development that led to contemporary amateur cartographic tools, it is useful to review a few of the broad strokes that cleared the way for consumer cybercartography. Several events of the 20th century have played a major part in this process: the military developments of World War II and the Cold War, and cartographic technology's more recent percolation from military to public use. This history traces the route from maps as read-only, national charts to read-write, global databases.

Perhaps the most salient point to keep in mind while thinking through GPS history is the connection between contemporary and historical methods of navigation through the notion of time. Modern cartography's earliest instantiations, by astronomers like Ptolemy

10 Lee, Jess. (2007, April 7) Map Making: So easy a caveman could do it. From The Official Google Blog. Retrieved April 7, 2007 from http://googleblog.blogspot.com/2007/04/map-making-so-easy-caveman-could-do-it.html

and Eratosthenes, were based on astral observations as well as the dynamic relationship between the sun and the earth. While previous measurements of Earth utilized two points upon the surface, this technological revolution added a third, celestial, point to triangulate latitude.

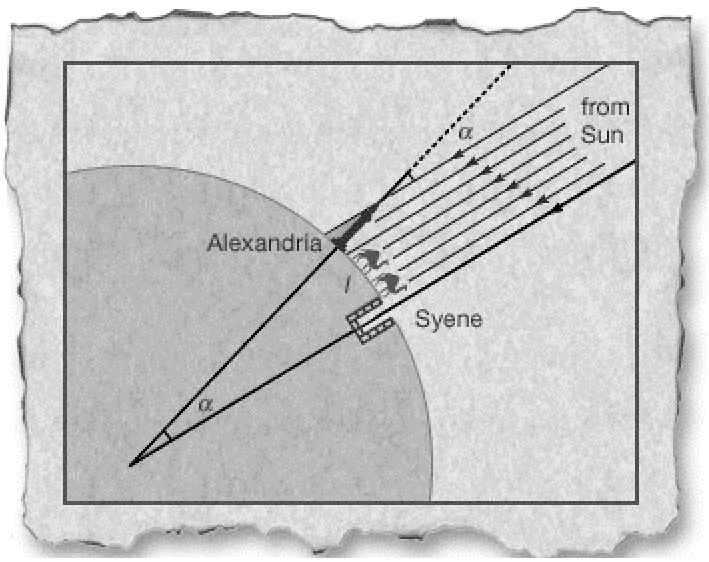

Fig 1:1 Eratosthenes' measurement of the Earth (Reproduction from Encyclopedia Britannica, Inc. 2000) When the sun is directly overhead as indicated in the figure by the solar rays illuminating a deep well, the Earth's circumference can be calculated from the measurement of the distance between Syene and Alexandria (shown in the figure by the arc *l*), combined with his measurement of the solar angle α between the Sun and the vertical.

This measurement, and every subsequent method for measuring and organizing the surface of the earth necessitated time, a spinning globe and rising and setting sun. This method is adequate for determining longitude but a way to determine accurate perpendiculars to satisfy the need for orthogonal constraints was still to come. This major navigational breakthrough came during early European sea navigations and the mid 18th century invention of the chronometer[11], a sea-worthy clock that could accurately calculate distance by time. It is not surprising that contemporary satellite technology utilizes these same spatiotemporal principles in figuring an exact location on the surface of Earth. GPS utilizes atomic clocks, accurate to within a billionth of a second to transmit time signals to a receiver on the face of the planet. A request is sent to 4 of 24 active satellites and the response times are matched to figure nearly-exact (to 100ft. aprox.) longitude, latitude,

11 Sobel, Dava. (1995) Longitude, The true story of a lone genius who solved the greatest scientific problem of his time. New York: Walker & Company.

and altitude. The satellite, as we shall see, marks the beginning of the shift from maps that use time for accurate navigation to maps that have the potential to display information in real time.

According to cartographic historian John Cloud, the Second World War was the most important event for 20th century maps[12]. In addition to changing the nature of war and nationhood, WWII promoted a corollary shift from national to global mapping programs. “The combination of globally-scaled battle theaters and new geo-positioning and weapons systems created demands for novel map projection systems and computational capabilities.[13]” This demand gave way to the projection ruling machine, used throughout the war with incomparable and impressive results. This analog machine unfortunately required highly skilled operators to generate maps and ran itself into obsolescence as digital technologies made their appearance in the next few decades. This period between 1940-1950 changed the way governments thought about, made, and used maps. The threat of non-neighboring warfare clearly created a need for better pictures of the entire planet.

This need was heightened in the proceeding years of the Cold War. This well-funded militaristic period produced a “geodetic revolution, literally, that underlies all subsequent cartographic developments.[14]” Following the Soviet launch of the Sputnik satellite in 1957, it was immediately recognized that this “artificial star[15]” could be used as a navigational tool. The revolution was in the form of a mass-centered datum, a neutral model of the globe with a standardized scale of elevation, the theory behind all contemporary global cartography. The World Geodetic System (WGS), engineered largely by the U.S. Department of Defense in the 1950’s is considered by some cartographic historians to be the greatest intellectual achievement of the Cold War. This

12 Cloud, John. (Unpublished) The Case For Missing Overlays: A Strategy for the History of the Digital Transition on Cartography. Silver Springs, MD: NOAA Central Library.

13 Ibid. p. 3

14 Cloud, John. (2002). American Cartographic Transformations During the Cold War. Cartography and Geographic Information Science. 29:3, pp. 261-282

15 Kelppner, Daniel (adapted by Gary Taubes). (1997).The Global Positioning System: The Role of Atomic Clocks from Beyond Discovery: The Path from Research to Human Benefit. Washington D.C.: National Academy of Science.

global standardization indicates a major shift in human thinking about spatial representation, reflecting both the need to map the globe in its entirety and the participation in a common system of international measurement. The WGS formulated a coordinate system that is still, with several improvements, in use in today's GPS technology. While still a government tool during this era, the WGS changed the way the planet is mapped at the professional level: answering the need for a standardized, uniform, and complete global picture.

The final major transitory phase was the move from government and professional use to public consumer products. The 1978 U.S. Department of Defense (DoD) launch of the first Global Positioning System (GPS) satellites placed fixed location indicators into orbit. Originally used to direct missile submarines, the GPS receiver calculates earth position based on a simple triangulation of time signals broadcast by several satellites. The resulting information is a fairly precise reading of location upon the surface of the earth in latitude and longitude coordinates. The DoD began opening the system for international use in 1983 following the drowning of Korean Airlines Flight 007 which had strayed into Soviet airspace. The announcement by the U.S. Federal Aviation Administration (FAA) promised GPS would be available free of charge for international use beginning in 1993 for a period of ten years[16]. This promise was fulfilled and renewed in 1994 by the Clinton administration. Consumer use was available but limited during the Regan era, by a reduced accuracy of 100 meter radius. On May 1, 2002 President Clinton turned off this reduction, called "Selective Availability", improving GPS accuracy to within a 10 meter radius. This crucial moment in the history of cybercartography generated amateur curiosity and ingenuity that lay the foundation for the subsequent developments of this decade.

Early adopters included an unlikely assortment of backpackers, urban planners, and hackers who saw immediate uses for the new positioning technology. Geocaching was one highly publicized example of how people began using GPS and the web for

16 Rand Corporation GPS report, Appendix B: GPS History, Chronology, Budgets—Appendix B The Global Positioning System.

entertainment. The game consisted of hidden "treasure" around the world locatable only by a website and GPS coordinates. Players would hunt down hidden containers, sometimes in obscure wilderness locations or sometimes in plain sight in the middle of a city[17] to take whatever was inside and replace it with something for the next player. The "treasure" was never something valuable, the value was in the hunt itself and perhaps the simultaneous novelty and empowerment of being able to literally locate a needle in a haystack with a few digital devices.

Soon after, the 2004 Alternate Reality Game (ARG) "I Love Bees" was created as immersive advertising for the movie *Halo 2*. The game led players through an elaborate scavenger hunt that utilized not only global space but traversed the boundaries of digital and real spaces ingeniously. Players were given clues that could not be deciphered without the engagement of large, geographically dispersed yet networked communities. One elaborately encoded data set was discovered to be a series of GPS coordinates[18] corresponding to public telephone booths at specific times. Clues were then communicated by phone to players who would subsequently post back to massive newsgroups. This ARG showed masterful use of the available technologies but also relied on consumer-end GPS knowledge- an impossibility before 2004.

Fig 1:2. Jane McGonigal puppetmasters the alternate reality game, "I Love Bees" (2004)

17 Geocacher U: Geocaching 101 website retrieved September 12, 2006 from http://www.geocacher-u.com/101/index.html
18 McGonigal, Jane. (2007) Why I Love Bees: A case study in collective intelligence gaming. AvantGame.Com retrieved March 20, 2007 from http://www.avantgame.com/McGonigal_WhyILoveBees_Feb2007.pdf

There remained, however, a lack of adequate mapping technology. MapQuest, released in the web's early days in 1996, remained the dominant web mapping software. While developers could write programs that copied MapQuest content for redisplay in other environments the data remained modulated by the original provider. The first wave of application programming interfaces (APIs) were not "hacker friendly", according to Tim O'Reilly of O'Reilly Media, which left a demand for reusable map data soon to be filled by Google, Microsoft and Yahoo[19]. An API, in short, allows programmers access to the database in its raw form, to be reused in any programmed shape. This marks a sea change in the way that maps are conceived and created; an API changes the map from the picture of space to the numerical representation of space, or data, that can be reshaped by users to suit their individual needs.

Today's cybercartographic uses defy complete description, ranging from weather to real estate, flight routes to single's dating sites. It would be difficult to provide an overview of all geospatial software and applications but any attempt to do so would be outmoded and exceeded by the time it were completed, particularly in light of the fact that since mash-up mapping has become so popular that new hybrid maps appear every few minutes. It serves us better, therefore, to categorize cybercartographic tools and protocols from a more theoretical standpoint and analyze some overarching qualities that fundamentally distinguish digital from paper maps. We will put practical applications aside for the moment to expand upon the nature of digital maps in both theory and in practice. In order to better understand the essential differences of digital maps from paper, we will sidestep from the historical to the semantic to forge a new vocabulary for discussing digital spatial information. As stated, the paper map is already an abstract picture of space represented in coordinates, geometry, color, and symbol. The digital map is comprised of these abstractions as well but we will integrate the digital lexicon provided by Lev Manovich to engage a discourse on the qualities of digitization in cartography.

Features of Digital Maps

19 Roush, Wade. (2005, October) Killer Maps. Technology Review. Cambridge, MA: University of Massachusetts Press.

Digital maps may often resemble their paper predecessors in form and style, adhering to established conventions for effective spatial representation[20], yet possess a range of qualities that distinguish them so much that they are essentially no longer the same thing. This type of change is occurring across media as we transition from analog to digital technologies: photographs are different than pixel files, newspapers are different than online newspapers, films are different than what we find on YouTube. Undoubtedly digitization changes understanding and use of media, for maps it enables unprecedented customization, shapes digital information around the human body in space, gives the ability to layer images and/or create expressions based on numerical data to display several ideas at once, and provides networked databases that are always available for individual and community use. For simplicity I term these qualities personalization, localization, layerability and persistence.

