

## Chapter One

### Introduction

Now when I was a little chap I had a passion for maps. I would look for hours at South America, or Africa, or Australia, and lose myself in all the glories of exploration. At that time there were many blank spaces on the earth and when I found one that looked particularly inviting on a map (but they all look that) I would put my finger on it and say, 'When I grow up I will go there'.

-- Joseph Conrad, *Heart of Darkness*, 1902.

I want to investigate in what ways this cartographic imaginary proliferates spaces and the ways in which we can live in them.

-- John Pickles, *A History of Spaces*, 2004.

#### 1.1 Aims

This thesis is one of the outcomes of an ongoing, ten-year long, cybergeography research project focused on describing the various socio-spatial forms of cyberspace, analysing their supporting material infrastructures and understanding their implications for the geographical organisation of everyday living. The epistemological and philosophical approach I have taken is centred around the map as a process of knowledge construction and as social-material site for critique. The goal of the thesis is to provide an analysis of the semiotic meanings and political 'imaginings' of cyberspace cartographies through a critical reading of maps of Internet network infrastructures.

To understand the power of maps, particularly in contemporary Western capitalist contexts, one must grasp how they stir both the imagination and work instrumentally in the exploration and exploitation of new spaces. As Joseph Conrad's narrator Marlow makes clear in the *Heart of Darkness*, mapped representations open up space to the imagination. This cartographic imaginary, according to theorist John Pickles, is more than looking, it inspires action, it

beckons space into being and needs to be understood in relationship to living within and through cyberspace<sup>1</sup>.

Cyberspace is often portrayed as the pre-eminent ‘blank’ space of the twenty-first century, an alluring virtual *terra incognita*. The fact that its digitally-mediated territories are composed of software code rather than vast deserts or impenetrable jungle does not weaken the desire for exploration or the potency of the cartographic imaginary in representing it in particular ways for competing interests. Cyberspace cartographies are opening up unique ways to visually understand the complex, multivalent and intangible nature of virtual spaces. Yet, just like in the *Heart of Darkness*, the opening up of cyberspace through particular cartographic gazes also closes down some avenues of development and some of the latent potential of virtual space at the same time. A mapped space becomes a known place, a controllable territory that can be more effectively used by certain interests and groups over and above others.

Many different aspects of cyberspace have been mapped, ranging from the physical infrastructure, the logical layers of data links, the routing details held in software code, traffic flows, customer statistics, hyperlink structures of the Web, the emergent patterns of social interaction, along with new interactive spatialisations<sup>2</sup> to navigate in the myriad of online forums and information resources (see Dodge 2005 for examples). The maps cover a range of different scales from individual local area networks and single websites up to global scale visualisation of vast topological grids and the graphical exploration of the online social networks of millions of people. Some of the maps and spatialisations adhere to established conventions of cartographic design, but many more use different visual vocabularies. A few are beautiful and many more are really

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<sup>1</sup> As pointed out by C. Board (viva, October 2006) Pickles’ notion is in many ways a subset of a more general ‘geographical imaginary’, that is particular historically contingent ways of seeing and thinking about places and social groups that, while they are subjective and stereotypical, actually affect how decisions are made. (cf. Gregory 1994). Maps are potent means for creating such imagined and preconceived notions of place and people (cf. Schulten 2001).

<sup>2</sup> Spatialisations are a form of visualisation where a spatial structure and map-like interface is applied to data where no inherent or obvious geographical one exists. They are used to provide an interpretable, navigable structure to various types of non-geographic datasets, particularly large text corpuses (cf. Couclelis 1998; Dodge and Kitchin 2000a; Skupin and Fabrikant 2003).

rather unappealing in terms of quality of design and aesthetics. A few are quite useful as practical cartographic tools for navigating new virtual space, but many more are not effective at all for route following or finding particular sites. However, all the maps provide a fascinatingly diverse picture of what cyberspace looks like, and they can also be read connotatively and interpreted politically to provide valuable insights into how people *imagine* the virtual territory to look in service to their interests and desires. Understanding the connotative meanings and political contexts of cartographies of cyberspace is, therefore, important because they not only reflect the nature of the virtual world according to the interests of map-makers and mapping institutions, but also because they play a fundamental role in shaping the ongoing social-material (re)production of those virtual spaces. They are active in the producing a cartographic imaginary of cyberspace but also in producing cyberspace itself.