Personalization: API and the user-generated map

A standard feature of digital maps is the ability for users to create maps based on specific queries of spatial databases. Unlike paper maps with set frames and edges, the digital map can be panned and scaled. Moreover, digital maps can be linked to user accounts and used to store default locations such as home or work. Digital maps can be drawn around any number of personal needs and respond to specific questions about navigation. Something to keep in mind when thinking about personalization is, in fact, the collaboration between the user and the data inherent in the appropriation of digital information. A login or user account is, of course, less personal than a physical home but more personal than a name tag because of this collaboration. A home becomes a personal space in part for the inhabitants' ability to control its appearance based on taste and ability. User accounts share this quality enabling complex behavior and evoking elaborate alterations for some users. Unlike a name tag, which is personalized to only a small extent, digital user accounts can store vast quantities of specialized, customized, information.

20 The discourse around cartographic conventions in geography ranges from issues of clarity of presentation, information design, standardized color, etc. Good resources from geography come from Alan M. MacEchchren or Edward R. Tufte for design.

An application programming interface (API) is an interesting part of cartographic personalization. APIs act as a sort of window for databases by allowing programmers access to data with varying levels of freedom to shape and control the information. Programmers can use an API to access the Google database to parse into customized interfaces. The outcome, often called "mash-ups" by the mainstream press, is a hybrid software that combines the data from Google with user-generated containers that hold, shape, and control the data.

Google's recent release of the "My Maps" feature allows users to create, store, and share annotated maps. "Humans have been making maps since the Stone Age. In fact, map-making predates written language by several millennia. Nowadays, people make maps online using tools like the Google Maps API -- but using an API isn't as easy as scribbling on a cave wall[21]." As the post says, My Maps takes the personalization features of the complex API and puts them in the hands of the non-programmer. Users can now easily add placemarks, draw lines and shapes, and embed text, photos and videos -- all using a simple drag and drop interface to create personal maps to share and store.

A paper map could be purchased and even annotated and personalized by a clever user. The digital map not only facilitates but in some ways requires personalization in order to make sense. Without a user query the map stays un-displayed, un-presented. I suggest that this change is ontological, it changes not only how maps are made and used but *why* they are made and used. Rather than providing just navigational information, a convention that even the earliest maps of the digital era conformed to, today's cybercartography allows for maps that detail and annotate individual experiences of space for many reasons. The ability to easily use spatial, annotated information is only beginning to enter our understanding of what is possible. My prediction is that within only a few years we will not easily remember this time when personal experiences of the past, present, and future were not commonly represented with spatial visualization.

21 Lee, Jess. (2007, April 7) Map Making: So easy a caveman could do it. From The Official Google Blog. Retrieved April 7, 2007 from http://googleblog.blogspot.com/2007/04/map-making-so-easy-caveman-could-do-it.html.

Localization: GPS, where everybody knows your name

My friend hacked his cell phone into a personal location device. He tracks his location back to a Google API map which, with a login of course, will show you not only where he is at on earth but where he has been for the last 72 hours. I share this with you only as an illustration of the profound changes in locality and customization, and their subsequent challenges to privacy and safety waiting around the corner as geo technology continues to filter down to private use. While this provokes questions about the future, our present technology is influenced and shaped by a need to connect abstract and ubiquitous digital information to located human bodies. As a large part of information gathering is around human need (eating, travel, entertainment, etc.) digital information is far more useful when spatially related to the actual *human* in need. Several features of digital maps highlight this connection- geotagging which connects digital information to precise global coordinates, customized local webs which filter information (and advertising) by geographic area, and mobile technology which reorients digital information around a body moving through space.

Geotagging is no small contribution to the massive interweaving of real world with digital information systems. The small act of embedding an XML tag in a web document <geo:lat>42:215724</geo:lat> and <geo:long>71:052854<geo:long> will sew together the digital file with the real world location of the Kendall Square T station here in Cambridge. Thus the web is not only a connection of networked computers sharing digital information but slowly webbing into real space, enhancing and enriching the experience of that space. Geotagging simultaneously provides an organizing principle to otherwise unsystematic data. When oriented around a global location, information can be easily searched and utilized by people in that location, a much better organizational feature than say, name or business type.

An interesting example of how localization can work to shape internet information is the website/software Loki which uses the IP address of a user's laptop to determine location and provide relevant information for that place. The service, from Skyhook Wireless, uses a WLAN-equipped notebook to access the company's Wi-Fi Positioning System (WPS), a database of known access points, to triangulate a user’s approximate physical location. After discerning location via WPS, Loki passes that information to websites to filter location-specific search and navigation information. Loki also provides automatic geotagging for blog postings and other media sharing sites like Flickr, so any information posted while running the software will include spatial tags. When Loki works, it works well. But it won't work everywhere, nor with all wireless hardware. Most reviews concur that while the software is theoretically sound it’s not technically perfect and provides limited information through “channels” that aren’t easily customized. Moreover, Loki relies on wireless networks for laptops which are currently sporadic and disjointed- users rarely have continuous coverage wherever they bring a laptop, regardless of how much they are willing to pay. Also, as the name suggests, mobile technology offers an even greater portability than the laptop computer. Mobile phones and portable devices that access wireless phone networks, like Blackberry, compensate for the laptop’s lack of both portability and continuity of connectivity.

It would be remiss to fail to mention onboard navigation systems in cars. This growing trend provides drivers with a dashboard mounted computer screen that simultaneously determines location using GPS triangulation, accesses a database of local spatial information, draws maps oriented around the moving vehicle and speaks driving directions in a pleasant, prosaic tone. No consumer-end spatial technology provides such wide reaching, specific, locating features. Save the data errors, incomplete street maps of rural areas and less wealthy nations, we are quickly eliminating the problem of being lost. At the same time, perhaps, we are eliminating the joy of getting lost. What are the long term implications of relying on accurate spatial data for precise, perfectly repeatable navigation? Surely we eliminate the frustration of being unable to find what we’re looking for but in what ways does it change our relationship to wandering, exploring, hiding? This objection to the otherwise positivist stance taken here is deeply entwined with issues of privacy. Global representations include, optimally, the entire planet: both those places that desire inclusion and those that are intentionally “off the map.” Increasingly precise and accurate GIS is a problem for the desire to be deliberately unfound- while you still may choose to not carry a GPS receiver, cell phone, there is no way to prevent your home from appearing on a satellite image. These are important questions raised by GPS and localization software, indicating perhaps the most immediate social repercussions.

The quality of localization adds a level of nuance to the idea of global databases. While there is spatial information available for the entire globe, and even other planets in some data sets, users rarely need to access more than their immediate surroundings for quotidian use. Localization, therefore, eliminates the need for a multitude of reference materials, combining the map with the phone book, the local paper, the local weather report to parse out the information relevant to a specific location and reorient the rest of the information accordingly, on the periphery. At present urban areas in wealthy nations tend to have more detailed local information than rural or developing areas. This is no doubt a corollary to the digital divide and will either improve as connectivity improves or require greater inspection as the geospatial web matures.

Layerability: Getting the whole picture

The old Rand McNally World Atlas included a section of plastic overlays imprinted with different aspects of the territory depicted. One could see the average yearly rainfall in Africa, the location of national parks in North America, or the various climate zones of the world. These overlays were often grouped into a section of the book although were summarily torn from the binding in my copy. What these plastic sheets showed was twofold; on a practical level they communicated the information they claimed to communicate, rainfall, climate, whatever. But on a theoretical level they showed the limitations of a territorial map and hinted at the possibilities of cartography. What you can see in a territorial overview, they suggested, is just a fragment of what a map might ideally express.

The digital map affords a new maturity, to continue a metaphor, to the display of information about space. At its most simple instantiation, the “hybrid” function on a Google map simultaneously represents neutral and lived space in two separate but concurrent layers. The “satellite” layer is image of the earth is a questionably neutral photograph of space as it is or was when the photograph was taken. This layer is a complex abstraction of real space. In a different way than paper maps abstracted space, the satellite image troubles the relationship between spatial representation and time, invokes highly relevant issues of privacy, and raises a century long debate about the complex nature of the photographed image. Moreover the “map” layer depicts a greater abstraction of space, perhaps more akin to the paper map in its symbology, which represents lived space, infrastructure, place names, borders and boundaries.

This seemingly simple layering of information, the satellite photograph with the abstract overlay of infrastructure produces a “hybrid” map replete with emergent meaning. What could not be seen by viewing either map in exclusivity becomes readily apparent by taking the two in concert. For instance, when landing in an airplane passengers often try to locate themselves according to landmarks. This process is often quite difficult because our relationship to landmarks is more often from the ground, from our embodied human perspective. From a bird’s-eye view, territory looks as if it would to a bird, often unfamiliar and disorienting to humans. The overlay of street maps connects the human to the abstract space by signifying the lived experience. Quotidian travel routes are marked by wide yellow tubes embossed with proper street names, two layers of symbology that connect the map user to the space: once by location of the street and reinforced by the name. Now we are able to embody the neutral map, to *be in* objective space conceptually through a system of familiar cartographic symbols. This example of layerability will be addressed further in a discussion about new digital subjective in Part II.

One further example of layerability is the “find nearby” feature introduced by Yahoo Maps in 2002, that provided spatialized phone book reference information centered around a user’s location on the digital map. This now commonplace feature was just five years ago novel but shows a natural evolution of digital information. The database containing spatial information was easily combined with the database containing business information, resulting in a natural, useful synthesis. While innumerable combinations of data that could serve as examples to illustrate this point are currently in development, the quality of layerability or what Manovich might call modularity, is an irreducible trait of cybercartography. Vellum overlays only expressed a desire to combine data sets, a desire met by modular digital information.

Persistence: Data and the map that precedes the territory

It should be made clear that persistence in this context does not mean permanence. Data longevity is, of course, one of the most controversial issues currently surrounding digital information. How will these databases hold up to decay over time and what are the implicit problems with making a total switch to an untested data format are both major concerns expressed by archivists and other people apprehensive about information loss. In this setting, however, the use of the word persistent should invoke another connotation; the theoretical idea of a database, stored on a server, that is constantly accessible to users.

Theoretically always networked and available the database is a continuous, uninterrupted stream of data. I have chosen the term “persistence” as an evaluative quality for several reasons; first it accurately describes what I feel is perhaps the most important fundamental difference between digital and paper and second it connects the real world map to the video game world linguistically. Originally used to describe multi-user dungeons (MUDs), persistent world was an umbrella term for every type of networked, online, play space[22]. The word persistent in gaming is meant to distinguish multi-user

22According to video games scholar Richard Bartle: The term persistent world was an umbrella term that was meant to describe everything from MUDs to MMORPGs, from Second Life to World of Warcraft, from Habbo Hotel to DikuMUD. “Its origins are purely descriptive: it refers to computer-moderated worlds which are persistent, as opposed to transient (as in a first-person shooter, for example).” The term came into use circa 1997, and was popular when communicating with people from related industries (telecoms, games) who didn't have enough knowledge of the genre's history to be aware of the myriad of other names they'd been called already. It was not a term used by the players, though, who went with MMORPG, later shortened to MMOG and nowadays MMO (one of the few occasions when an acronym has proven so long that it has had itself to be abbreviated). The term's heyday was the dot com boom, but gradually the players won and it slipped into more marginal use. "Persistent worlds" is not used a lot these days, mainly surviving on the strength of am IGDA white paper which tried to reinforce it in 2004 (http://www.igda.org/online/IGDA_PSW_Whitepaper_2004.pdf). At the moment, academics tend to call these things "virtual worlds", which is an excellent term games or worlds from transient or solo games. Unlike a first person shooter or personal video game, a persistent world is still “there” when you stop playing. It is available for you to reconnect to at any time, but more importantly it is there for others to experience when you are not. These spaces are often colloquially termed “virtual worlds”. Whereas virtual, as a concept, invokes the continuum of truth or reality, persistent is a temporal quality and a more relevant parameter by which to evaluate data. Virtuality is a quality of experience, persistence is a quality of data.

This quality is particularly relevant to the newest form of cybercartography, the digital globe. Often called “virtual world” technology by geographers, the persistent, modular representation of our Earth shares many qualities with what the game world would call virtual, or persistent worlds. This quality is at the heart of Part III, a comparison of Google Earth, a model of the real world built from data and Second Life, a model of an imaginary world also built from data. What both of these spaces share is their relationship to data and that data’s persistence. The word persistence serves, therefore, to link these two previously unconnected ways of visualizing spatial data.

In Conclusion:

Time magazine’s oversight of cartographic tools in last year’s issue could not have been for a lack of importance to the changing modes for human communications. Maps, a primary communication device, are perhaps a “self-evident” technology, as Lisa Gitleman might say. This self-evidence leads to a level of invisibility that makes the importance of maps somewhat difficult to see. This investigation troubles the rupture initiated by digitization in cartography: the rupture that split data from presentation leaving maps that resemble the ones that came before while being, in fact, completely different. The protocols associated with these new maps are quite different than paper ones, as evinced by the discussion above, making way for new engagement modes and

marred only by the fact that it's used in other fields nothing to do with MMOs (well, and the tradition that the game/social world separatists always try to make any umbrella term refer specifically to one side rather than the other).

room for a new type of map: a map which ideally integrates human experience with spatial accuracy. This integration will be the subject of Part II.

Part II: The Practice of Everyday Maps

What the map cuts up, the story cuts across.

-Michel de Certeau

The previous chapter refocused digital cartographic discourse, appropriately, around data. Digital maps are necessarily different than paper maps and any conversation about them requires a new set of evaluative properties, vocabulary, and a rethinking about the location about meaning in spatial representation. This rethinking obfuscates the once clear distinction between spatially accurate and inaccurate maps. In the age of digital data we must abandon pure accuracy in favor of a far more nuanced construct that does not rely on a binary of true vs. false, rather a continuum of utility. Satellite depictions of the planet confuse our sense of accuracy by being simultaneously more and less accurate than paper maps. The satellite image may be a perfect representation of space as it is or it may be an utterly incorrect representation and the problem is, "you have no way of knowing what you're going to get.[23]"

Michel de Certeau writes a rather useful reframing of spatiality in *The Practice of Everyday Life* which provides a cohesive vocabulary for a similar reframing of maps. De Certeau reinserts the human into space irrevocably, arguing for lived, practiced spaces that do not exist without the human experience or "narrative".

> The operation of walking… is transformed into points that draw a totalizing and reversible line on the map. They allow us to grasp only a relic set in the nowhere of a surface of projection. Itself visible, it has the effect of making invisible the operation that made it possible. These fixations constitute procedures for forgetting. The trace left behind is substituted for the practice. It exhibits the (voracious) property that the geographical system

23 From a conversation with Daniel Sheehan of the MIT GIS laboratory on 4/29/07 on the topic of professional vs. amateur needs from a map and the reliability of Google Earth satellite database.

> has of being able to transform action into legibility, but in doing so it causes a way of being in the world to be forgotten[24].

Thus the paper map obliterates the process by which it was made, by human survey and observation, rendering it "relic" without practice. De Certeau argues for a reinsertion of this process into an understanding of spatial experience. In this digital era, the human process is deeply embedded but nearly indiscernible in a traditional understanding of cartographic technologies. Surely human agency designed, created, and launched the satellites which orbit and photograph the planet. So objective these images may seem, they are still an apparatus implicit with humanity. Moreover the authorship of a digital map is not easily determined. To use de Certeau's language, the "geographical system", impugned for abstracting away experience, must now be expanded to make room for the neo-geographer, you and I. As creators of personal maps of experience, how might we reintroduce elements of practice like trajectory, temporality, preferences and subjectivity into the process of cartography?

This chapter is ultimately about a reintroduction of the subject into the abstracted "relic" of the paper map through digitization. For many common maps, the predominant feature is terrain, a quality that can be measured, observed and quantified. This type of cartography stems from a long tradition of representing space objectively and is much the root for many contemporary cartographic developments. Other features of space are often mapped, features of lived space such as borders, infrastructure and other semi-permanent vestiges of human impact on land. These representations are moments in time, pictures of space as it is for the moment. Within this node of spatial representation is the phenomenological which portrays qualities of experience within the lived or neutral space. These layers are ephemeral, human, and deeply subjective pictures of space. To illustrate these varieties of representational styles, this essay will compare historic cartographic paradigms with our contemporary digital one.

24 De Certeau, M. (1984) The Practice of Everyday Life. Berkeley and Los Angeles, CA: University of California Press. p. 97

A historical look at cartography is as non-linear as the space it represents. To tell the story of maps, as we will, we must not only isolate moments in time as thematic representations, but also separate those moments from their chronology to see the bifurcation more clearly: the Cartesian objective, neutralized, scientific against the subjective, personalized, religious. These tropes are largely characterized by the ages from which they originate but provide an engaging discourse on the nature of pre-digital maps. The proceeding chapter will discuss first the objective mandate of maps illustrated by Geography's father, Ptolemy followed by an examination of early Medieval European maps as stellar examples of human cartography and subjectivity. Digital and networked maps, as we will see, provide a natural synthesis for these polarities- a way to reintegrate the subject into the objective map as well as the cartographic process.

Ptolemy and quantitative orthogonal representation:

Cartography so predates our history that few traces of the ancient process remains. "No one knows when or where or for what purpose someone got the first idea to draw a sketch to communicate a sense of place, some sense of here in relation to there.[25]" While no evidence of the earliest survey process exists, surviving maps of stone, wood and occasionally skin and bone, bespeak an early need for spatial representations[26]. Prehistoric maps have been found on nearly every continent, discoveries that show an important tool for the oral culture. Even for pre-text people, communications of space were a necessary part of life. Mental models might be easily generated an individual with varying degrees of accuracy, but for a shared notion of space an image becomes the most reliable tool for group decision making, planning, and navigation.

But what separates a map as a picture of space from a landscape drawing? Unlike the landscape's aesthetic value, the map is utilitarian, a functional tool. The functionality of the map is based on a long tradition of the pursuit of an objective ideal and the belief that "a perfectly accurate map could be drawn if there were enough people to go and check

25 Wilford, John Noble. (1981) The Mapmakers. New York: Alfred A. Knopf.

26 Lister, Raymond. (1970). Antique Maps and Their Cartographers. London: G. Bell and Sons, Ltd. p.13

it.[27]" This flawed theory does not account for time or the last half century of work in situated cognition but is still a fairly common colloquial belief. It behooves us, then, in this time of seemingly perfect, neutral, satellite imagery, to explore the validity of this objectivist model. What follows is not a linear history, rather several historical examples of the development of cartography's objective underpinnings.

Fig. 2:1. Ptolemy's world map, (circa 150, print circa 1300)

The history of modern cartography begins in Greece and has been attributed to the astronomer Klaudius Ptlemaios of Alexandria (A.D. 87-150). Better known as Ptolemy, he is credited with the creation the first *mappamundi*, maps of the world. The *mappamundi* shown here (Fig. 2:1) is "inaccurate according to modern standards, yet remarkable for the time it was conceived.[28]" The translation is based on a conic projection which while only somewhat more distorted than our Merkator projection, shows that ancient Greece was not beguiled by the notion that they lived atop a flat Earth. Moreover, the presentation of earth's portrait, traversed by a orthogonal lattice of longitude and latitude rendered it orderly and knowable, in line with the Greek cosmology. Ptolemy as

27 Tufte, Edward R. (1997). Visual Explanations: Images and Quantities, Evidence and Narrative. Cheshire, CT: Graphics Press. p. 14

28 Lister, Raymond. (1970) Antique Maps and Their Cartographers. London: G. Bell and Sons, Ltd. p. 16

the forbearer of Geography and the quest for accuracy in geo-representation should rightly be considered the patron of the orthogonal overlay, his maps are among the first to use a grid to measure and depict the relationship of places on paper. His work precedes and informs generations of astronomers, explorers, cartographers and geographers who have added to the cartographic process in the intervening millennia and certainly underlies the essential concepts of modern digital global positioning.

Although these maps did not reappear in Europe until the turn of the 15th century when they were brought to Florence from Constantinople they represent an early human desire for order based on observable, calculable data. Ptolemy's observations, while over a millennium before their bloom, proved a seed of intellectual curiosity that flourished in Renaissance Italy. This idea that space could be envisioned systematically, "pictures of individual lands with their relative positions[29]" greatly appealed to Leonardo da Vinci who's work on the Vitruvian man shared this type of relative positioning. Underlying this practice is an ideology that translates topography into geometry: a flat, ruled, surface governed by orderly and sensible principles. "Leonardo belonged to a society that, like every human society anywhere in the world since the dawn of mankind, believed that geometric patterns formed in geometric patterns formed in orthogonal relationships not only pleased the eye aesthetically but possessed talismanic power.[30]" Beyond merely knowing how to get around, a map of space could reveal secrets of the universe. This thought underlies, to some extent, the materialist scientific tradition which privileges observed, quantifiable data.