This new and diverse emerging domain of cyberspace mapping activities can be usefully conceptualised, following Edney (1993), into three distinct cartographic modes. The first mode, what I term, ‘maps of cyberspace’ is mapping which describes the material information and communications technology (ICT) infrastructures and documents the operations of cyberspace itself, as viewed from an external position. (This thesis is focused on this mode through the analysis of Internet infrastructure maps.) In some senses they can be thought of as the thematic maps of cyberspace and are distinct from the other two modes. ‘Maps for cyberspace’, the second mode, are maps and spatialisations created for navigating within cyberspace; they are expressly designed to be used to ‘interface’ virtual spaces themselves. The final mode, ‘maps in cyberspace’ involves putting existing forms of terrestrial mapping online to widen access and add user interactivity. This mode is far and away the most evident in terms of the many millions of people using online services like MapQuest and Google Earth. (These three mode conceptualisation is discussed further in chapter three.)

## *1.2 Research questions*

The major research questions tackled by the thesis are threefold:

1. What are the main ways that Internet infrastructures have been mapped?
2. How do the elements of cartographic design in terms denotative signs on these maps work in creating particular kinds of connotative meanings about the Internet infrastructures?
3. Within what kind of culture milieus and political contexts are these maps of Internet infrastructures embedded and how does this effect the power they exert in advancing particular interests and agendas?

A range of relevant empirical evidence to answer these questions has been gathered, primary from texts published online and from corporate reports and government documents. The primary cartographic evidence is analysed utilising three methodological approaches: (1) processes of audit and classification, (2) semiotic interpretation of connotative meanings of representations and (3) a deconstructive reading of the maps.

## **1.2 Defining themes**

Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts...A graphical representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding... (Gibson 1984, 67.)

### *1.2.1 Cyberspace*

Historically considered, cyberspace emerged from the convergence of two sets of technologies: those for the transmission of information and those for the automation of computation. (This convergence is itself premised on the fundamental digitisation of the operations and products of both of these sets of technologies.) Since the second world war the technologies of computing and telecommunication have grown dramatically in capacity and fallen in per unit cost. As is well noted, they have diffused throughout society and have had a significant transformative agency in the nature of everyday living (Castells

1996), including radically altering space-time relations in complex ways through processes of space-time convergence, time-space compression, and distancing of service provision (Janelle 1969; Harvey 1989; Giddens 1990). They also give rise to cyberspaces, the conceptual spaces of information flows and social interactions that are continually created *within* the infrastructural ensemble of digital computing hardware, software code and high-speed telecommunications networks.

Cyberspace is not the technology or infrastructure itself (although it cannot exist independently of these), but the *experience* of virtual spaces that these engender. The word literally means ‘navigable space’ and is derived from the Greek word *kyber* (to navigate). As a description of virtual space it was conceived by William Gibson, in his novel *Neuromancer* (1984, 51), as a three-dimensional ‘data-scape’ inside the global matrix of computer networks where disembodied users interact with “clusters and constellations of data”. As an everyday human phenomena, cyberspace is much more mundane than Gibson’s science-fiction imaginary, but is fast becoming as powerful in mediating social relationships and re-shaping the material world. For example, cyberspace “is the ‘place’ where a telephone conversation appears to occur. Not inside your actual phone, the plastic device on your desk. Not inside the other person's phone, in some other city. The place between the phones. The indefinite place out there, where the two of you, two human beings, actually meet and communicate” (Sterling 1992, 1). Cyberspace is also the ‘space’ where your money is (to paraphrase John Perry Barlow<sup>3</sup>) and is fast becoming the primary archive of many of personal memories (through online diaries and blogs, emails and text messages, digital photographs, and so on). The Internet is most obvious element of cyberspace currently in Western societies, but it is only one particular socio-technical instance amongst many (albeit a very rapidly growing, complex and heterogeneous one).

Cyberspaces are not ‘real’ in terms of common-sense definitions of material ‘stuff’ you can touch; they are, in Gibson’s phrase, a ‘consensual hallucination’ created by software code and visual interfaces, and made tangible by access

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<sup>3</sup> Cited in Rheingold 1993, 68.

devices (screens, keyboards, speakers, mice, joysticks, and so on). However, they are perceived as real places in that they can have very real, material consequences (e.g., money being stolen electronically from a bank account). This is because cyberspace is folded into everyday lived experience more and more, rather than being some exotic, dissociated paraspace<sup>4</sup> (as it was frequently depicted cinematically in the 1990s). Uses of ICTs are themselves embodied and the experiences of virtual spaces form a complex continuum from purely material spaces to wholly cyberspaces, with many social activities now taking place on the thresholds between the “virtually real and the actually real” (Madge and O’Connor 2005, 83). An illustration of this experiential continuum is the extent to which cyberspace explicitly draws on material socio-spatial relations and geographic metaphors to create new spatialities and a sense of place (see also chapter four discussions on role of metaphors to explain the nature of the Internet).

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<sup>4</sup> Paraspace means ‘other space’ - a sublime space that has forms and practices alien to that in geographic space (see Bingham 1999).