The maps of Ptolemy's *Geographia* traveled to the east following the fall of Greece and returned over a thousand years later to the fertile scientific grounds of Renaissance Italy. The intervening years were governed by a spiritual telos; Christianity was the guiding epistemic principle. "Christians, after their long and bitter struggle for recognition in pagan Rome, had come to reject much of classical learning as sinful, especially the

29 Edgerton, Samuel Y. Jr. (1987) From Mental Matrix to Mappamundi to Christian Empire: The Heritage of Ptolemaic Cartography in the Renaissance. In David Woodward, ed., Art and Cartography p.11

30 Ibid. p. 11

rendering of stereometric forms in art. Like the classical style, Ptolemy's cartography was deemed inappropriate for expressing the true Christian spiritual reality of the world.[31]" It was during this period that maps of a different character flourished: maps that illustrated biblical myth, layering stories atop the lived world.

Same space, different picture. Medieval Maps:

Several categories of maps from the Medieval period have anomalous characteristics that although accused of gross spatial inaccuracy, depict something more than space. Examples of European map styles from the 12th-15th centuries remain, depicting pilgrimage routes, sailing ports, and an overall orientation of the mortal world around philosophical and religious ideology. The disparity between the Medieval period and the preceding cosmology of the Greeks indicates a shift in episteme; a privileging of the Biblical and mythological over a knowable, orderable universe.

Donald Lowe lays out eras of perceptual frameworks or "epistemic orders" that help us to contextualize Medieval cartography in his chapter on the "History of Perception". Although Lowe's time periods only extend back to the Middle Ages, they give a sense of how changing priorities and worldviews are embodied deep within modes of perception. According to Lowe, the epistemic order of the Middle Ages was anagogical, privileging the interpretation and demystification of scripture as a fundamental characteristic of meaning. "Medieval anagogy presupposed the absolute being of God with all else, including the knower and knowledge, dependent upon him." Or more simply, "one could only know in reference to God.[32]" Lowe makes connection between episteme and a sensory hierarchy for communications media. As the perceptual apparatus is not limited to neurological functions, the body and how it perceives information must also be impacted by an overarching epistemology. For the Middle Ages, he finds, the dominant media "sensing hierarchy" was hearing and touching over seeing. Before print, writing or chirography was limited to an elite, thus what could be heard was more valuable to the

31 Ibid. p. 26

32 Lowe, Donald M. (1983). History of Bourgeois Perception. Chicago: University of Chicago Press. p. 10

overall culture than what could be read. Before the invention of typography, visuality never succeeded in overthrowing the aural and tactile emphasis of the human senses.[33] It figures from this reasoning then that maps of the Middle Ages would have both the epistemic qualities of an anagogic priority, focusing not on matters of geographic representation but on scripture and myth. Moreover, the spaces represented by some of these maps indicate a simplified way of communicating complex texts to a pre-literate society. Medieval maps therefore provide a unique example of how maps produced outside of the desire for spatial accuracy look. These maps do not remove the human from the space, rather orient the space around the subject and the human experience.

The popular T-O (or O-T map) depicts the Earth as three major continents divided by a cross, or T, and surrounded by a ring of water (Figs. 1:2 and 1:3). Most surviving specimens of this particular representation were authored by Isidore, Bishop of Seville in the early 7th century. and centers around the intersection of the two major rivers with Asia at the top of the map, occupying 2/3 of the space. Europe and Africa are of equal distribution at the bottom to the left and right respectively. The tripartite structure of this map is a tribute to the division of the continents between the three sons of Noah[34] and may have born a "satisfying echo of the Trinity.[35]" Moreover, the map is curiously oriented around Biblical space; the idea of an earthy paradise to the east (represented at the top of the map) and human's migration down/west. The rivers which flow down from paradise, represented by the center bar of the T, also form the barrier which prevent return.

33 Ibid. p.8

34 Edson, Evelyn. Mapping Time and Space: How Medieval Mapmakers Viewed Their World. London: The British Library. p.15

35 Ibid. p. 15

Figs. 2:2 and 2:3. Early T-O maps, Isidore of Seville's tripartite world map, printed in 1472 (left), T-O map from Jean Mansel's *La fleur des histoires* (Lambert of St Omer), 15th century (right).

We are cautioned against perceiving this map as we would a navigational or planning tool. Bearing in mind that the T, now but more so a thousand years ago, did not only represent the Church but was ideologically inseparable from it, we are able to see a picture of the world from an explicitly religious telos. These maps do not depict terrain so as to be useful in decision making but rather show the mortal world as where it is separate from the spiritual. The Christian concept of a world that was derived from the simultaneous creation of time and space, in Genesis, would require maps that were able to depict all of this: not only time and space, but also the distinction (and integration) between human and mythical space. These maps were often drawn as accompaniments to spiritual texts to illustrate, and no doubt perpetuate, cultural and mythic reality.

Intention is the key to what the map conveys. What becomes clear through looking at the Medieval maps is that the cartographer’s ideology not only informs the way the map is drawn but more importantly what the map depicts. We tend to treat this question as irrelevant in our understanding of maps whereas we trouble it in other areas of science and technology: within what paradigm do the conventions reside and what are other possible ways of envisioning them?

Figs. 2:3-2:4. Horlogium or travelers' sundial pairs the months with the positions of the sun (left). Zonal map from Macrobius' Commentary on the Dream of Scipio depicts Earth climates (c. 515 BC, right).

A list map, credited by Edward Tufte[36] as the earliest form of visualization displays textual information distributed either geographically or along what reads like a timeline. A list map might provide information grouped together in text as it is on the surface of the earth or instructions for a traveler. One stellar example of a textual map is the Horologium or travelers' sundial (Fig. 2:3). This map, or diagram to be exact, works as a date and time figuring device for travelers by calculating shadow length by month and year. These diagrams were thought to be "frequently copied and dispersed without correcting these figures so their practical use was limited.[37]" But what we can see from this chart is a literal connection of the human to the data; a ubiquitous yet more subtle quality of all of the maps discussed here.

In addition to maps that indicate an individual human perspectives, other maps like the Zonal map (Fig. 2:4) depict shared spaces. These maps distribute information into general regions. These maps resemble, to a degree, modern diagrams or visualizations for their distribution of information in abstracted terms. Surviving zonal maps are thought to be related to the *climata* of Ptolemy's day, diagrams of planetary climate zones, although

36 Tufte, Edward R. (1997). Visual Explanations: Images and Quantities, Evidence and Narrative. Cheshire, CT: Graphics Press. p. 10

37 Edson, p.69

without practical application[38]. A particularly useful example comes from Macrobius's *Commentary on the Dream of Scipio* in which they are used to illustrate his complex ideas of the phenomena of heaven and earth. This drawing depicts five climates, "inhabitabilis", or uninhabitable to the extreme north and south, "temperata nostra" or temperate climates on either side of the center belt, labeled "temperata antetorum" thought to be a neologism meaning opposite. What is important about this depiction is the level of abstraction provided by the cartographer in conveying qualities of space. Rather than depicting terrain with the climate zones dawn atop as we are likely to do, Macrobius envisioned climates as something separate from land, as an independent feature of the planet as experienced by the many, as opposed to the individual.

The most striking difference about these Medieval maps is that they do not only represent space, but use space as a framework for illustrating other concepts. These maps function primarily as either representations of religious myth or provide specific instruction to the user. They are depictions of a different type of space, dependent on humanity for its very existence to journey in time or to perceive allegory. The Medieval maps ontologically integrate time into space, so that the representation is understood as an instance or part of Biblical history, and not misunderstood as permanent, intractable reality.

The rarer pilgrimage or itinerary map (Fig 2:4)[39], survives in only several instantiations from Benedictine monk, Matthew Paris (c.1200-59). These curious maps depict an imagined journey of a religious pilgrim, abstracting not the terrain but the built space the traveler will pass through. Paris iconizes major buildings of the towns as an architectural synecdoche; the pictures of buildings represent buildings that signify whole towns or cities. Beyond this beautiful confluence of abstraction, Paris's maps depict a journey that privileges experience over space. The map literally erases the terrain between the cities, showing only what one will see when he arrives. In this way, the map embeds the human within its meaning, requiring a journey of real or imaginary movement.

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38 Brown, Llyod A.. (1980). The Story of Maps. Boston: Dover Publications. p.97 (Brown refers to the zonal map as "unrelated to practical cartography")

39 Edson, pp. 118-125

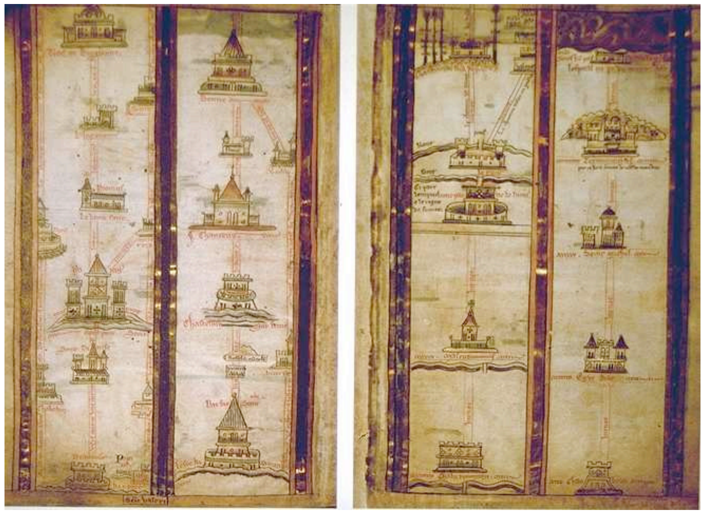

Fig. 2:4. Itinerary, from London to Apulia, Matthew Paris, 1250

This type of movement is neither implied nor necessary for an objective map; this map merely presents a territory in which life is irrelevant. A user can trace a trajectory with a fingertip and imagine movement but the movement is external to the map. This is explicitly not so with a pilgrimage map- the map requires movement in order for its functionality to be fulfilled. Indeed the map exists without human movement, but it is not in this sense fulfilling purpose hence not a map of a pilgrimage. What this means for the purpose of our discussion is that the subject is now embedded in the map's functionality. In this sense the map can not exist without people.

This point is highlighted by a look at age contemporary *puertolanos* or portolan maps that were generated and used by sailors at sea as opposed to religious scholars in the Medieval period. In his essay on "Cartography and the Colonialist Space", Shankar Raman connects these maps to practical experience. The portolan, he finds, "provided an indispensable link on the level of material practice to ground, as it were, the emerging re-conceptualization of space and subjectivity obliquely expressed in Ptolemaic maps.[40]" So it is not only the product, the portolan chart, that is of import but the process by which it is created: by sailors on ships marking of points of experience—a process inseparable from the final product. This type of map is accurate insofar as it represents a picture of

40 Raman, Shankar. (2001). Framing "India": The Colonial Imaginary in Early Modern Europe. Stanford, CA: Stanford University Press. p.121

space from above, the way we expect a map to look, yet it is based on unsubstantiated subjective information. This “link” Raman indicates is embedded within the process of humans creating maps of experience, creating representation of the territory the way it is actually experienced. Envisioned on a portolan chart is a representation of how the space is used.

The 16th century revived Ptolemaic conventions sparked initially by the Renaissance followed by the scientific revolution and an unquenchable thirst for scientific discovery. Subsequent cartography conformed, for the most part, to conventions of objectivity which wiped the human off the map for several hundred years. I argue that digital and networked technologies enable a new type of map that is at once objective and subjective; a map that allows for abstractions atop concretions as a sort of virtual palimpsest. This synthesis is illustrated by the “hybrid” feature of Google Maps which allows for simultaneous view of “neutral” and lived spaces.

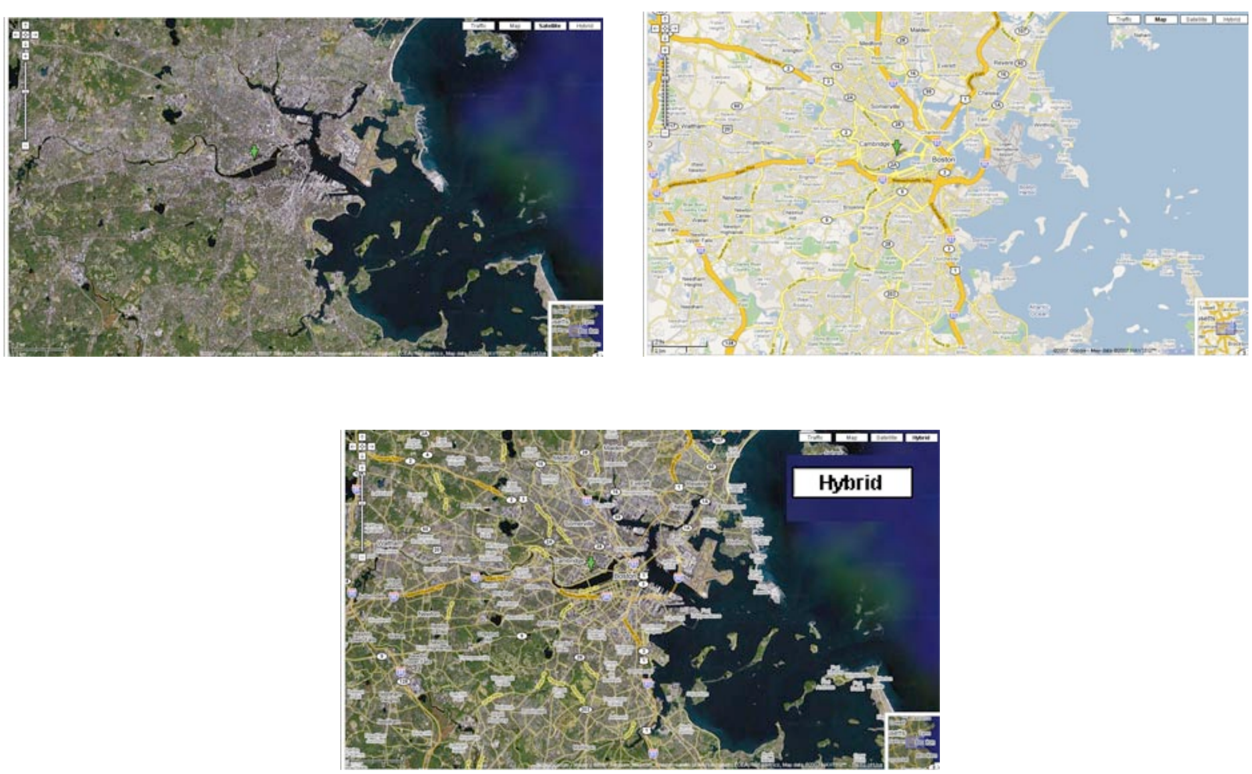

Fig. 2:5. Three layers of Google Maps: Satellite, Map and Hybrid (clockwise from top left.)

Hybridization mimics the poles established at the start of this essay, a bifurcation of objective and subjective space. The clickable buttons labeled “satellite” and “map” respectively, however, are the only place where this distinction is clear. Within the digital map, subjectivity and objectivity are interwoven so that while vestiges of pure objectivity can be seen in cartography’s claim to accuracy, the subject has become an inextricable part of the same cartographic process. To illustrate this point we will examine a very recent incident of Google Maps’ representation of Hurricane Katrina.

Who’s World is it Anyway? Google Maps and Katrina Images:

The tradition of accuracy is strongly reflected in issues surrounding contemporary spatial representations. As cartographic technology improves, generates more convincing depictions of space from above, the debate over accuracy becomes marginalized in favor of an acquiescence in a sort of “truthiness” or sense that the data is true enough. This phenomenon is illuminated by the continuing problem of how Google Earth has chosen to represent the Katrina devastated Gulf Coast in its satellite image database.

Immediately following the 2005 hurricane, Google Earth became a valuable tool for evacuees hoping to estimate damage to their property. By using amateur fly over photographs as “overlays” in Google Earth, networks of people banded together to determine which areas had been hit by flooding and posted the information to bulletin boards. Photographs taken from a Cessna Citation jet were available within 24 hours after the storm. Although not entirely clear, the images, when matched to GPS coordinates in Google Earth, gave a good sense of the condition of a home, street, or neighborhood. The novelty of the software encouraged many new users to lend a hand to the effort, according to a September 5th, 2005 New York Times article[41]. This example provokes interesting questions about temporality and global imaging. The fly-over images were clearly being taken as valid real-time information about the state of the disaster area, lent additional credibility from their alignment with GPS coordinates in Google Earth’s global

41 Hafner, Katie. (2005). For Victims, News About Home Can Come From Strangers Online. New York Times, September 5, 2005

framework. While this is an extreme circumstance, it does clearly indicate a new type of amateur cartographic behavior. A plane flew over, photographed and posted aerial images to the internet. The images were obtained by neo-geographers at home who responded to queries from displaced Gulf residents and generated mostly-accurate maps of the real-time flooding in their communities. These maps were either reposted to the internet or described in email[42].

Google Earth's representation of Katrina's damage did not stop there and has, in fact, recently become the center of a heated debate within GIS communities, raising serious questions of accuracy, politics and digital cartography. Last week (March 25, 2007) Google came under heavy criticism from user, Geographic, and journalistic communities for its unexplained swapping the post-Katrina images with the pre-disaster ones seen here. In a letter to Google, D-N.C., chairman of the House Committee on Science and Technology's Subcommittee on Investigations and Oversight, Brad Miller demanded an explanation for the imagery switch. "To use older, pre-Katrina imagery when more recent images are available without some explanation as to why appears to be fundamentally dishonest[43]," the letter states. It goes on to directly inquire if the Federal Emergency Management Assistance (FEMA) agency had contacted Google requesting the images be changed. This suspicion reflects not only a deep distrust of the agency's attempt to cover up mismanagement of the crisis but also impugns Google as a potential collaborator in revisionist history.

Google's quick and thorough response earlier this week came in the form of replacing the previous images accompanied by a blog posting by Maps/Local/Earth director, John Hanke. Hanke writes:

> In 2005, shortly after Hurricane Katrina hit New Orleans and the Gulf Coast, a very motivated group of volunteers at Google worked with NOAA, NASA, and others to post updated imagery of the affected areas in Google Maps and Google

42 Ibid. Amateur cartographer, Leonard Sprague of Gainesville, Fla writes, "Actually, it looks like your house looks pretty good…Unfortunately it doesn't look so good for some of your neighbors. Best of luck to you and your family."

43 Miller, Brad. Letter to Google CEO Eric Schmidt 3/30/07. U.S. House of Representatives website. Retrieved April 1, 2007 from, http://democrats.science.house.gov/Media/File/AdminLetters/miller_google_katrina_maps07mar30.pdf

> Earth as quickly as possible. This data served as a useful reference for many people… Several months later, in September 2006, the storm imagery was replaced with pre-Katrina aerial photography of much higher resolution as part of a regular series of global data enhancements. We continued to make available the Katrina imagery, and associated overlays such as damage assessments and Red Cross shelters, on a dedicated site (earth.google.com/katrina.html). Our goal throughout has been to produce a global earth database of the best quality -- accounting for timeliness, resolution, cloud cover, light conditions, and color balancing[44].

The suggestions that Google operated out of malfeasance by replacing the images of devastation were connected to a range of conspiracy theories, from the FEMA implication made by Rep. Miller to the suggestion that the maps had been changed to indicate successful recovery in hopes of revitalizing tourism to the area. These accusations were quickly dismissed by Google's blog statement and reinstitution of the lower quality images of flooding. The reasonable explanation may explain the overlay switches but the theoretical problem indicated by this event is not so easily dismissed.

The problem is perhaps best illustrated by the final paragraph of Representative Miller's letter to Google:

> Digital technology has any number of benefits, as Google's healthy balance sheet demonstrates. However, experience has also shown that such technologies pose a particular threat to photography as a representation of reality. While we can understand that Google would prefer the most recent imagery of the New Orleans region for its Web site, to use older, pre-Katrina imagery when more recent images are available without some explanation as to why appears to be fundamentally dishonest. The entire country knows that New Orleans is a great American city struggling to recover from an unprecedented disaster. Google's use of old imagery appears to be doing the victims of Hurricane Katrina a great injustice by airbrushing history[45].

Several key points stand out from this succinct accusatory paragraph. First, Miller indicates Google's "healthy balance sheet," a barb not missed by the blogosphere which immediately picked up on the implications of a misuse of power in postings like "Is Google Finally Evil?[46]". The relationship between power and wealth and cartography is not a new one by any stretch of the imagination, and this accusation squares with a

44 Hanke, John (2007) About the New Orleans imagery in Google Maps and Earth. Google Earth Blog, Monday, April 02, 2007. Retrieved April 2, 2007 from, http://googleblog.blogspot.com/2007/04/about-new-orleans-imagery-in-google.html

45 Miller letter

46 New Media Life, Understanding online communities one pixel at a time blog, April 2, 2007. Retrieved April 2, 2007 from, http://newmedialife.wordpress.com/2007/04/02/is-google-finally-evil/

historic reading of maps and spatial control. There is, however, a much bigger accusation being directed by this paragraph; one that impugns the digital nature of the digital map, making the same very equation that I make within this essay: the homogenization of digital data that enables a cross-media discussion. Miller asserts that digital maps are not only akin to photography, but can also be "airbrushed[47]" to correct imperfections in the same way a model is corrected on a magazine cover. This is an equivalence that illuminates the ease and completeness with which digital maps can be altered as well as the lens of scrutiny and skepticism through which they should be evaluated.