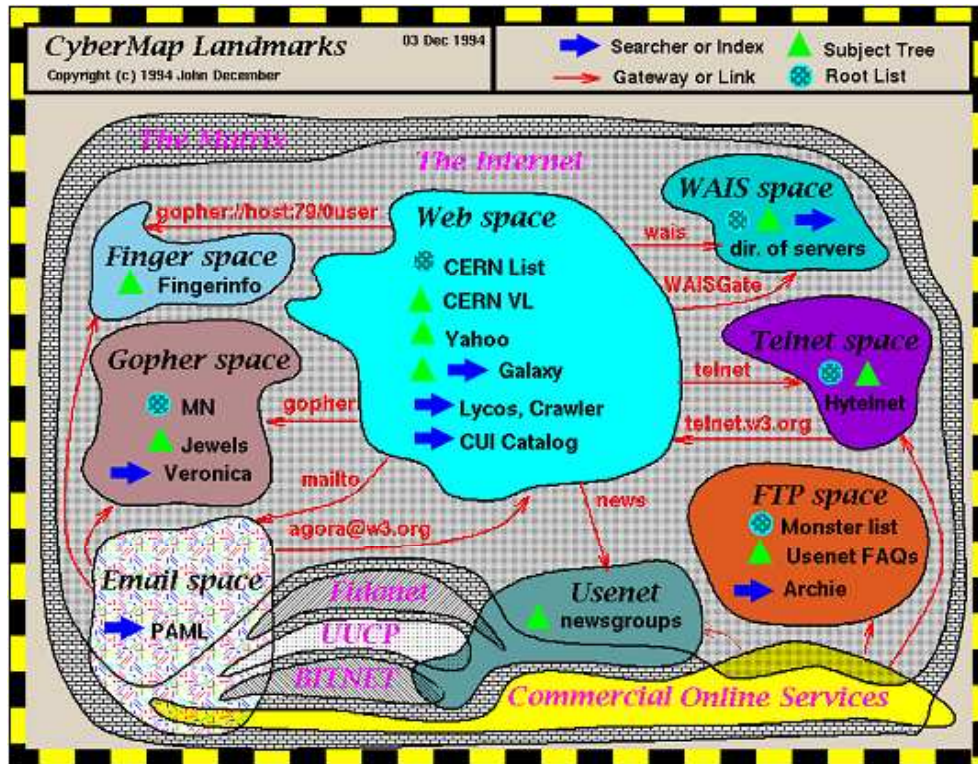


Figure 1.1: An attempt to sketch the principal online virtual spaces of cyberspace, circa 1994. While it is now out of date factually, the map is still useful for the way it conceptualises cyberspace as multiple, irregularly-sized domains with fluid boundaries, and many interconnections and overlaps. (Source: December 1995, no pagination.)

Given the bleeding together of real and virtual activities, cyberspaces are always contingent on the time and place of their production. Typically, they are heterogeneous in structure and fast changing. There are a rapidly expanding range of online virtual spaces experienced through different forms of interaction and communication affordances (Figure 1.1). There is also convergence of technologies that allows new spaces to emerge (such as the rapid growth in text messaging on mobile phones, or the emergence of voice over Internet protocol telephony services). Reliable, representative and comparative statistics on the scope and structure of cyberspace are notoriously hard to gather and quickly become obsolete. All these characteristics mean it is challenging space to survey and has served as a driver in the development of new techniques of mapping.

### 1.2.2 *Internet*

The focus of this thesis is on just one element of cyberspace, the Internet, a global network of networks that uses TCP/IP protocols<sup>5</sup> to communicate. It burst into the popular imagination in the early 1990s after a twenty year gestation in academic and research communities. At a conceptual level the Internet is not a material entity, rather it is an agreement between a heterogeneous collection of networks to exchange data traffic using common protocols. The ease of connecting individual networks together, that is inter-networking, via IP (internet protocol) has been paramount to the Internet's success and phenomenal growth. Importantly, the core Internet protocol, Searls and Weinberger (2003, no pagination) note, "doesn't specify what people can do with the network, what they can build on its edges, what they can say, who gets to talk". This openness gives rise to the Internet's three key virtues: no one owns it, everyone can use it and anyone can improve it (Searls and Weinberger 2003).

Anyone with a computer, a modem and a telephone can connect to one of the networks and, through it, to the rest of the public Internet<sup>6</sup>. (Note, there are many private intranets which also use the same TCP/IP protocols but are not interconnected to the public Internet.) The sum of the Internet's nodes and their connections is greater than their parts, forming a network of network that empowers millions of people to directly communicate and share information with each other for the first time in human history.