There is still another issue raised by this little story, indicated by John Hanke's list of priorities for the Google satellite photos. Hanke mentions "timeliness" as a key factor in determining an image's quality for inclusion in the database. What on earth could he have meant by this? Most likely it is a response to the problem at hand and refers to images that are the best representation of "what is" but this explanation is deeply problematic when explored even slightly superficially. The use of time as an evaluative characteristic, particularly when coupled by issues of cloud cover or resolution, imply that there is a time that is more neutral than another. Presumably this is a time that is sunlit, cloudless, and well photographed. These may be the best conditions for viewing the surface of Earth from above but they should by no accounts be mistaken for neutral conditions.

This event highlights cartographic non-neutrality with regards to the representation of time in the hurricane torn Gulf region. Pre-hurricane images of the Gulf area may better meet the qualities of ideal viewing conditions while disregarding cartography's mission of accuracy with regards to representing land as it is. This new problem is created by the type of semi-instantaneousness of satellite images which on one hand provide a sense of being real-time (as the overlays were used immediately following the storm to locate damaged property) but on the other provide an uncanny representation of ambiguous yesterdays: an indeterminable time that was, of course, cloudless and sunny. The crucial

47 Miller probably uses "airbrush" as a layman's understanding of how images are corrected. In truth, nearly all image correction is done with digital tools and digital photographs rather than an airbrush and paint upon a paper photographic print. I assume, therefore, that the statement implies the use of digital technology, whether Miller was aware of it or not.

decision about which time to represent is unique to satellite imagery, a departure from the abstracted, time-independent, spatial representations of the paper map.

A fruitful example of the embedded subject, this story about Google's difficulty in representing the current state of Gulf region clearly indicates an emergent difficulty facing the challenge of objectivity in maps. Because satellite images are essentially photographs they are now faced with the inherent complexities of photography, a discourse ranging from problematic apparatus to manipulated artifacts. Moreover, the satellite image can never be entirely neutral or objective, regardless of Google's hopes for ideal viewing conditions. There will never be a way to clear off the planet for a few minutes while Google takes a neutral picture for its database. We are all, therefore, permanently embedded in some way, within the pixels of Google Maps/Earth. This is abundantly clear to these Dutch sunbathers (52° 4_43.38_N, 4°19_58.02_E[48]), imprinted forever or for the time being, within the satellite overlay currently used in the default Google Earth.

Fig. 2:6. Sunbathers near the Leidschendam area of the Netherlands caught on Google Earth satellite photograph.

48 Google Sightseeing: Why bother seeing the world for real? Blog posting, September 19, 2006. Retrieved March 15, 2007 from, http://googlesightseeing.com/2006/09/19/topless-sunbathing/

While these people could, of course, be removed digitally, "airbrushed" as it were, there is no end to the ouroboros initiated by even thinking about that process: however would the airbrush artist determine how a neutral planet should look?

We see that even at the level of objective data the human is back on the map, so to speak. On a paper map, areas of pastel shading demark territory. This type of abstraction provides a clear symbolic separation between the actual land and what is represented by the map and, I offer, a buffer between the image and the illusion of reality. The satellite image, however, exchanges that abstraction in favor of a far less noticeable one, digitization. Rather than Texas symbolized by a large pink area in the shape of Texas, it is now represented by an overhead photograph laid upon a three dimensional terrain wireframe. Reliance on satellite images as realistic or accurate representations of space is inherently problematic because of this digital nature which gives the appearance of real but is in actuality, a mere slice of space and time. This problem may be temporary as technology improves to allow access to real time streaming satellite images of the planet. This likely possibility opens the door to a host of mind boggling privacy issues only suggested by the current capabilities of Google's spatial representation tools.

In Conclusion, the Subject of the Digital and the Digital Subject:

I opened with a popular quote from Michel de Certeau which impugns cartography for reducing lived experienced to the "legibility" of spatial abstraction. In similar findings, Geographer Tim Stott writes, "physical description is to geography what anatomy is to sexuality. They no longer suffice to realize the complexities of their 'domains.'" Nevertheless, these complexities can still be plotted, surveyed and mapped.[49]" Both Stott and de Certeau indicate a new way of being in and thinking about space; a method that accounts for the unpredictability and specificity of spatial experience. Digitization has ruptured cartography at every level, from the technical survey apparatus to the way the maps are drawn by people to express a multitude of intention, need, spatial desires.

49 Stott, Tim. (2004) Next on the Left, or: 'What good is a map if you know the way?' Variant 21, Winter 2004. Retrieved March 27, 2007 from http://www.variant.randomstate.org/21texts/issue21.html#L7.

While the T-O maps of the early Medieval period tell stories of what happened to people in space, it is the illustration of biblical myth transposed with places on earth encourages a greater sense of reality to the story but also provides a greater sense of story to the place. In this way, subjective maps, or human maps, represent space in a different way and for a different purpose than creating abstract “relics”. The digital map mimics this type of intention in several ways: primarily the Application Programmable Interface (API) or mash-up which allows users to create maps of experience and lived space but also in the communities that have formed around cybercartography that utilize maps as a storytelling medium and mode of virtual travel.

The API, as outlined in Part I, allows for the redistribution of database content into user-generated containers. This April, Google released a new tool called “My Maps” which allows for simplified creation of customized maps which can be saved and shared with others. Basically an even easier way to customize and redirect spatial data, My Maps allows the neo-geographer the ability to “add placemarks, draw lines and shapes, and embed text, photos and videos -- all using a simple drag and drop interface. [50]” By turning customized cartographic tools over to amateur geographers, Google[51] is enabling a new type of subjectivity, a new mode for the representation of space.

Where the API permits customization and infuses neutral spatial data with personal, experiential consequence, networks construct communities to assign further human value to the data. In blogs and on bulletin boards across the web, conversations about maps and cartography are changing the way maps are created and used. The networked aspects of cartography indicate the third and final section of this thesis, the shared spaces of digital cartography. Built from the essential digital information described in Part I, infused with meaning and subjectivity as explained by this chapter, the development of a cartographic community will be the core of the next chapter. When we look at Google Earth as a cartographic system made from digital information, we are consequently able to consider

50 Lee, Jess. (2007, April 7) Map Making: So easy a caveman could do it. From The Official Google Blog. Retrieved April 7, 2007 from http://googleblog.blogspot.com/2007/04/map-making-so-easy-caveman-could-do-it.html

51 And others including NASA Worldwind, MSN World, etc.

the imaginary world of Second Life as “cut from the same cloth.” This fruitful comparison allows for discourse about the consequences of many users contributing to, commenting on, and exploring in the navigable map.

PART III: 3D NAVIGABLE MAPS

To order chaos, ancient Hawaiian navigators used no external instruments to locate themselves in space, read the ocean, and "wayfind" the often immense distances between Polynesian islands. Part of this nearly extinct art involves experienced wayfinders reading the direction and intensity of ocean swells with the male body's finest navigational device: the testicles[52]. Either by sitting on the bottom of a thin canoe or physical immersion into various currents, navigators could read temperature, speed, and direction as clearly as we read a Google Map today. The body's sensitivity combined with practiced and shared knowledge led to an extraordinary navigational system which enabled native Polynesians the ability to travel remarkable distances with no extraphysical device. This practice has been mostly replaced by modern and Western navigational systems, including satellite positioning and GPS receivers[53], but should remind us not only that the body is a powerful navigational tool but also that we rarely go anywhere without it. New cartographic technologies trouble the way the body navigates space by increasing the amount of available information far beyond the capacity of memory. Furthermore, navigable virtual places rupture the relationship of the body to the map by allowing us to go beyond the *view* to the bird's eye *experience* of space.

For the most part, the maps we have discussed so far are two dimensional (discounting the dimension of time). This chapter deals with maps that are radically and unequivocally different than not only paper maps, but also their recent 2D predecessors: 3D navigable maps. Unlike the static map, the virtual globe or virtual world not only depicts space but also *simulates* space using 3D graphics. This change enables the simulation of motion through space and thus forces a rethinking of what and how we consider maps. Users of these new maps experience spatial representations not only from a bird's eye view but now with a bird's ability to fly, take off and land. The explosion of mobile devices

52 Witt-Millier, Harriet. (1991). The soft, warm, wet technology of native Oceania - sea navigation. Whole Earth Review: Fall.

2 The Polynesian Voyaging Society still makes device free sea journeys but there are very few skilled wayfinders left.

enabled with GPS and cartography, combined with the increasing geocoding of digital information leads us inevitably to new access modes for spatialized information. As our lives become increasingly entwined with spatial information, it behooves us to think through the possible futures indicated by the navigable map; futures that abolish the clear distinction between on and offline, and enable a convergence between a wealth of data, the standardized map and the maps in our heads.

This chapter addresses two major themes of navigable cybercartography: first, the geospatial web or linking of digital information to real world spaces, and second the development of virtual places that depict both real and fantastical spatiality. Both themes are related to spatial practice, the former in the ways we move through real spaces and access digital information through mobile devices, and the later, how we navigate virtual spaces like Google Earth or Second Life. These themes are linked through Kevin Lynch's notion of wayfinding, or "strategic link" between the world we see and the world we imagine.

Theoretical perspectives on spatial navigation, Lynch and de Certeau:

Lynch suggests a mental image, "the product both of immediate sensation and of the memory of past experienced [that] is used to interpret information and to guide action.[54]" This concept of space, held within our individual minds, is a composite of the space the body is in an a given moment combined with the space as understood from memory. Best illustrated by the moment when walking or driving, that a person thinks, "oh now I see how it all fits together", this is a sort of internal, conceptual map. This map allows for not only individual growth according to Lynch, but a heightened sense of emotional security and deeper "human experience." To be clear, knowing where one is in space makes one feel secure, happy, and situated; emplacement orders chaos.

An experienced Hawaiian wayfinder needed no compass or map to pilot his canoe from place to place, which although in my opinion remarkable, Lynch found a to be source of

54 Lynch, Kevin. (1960). The Image of the City. Cambridge, MA: MIT Press. p. 4

"[s]train and anxiety.[55]" This stress, he contends, comes from an unpredictability of the environment and a reliance on only the most highly skilled navigators to get around. This anxiety is acerbated by maps and navigational devices, he finds, even if at the loss of "the positive values of legible surroundings.[56]" Meaning, we may be able to wayfind anywhere but without the comforting sense of place that the internally created mental map provides. We see, therefore, a difference between knowing *how to get from place to place* and *knowing a place*. Lynch privileges the later because it is knowing a place well that gives a person the feeling of safety mentioned above.

Here again de Certeau is indispensable for his embodied notions of spatial practice. To de Certeau, who locates the experience of space within the linguistic discourse, walking or moving through space is akin to the telling of a story. "Travel (like walking)," he argues "is a substitute for the legends that used to open up space to something different." Travel produces "'an exploration of the deserted places of my memory',[57]" linking experienced space to memory and conceptualized space. What this means, to us, is that movement through space has replaced the cultural role of myth to de Certeau. As we walk through the spaces we share with others, we are creating personal stories out of the collective environmental text by integrating the vision of the landscape into the larger cognitive picture of space. This idea figures strongly into our understanding of contemporary cybercartography for, as we shall see, these navigable maps are essentially practice. They are collaborative, conceptual spaces dependent on the human journey for meaning.

De Certeau's ideas of creating meaning through trajectory combined with Lynch's internal spatial picture provide an interesting starting point for a discussion on navigable maps. The trend towards depicting spaces using 3D imaging has led to the development of many consumer-friendly networked maps. The following section builds atop the foundation set by the previous two chapters by comparing two of these maps, virtual globe, Google Earth and virtual world, Second Life to illustrate a changing relationship

55 Lynch, p.5

56 Ibid.

57 De Certeau, M. (1984). The Practice of Everyday Life. Berkeley and Los Angeles, CA: University of California Press. p. 107

between digital information and space. We are able to take these two artifacts in concert, as digital maps, because they are essentially made from the same material, of spatial data. Drawing upon albeit different coordinate systems, Second Life and Google Earth both fulfill the definition of map set forth in Part I, *a visual representation of spatial data.* This comparison provokes not only a rethinking of the digital map but indicates a permeability of the "wall" between digital and real world space. This permeability, exemplified both by the shaping of digital information to the parameters of real-world space or *geocoding* as well as the ubiquity and constancy of digital information, provides an accessible metaphor for the blending of conceptual and real space enabled by geospatial technology. The line indicated by the terms "online" and "offline" is perhaps not as distinct as we had thought.

Our final project, then, is to turn our focus away from the componentry and utilization of the digital map towards the environments of networked cybercartography. This network consists both of the connections between computers as well as the clicking humans creating communities and meaning. Networked cartography seamlessly meshes internal and external human spaces, troubling our assumptions about imagination and spatial representations. How must we update Lynch's wayfinding theories to account for onboard automobile navigational systems, if at all? In any case, we must account for the radical change from the individual map of space (whether a mental picture or a paper map) to the unprecedented shared map of space enabled by digital networks. Digital maps enable shared real and imaginary maps that mutually inform and are informed by the material world. This claim will be illustrated first by an overview of the so-called geospatial web, followed by a discussion about the shared and divergent properties of Google Earth and Second Life to see how these digital maps enable the creation of myth through collaborative navigable imagination. We will conclude this chapter with questions for future study about what is there, if anything, to be learned from fantastical spatial representations that might benefit real world maps.

The Geospatial Web: Connecting real to the digital

According to a recent Wall Street Journal article, Nokia is attempting to combine GPS and other technologies under a plan called "augmented reality." The idea, still several years from market, is that consumers could point a phone with a built-in video camera at a building or person and have relevant information pop up on the screen[58]. Ideas like this one suggest that technological development is headed towards connecting the human body, with relevant digital information.

The geospatial web is something that is often referred to but rarely talked about in great detail. It is possible that this network is theoretically in place but few users possess the technology and wherewithal to help create and spread the “web” in question. I suspect that like the internet, which seemed to spring up overnight, within the next few years we will become increasingly surrounded by geocoded information, easily accessed upon our mobile devices. Furthermore, I assume that we will so quickly adapt to this technology that we will have difficulty remembering a time when we had to go to a terminal, connect a laptop, or, heaven forbid, phone an operator, in order to obtain the information we need. For the time being, we are suffering from an wealth of applications to parse geocoded data, but a dearth of users to provide the information to attach to places. This meshing of spaces helps update Lynch’s ideas of spatial well being, because now a map of space has the potential to provide far more than spatial orientation. Geospatial web information could provide the satisfaction from “legible” surroundings Lynch indicated.

There are many ways geocoded data finds its way to users, indicating a human instinct and aptitude for geographically-oriented information. As one journalist so succinctly put it, “we are still fleshy creatures who must fulfill our basic needs locally.[59]” It therefore stands to reason that global positioning, which can determine a user’s location, would be a useful tool in the organization of otherwise nonsensical information. This has particular developmental applications for advertising: “…the “context” for contextual ads is no longer a list of keywords but a location – meaning that the primary measure of an ad’s

58 Sharma, Amol. (2006) Technology (A Special Report): Telecommunications --- What's New in Wireless: A look at mobile devices and services you can expect in the next year -- and beyond. The Wall Street Journal. Dow Jones & Company, Inc.

59 Roush, Wade. (2005) Killer Maps. Technology Review, October, 2005. Cambridge, MA: University of Massachusetts Press.

relevance to the user is simply proximity, with no fancy psychographic algorithms involved.[60]" If non-requested information like advertising is simplified by GPS, queried information becomes some sort of omniscience. If you need to find the nearest open drugstore at night, with the ability to fill your prescription, on foot, in a foreign city- just press a key on your portable. What could be better?

The Yellow Arrow "global public art project" coordinated at yellowarrow.net was at the vanguard of this meshing between digital and real space. Yellow arrow shaped stickers connect users to digital information by SMS, text message. Anyone can place a sticker in public space and send their observations about the place a centralized database by SMS. Subsequent visitors send the same code (marked on the arrow) to retrieve the message. Tagged places range from information about businesses in the sticker's proximity to non sequitur statements left in the spirit of creativity[61]. While the project was an early adapter to geospatial information, the utility of that information, perhaps left something to be desired. A stranger's opinion on a city street is often not hard to come by. Developments like the aforementioned Nokia "augmented reality" and other projects that promise to integrate reliable, vetted sources of information with far more geographic relevance, moving slowly from unreliable to reliable sources of information. That change will integrate developed spatial databases, like Yelp.com, Google's business review site, with real-time location sensing to completely remove the line between on and off line.

What does this mean to cybercartography? As the information stored about places becomes tagged with the GPS coordinates of that place, it becomes essentially part of a map. We might think of the geospatial web as a new sort of map, a web of information stored in databases, that can be transmitted to mobile devices, to you wherever you are. This type of map departs from the material or digital and moves towards the conceptual. It is closer in scope to the map described by Kevin Lynch in *Image of the City,* a mental map that enables a feeling of security only stored in collective memory, or server. Users with "Augmented Reality" phones might never need to know places the way their

60 Ibid.

61 Yellow Arrow website. Retrieved April 14, 2007 from <http://www.yellowarrow.net>

ancestors did, by looking, learning, being lost. This prospect has both positive and negative indications: on the positive, we would never experience the disorientation and fear of being lost or the negative, we would never experience the pleasure and mastery of learning to be found. This rich topic certainly deserves more attention and would perhaps be a good subject for future work.

Returning to the second type of 3D map, the rendered virtual place, we focus our attention to digital representations of space that are navigable. In many ways the navigable digital virtual globe (like Google Earth) and the geospatial web are quite similar. They are share a GPS coordinate system based on planet Earth; they both spatialize digital information for navigation, wayfinding, decision making; and they both allow for creative spatial expression. In light of these similarities, it is easy to envision an impending convergence of cybercartographic technologies: an overlapping of the digital visual representations of space and the digitized experience of material space. How might the virtual globe and physical spatial practice adapt for this union? Many contemporary Google Earth games, overlays, and communities indicate changes that use real space for fantastical means. This integration of real space with fantastical practice means an inevitable change in the way we think of and how we use maps in the future.

Memory Palaces to Second Life:

De Certeau speaks of the places of his memory that are stimulated by moving through new spaces. The blurry line between the real and digital spaces indicated by the geospatial technologies above is also seen between real places and places of the imagination. Imaginary, conceptual spaces are well illustrated by the memory palace, well documented in Jonathan Spence's *Memory Palaces of Matteo Ricci*. Memory, no doubt, was a prized skill in pre-print cultures. The ability to commit long histories or speeches to memory was in high demand and it is no surprise that the memory arts, *mnemotechnics,* were widely practiced throughout the Classical period. The art of spatializing information in order to organize memories for easy recall is considered, still, to be the best way to induce artificial memory[62]. The practice requires building a "palace" in the mind where each room represents a stage in a progression. While novices constructed a palace by going to a real one and memorizing the rooms, the memory palace could just as easily be any structure that can be imagined. The advantage of starting with a real palace, of course, is that it already exists. The student would carefully walk through the halls, remembering every room. For training (and for examination) a student would go someplace else and then attempt to describe the palace. The memory palace was the foundation. While the palace never changed, the objects inside of a room do. The strategy when is to walk into the first room of your memory palace and place the first stanza of your address next to a distinctive object, the second stanza next to another object, and so on[63].

It is not difficult to form our own mental picture of students pacing the rooms of a Roman palace painstakingly committing the geography to memory. Capitalizing on the brain's capacity to remember images, spatialization creates a way to explore conceptual space in a way that the linearity of text eliminates. While the goal of this exercise was to produce a linear text, the production method was as non-linear as can be. The erection of a conceptual palace provides students of memory with a place to visit. This type of navigation in imaginary space is reminiscent of one of the behaviors of Second Life; a conceptual place that can be navigated and explored. Also made from imaginary material, often modeled after real world places, Second Life has the added benefit of being shared and collaborative.

Second Life and Google Earth share qualities of navigability and persistence. Both allow for the addition of user-generated content and facilitate communities built around digital space, digital maps. These new types of maps indicate the changing role of spatialization of data in the networked environment. How better to explore your world than flying around a digital globe? How better than to share your memory palace than to make a 3D model of it for others to explore? These questions will no doubt be answered by the

62 Yates, Frances A. (1966). The Art of Memory. Chicago: University of Chicago Press.

63 Spence, Jonathan D. (1985) The Memory Palaces of Matteo Ricci. New York: Penguin Books

immediate future of geospatial technology as real and digital spaces converge in both handheld devices and spatialized data worlds.

Google Earth and Second Life: Navigable Maps

It is not surprising that the technical term for digital globes and GIS visualizations is "virtual reality[64]". Both Google Earth and Second Life are comprised of spatial data, navigable 3D spaces. Second Life, like any persistent digital world, is in many ways a map; a map enabled by and dependent on digital technology; a new type of map that is persistent, navigable and collaboratively conceptual. This assertion requires a change in thinking about cartography that accommodates a broadening of the definition of spatial data. In order to think of Second Life as a map of space, one must first accept that the imaginary spaces of the world are indeed spaces. It is also necessary to then abandon pre-digital notions of cartography. We can not think of the MMO world as a way to navigate land or otherwise apply antiquated cartographic expectations to the digital map. Instead, along with an update in definition comes an update in utilization: this digital map is navigable, inhabitable, and most importantly communal.

Within Second Life there are two types of in-world maps that provide separate functions. The mini-map, part of the head-up display (HUD) helps users orient themselves in their immediate surroundings. This map depicts an aerial view of the user's location and indicates the presence of other user's in the vicinity by a green dot. A search beacon implies the field of vision and helps replace many of the spatial cognitive cues provided by the human sensory apparatus. The mini-map facilitates navigation and operates much like similar maps within video game environments. The search or world map is a large overview of terrain that is largely used to locate events and travel between places. Clicking on a place initiates a transportation process that brings user's avatars from one location to the next. This map bears an uncanny resemblance to Google's satellite data, raising interesting questions about the nature of new cartography. Is the representation of data-based territory in the same way as real space a way the experience seem more real or

64 Fisher, Peter and David Unwin (eds.) (2002) Virtual Reality in Geography. London: Taylor and Francis

is it, a way to organize otherwise disparate information around a familiar metaphor?

Since its release in 2005 Google Earth has accumulated a massive user base, ranging from passive digital globe spinners to highly engaged detectives and overlay creators. Moreover, this year's introduction of the Sketch Up tool, which allows Google Earth users the ability to create three dimensional geometrical models of buildings to insert into the digital landscape, provides a level of unprecedented cartographic interactivity. Google Earth users are now active participants in the collaborative representation of the space around them. It could be said that Google Earth users fulfill de Certeau's mythic implications by sharing these navigable spaces, creating spatial journeys which, unlike the human walking in space, is recorded, repeated exactly and shared.

Like Google Earth, Second Life is a visual representation of spatial data. The data, or signifier, that comprises the later has a different relationship to the signified than the real-world map. Each point on Google Earth corresponds directly to a point on the planet. Therefore we can loosely imagine that each bit of data contains a direct relationship to a geospatial coordinate (GPS number). This relationship is not direct in SL, where spatial coordinates correspond to imaginary, user-generated places.

Second life is a relatively new technology, released for alpha testing in 2002 but growing to nearly 6 million registered users by mid-2006[65], changing every moment. Unlike the real world, a virtual one is not constrained by the same rules of physics which leads to some interesting spatial quandaries. A lot can be learned about the complexities of spatial practice within the virtual world through a look at how Second Life has dealt with the physical properties of in-world travel. Because the rules of practice are neither limited by earthly physical properties, nor intractable, Second Life provides an interesting counter to Google Earth because, perhaps, it shows the anxieties and possibilities contained within a navigable map.

65 Figure from Second Life home page, May 1st 2007.

When Second Life was originally developed in 2002, avatars could either walk, fly, or teleport around the virtual landscape. The type of teleportation originally implemented, point to point (p2p), allowed users to click on a place signifier either in text or map form and be relocated to that place instantly. Within a few years, the designers at Linden Labs felt that a lot of interesting, beautiful places were being circumvented by p2p travel as users were clicking on places they knew rather than looking for new places. Several years into development, Linden introduced teleportation hubs (telehubs). These hubs, placed around the world at Linden determined locations, were intended to encourage exploration of the elaborate user-created environments by forcing avatars to travel on foot or fly through the landscape.

Although designed to promote creativity, the telehubs soon posed a problem to the in-world economy[66]. Because avatars were forced through these discrete transportation points, the humans operating them utilized real-world real estate tricks and began to buy all of the valuable land in the immediate vicinity of the hubs. In a world created entirely from bit data, the value of the hub-adjacent property was created only by the fact that users were forced to pass through it. This created the perfect entrepreneurial opportunity for businesses, land dealers, and even potentially unethical behavior. It is unclear from the official documentation how far this process actually went before Linden changed the physics of their world but what is important is that Linden could and did *change the physical properties* of travel within the world. The telehubs were instantly replaced with a Second Life news source called *Infonet* which also invoked its own "outrage" from user communities[67]. In an attempt to assuage the user community, Robin Linden of Linden Labs writes in a community blog posting:

> Many people see this decision as detrimental to the structure of Second Life. I see it as an opportunity to move away from an organizational system based on forcing people to stop somewhere other than their planned destination, and instead to create a new one, in the same places,

66 In a blog posting regarding the replacement of the telehubs with Infonet s

67 According to user blogs, the main objection to the replacement of the telehubs with Infonet was an unfair monopoly to the news provider. Many felt Infonet was not the best source of in-world information and were suspicious of the decision. (see "Infofunnel" December 8,2005 blog posting at Second Thoughts blog < http://secondthoughts.typepad.com/second_thoughts/2005/12/infofunnel.html>)

where we really think about why someone might want to be there[68].

Although this posting is vague, Linden emphasizes the fact that the telehubs "forced" traffic rather than allowing agency. Spatial agency allows user communities to determine which places are interesting and subsequently encourages designers to create places that attract more users. Second Life quickly learned that this is not a behavior that can be "forced" or even encouraged but must come from the users. In the spirit of collective intelligence, the crowd goes where the crowd wants to go. Through personal agency, a user can choose to p2p teleport, walk, fly or not, creating the spatial stories of which de Certeau spoke.

In this way Second Life behaves much more closely to Google Earth than real earth, as a representation of space meant for exploring. Of course, these products have different goals in their spatial representations. For Google Earth, perhaps the project is creating a platform for people to explore, represent, and form communities around 3D representations of real space. For Second Life, the project is to develop a platform that allows users to explore, represent, and form communities around imaginary spaces. However, the similarities between their tools beg inspection as they begin to conflate our notions of real and fantasy spaces, through explorative practice. Navigable maps allow for this type of exploration, providing the new types of landscapes invoked with the opening quote from Marcel Proust. Now we can see that the real "voyage of discovery" is no longer about where we go but how we go there, and how we represent what we have seen. The navigable 3D world affords virtual travel but moreover, perhaps, a shared neutral space to be reshaped and coerced into common myth.

So what now…

This paper a as a sort introduction to some of the concerns and forms of cybercartographic change and there remains much more work to be done in terms of rethinking the word, form, and practices of maps. Virtual spaces offer room for

68 Linden, Robin. (2005). Formerly Known as Telehubs. From the Official Linden Blog, November 27, 2005. Retrieved May 1, 2007 from http://blog.secondlife.com/2005/11/27/formerly-known-as-telehubs/

simulations without the constraints of real world physics. Earlier this year, Microsoft Earth announced the impending release of a consumer flight simulator based on their digital globe. This means that users can fly around the "real world" much like a video game. Unlike a video game, this data is a map, the same map used for real flight navigation, meteorology, and finding directions to a new dentist. Moreover, depending on the parameters of the simulation, users could feasibly land planes at the same time, on the same runway, occupying the same metaphorical air. This sort of spatial paradox indicates a whole new set of questions accompanying the new digital map and deserves greater attention as these technologies develop.

A map is no longer something that is stored in the glove box of the car, or in an Atlas on a low shelf on the bookcase. Maps are now a far more complex part of everyday spatial existence. They cling to us whenever we connect to wifi or carry a cellphone. They are no more pieces of paper with embedded abstract meanings, but navigable places for exploration, creative expression, and meaning making. Cybercartography has changed not only the meaning of maps but moreover the meaning of mapmaker, making you and I complicit in the representation of space.

CONCLUDING THOUGHTS

This paper has explored how the digital has ruptured the meaning of the map and what is implicit in digital behaviors that changes the way maps are made and used. Digital maps are part of a larger system of cybercartography which includes not only representations of space but the people, networks, and tools used to create them. I have argue that digitization has enabled a new type of map user, one who is also often the map maker and thus allowed for subjective maps that are about more than mere depictions of space. New expressions are followed by new forms as cartography transitions into 3D and navigable representations. The ability to fly through a map afforded by a virtual globe blurs not only the line between real and virtual spaces but also moves cartography within the scope of a Media Studies project.

I began this paper by contending that digital maps were radically different than the paper maps they now only slightly resemble. While many digital maps maintain cartographic conventions so tend to look much like their paper predecessors, implicit in their digital nature are affordances that enable unprecedented spatial expressions. These expressions, as I illustrate in Part I of this paper, are personalized, localized, layered and persistent. Personalization renders maps that are deeply subjective, stories of people's experiences of their space. It also means the ability to store these spaces as an extension of identity, My Maps of my space. These maps are often localized, for digitization allows maps to center around users wherever they are. Localization, made possible by databased information, changes the way information is distributed in space, now around you. Cybercartography can be layered to show a set of features or how features interact with each other. Much like an intricate set of vellum overlays, digital layers allow neo-geographers the ability to envision complex problems and spatialize information fairly easily. And finally, being digital means the information is available over a network to be accessed, shared, and edited by many. These are surely broad strokes for a rapidly developing portrait of cybercartography. As technology develops, these categories will certainly need refining and nuance but presently provide a good starting point for thinking about the ways digitization has irrevocably changed who makes maps, how, and why.

Part II looked at historical instantiations of spatial representations, focusing on maps of the early Medieval period. Maps drawn from within a deeply religious paradigm represented space quite differently than our orthogonal, scientific conventions. These maps displayed a range of representational styles, from biblical narrative to thematic spatial overviews and help us to see how space can be used to illustrate information in different ways. This historical example helps illustrate a change in cartography brought about by digitization, the ability to hybridize conceptions of space and layer different depictions atop each other. Furthermore we are able to see from the example of Google Earth's difficulty in representing the hurricane Katrina-torn Gulf region, the complexity of cartography in this digital era. Satellite imagery provides a sense of accuracy that is problematic when time is accounted for. Cybercartographic abstractions, therefore, occur doubly, once in the abstracting of territory as image and again as abstracting the image as a digital file.

The paper concluded with a look at 3D navigable maps like Google Earth and Second Life to see how new cartographic spaces are able to mesh real and fantastical, internal and external spaces. The geospatial web, attaching of GPS coordinates to web information, brings digital information directly to people in real places through mobile devices. This cartographic technology has the potential to fill gaps in our mental maps, increasing the sense of "security" put forth by Kevin Lynch in *Image of the City*. Spatialized information hangs metaphorically in the air, waiting to be accessed. While this layer of conceptual information has the power to relieve spatial anxieties (like being lost) it brings a new and complex relationship to space that begs further exploration. This chapter also discussed the potentials of virtual worlds to provide a model for spatial navigation. The ability to teleport, walk, or fly provided by both virtual globes and virtual worlds puts a new type of map onto the table. This new format contributes to the blurring of real and fantasy spaces through practice; as we explore networked 3D spaces, we make a new sort of communal myth.

This paper can serve only as an introduction of cartography to the project of Media Studies. As we have seen, new technologies have changed the relationship between maps and users, maps and mapmakers, forcing a reevaluation of what maps are. In this reevaluation we find old colloquial understandings of cartography insufficient and begin to sketch out a new type of cartography: cybercartography, a system that includes the technology, the spaces, and the people in the spaces. Still many questions are raised by the topics presented here: what do these new behaviors and technologies mean for privacy? How might virtual worlds better integrate with real spaces? What sorts of freedoms are elicited from navigable information layers and at what cost? Answers to these questions must come as cartography has inevitably and irreversibly part of everyday expression and leave us with exciting room for future study.

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