Built around this agreement is a vast socio-material infrastructure to move data and to provide services. The physical construction of the Internet ranges from individual PCs connected via modems, to small domestic LANs up to immense networked assemblages such as undersea cable systems linking continents that cost billions to construct and require specialised ships to maintain them in working order. Given its open architecture no one knows for sure quite how

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<sup>5</sup> TCP/IP - Transmission Control Protocol / Internet Protocol.

<sup>6</sup> Various 'digital divide' issues exist, notwithstanding, relating to the unequal distribution of the Internet access and production (e.g., Warf 2001); for example, the cost of access, particularly telephone charges, vary markedly between countries (e.g., Petrazzini and Kibati 1999) along with the freedom to communicate without state censorship (e.g., Reporters without Borders 2003 analysis of Internet surveillance). See wider discussion in chapter five.



much infrastructure is enrolled in the ongoing production of the Internet, but it is significant. In January 2008, for example, there were some 541,677,000 hosts on the Internet according to one of the most creditable ‘hardware’ statistics<sup>7</sup>, an increase of 20% from January 2007.

The development of the Internet has not been achieved independently and is bound up in the histories of telecommunication technologies, computing and wider social and political-economic histories of media (including easily overlooked and banal infrastructures, such as the ASCII text encoding format). The contemporary Internet is the outcome of a specific set of political-economic relations, most especially to do with the Cold War funding for computing research; the Internet has a particular historical geography that centres it in the U.S., and early Internet development was guided by the military-industrial-academic complex (cf. Abbate 1999). It was only later that it became re-appropriated into the public and commercial domain.

The Internet itself is experienced as a variety of different virtual spaces and media channels that are built seamlessly on top of it, including email, instant-messaging, peer-to-peer file sharing, and, of course, the Web. As Castells (2001, 269) rightly points out, the Internet is more than just the sum of its infrastructural parts; “it is the technological tool and organisational form that distributes: information power, knowledge generation, and networking capacity in all realms of activity.” It should be viewed as a general purpose technology, much like steam power and electrical current, in that it sets no preconditions on how it is used. As such, the Internet forms the vital motive force for ongoing processes of economic and cultural globalisation. The Internet is the cardinal infrastructure of the network society (Castells 1996).

### *1.2.3 Infrastructures*

Conceptually, everything that works in the background necessary to effect a certain action or event is infrastructure. Infrastructures work transparently and

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<sup>7</sup> The Internet Domain Name Survey, a biannual survey by Network Wizards, <[www.isc.org](http://www.isc.org)>. A host is an Internet computer assigned a fix domain name, typically they are servers and routers which are permanently networked. The survey does not attempt to count the many hundreds of millions more PCs and computing devices that users connect to the Internet at various times.

have innate tendencies to disappear from consciousness (except, of course, when they fail). Multiple infrastructures mesh together into complex assemblages (e.g., air transportation); new infrastructures are often built onto of existing ones (e.g., fibre-optic cables running through old steam pipes). New infrastructures can emerge rapidly, but then quickly become naturalised and taken-for-granted in the everyday landscape of consumption (mobile telephony for example). Many infrastructures, particularly utility networks, are largely hidden from view being conveyed underground and in unseen service spaces of buildings; further the production of the infrastructural services are often far removed from the point of their consumption (especially so with growth of global supply chains). “[U]sers tended not to worry where the electrons that power their electricity came from; how their telephone conversations (or later faxes and Internet messages) were flitted across the city or the planet; how complex technological systems sustained their journey to work; or what distant gas and water reserves they were utilizing in their homes” (Graham 2000, 184). In the context of affluent Western consumer societies it is easy to assume that some infrastructures, increasingly including the Internet, are geographically ubiquitous and socially universal; while the conveniences they bring become viewed as *necessary* to living.

Given these characteristics, infrastructures, including Internet networks, tend not to be studied sufficiently within the social sciences (except for policy studies focused largely on their regulation). Studying infrastructures academically is made harder because they are often deliberately ‘black-boxed’ to keep outsiders from observing (and questioning) their operational logics. (It could be argued such external ignorance of the internal workings of network infrastructures usually serves the interests of the organisations operating them.) Although they can easily appear ‘natural’, infrastructures are anything but. They are designed and operated in particular ways (e.g., universal service versus cherry-picking through differential pricing), they have politics. Internet network infrastructures, connecting places together at various scales to facilitate efficient data transmission, are no different; they are bound up in wider sets of power relations.

One productive route into the study of infrastructures and their politics, I would argue, is through map representations of them. Maps of Internet network

infrastructures reveal something of the nature of Internet itself (such as differential ownership patterns and the unevenness of the places served), but more than this they also reveal how the Internet is being conceptualised by the organisation behind the map. Maps then can make the Internet's politics visible for scholarly analysis because they ineluctably make the agenda of the map-makers visible.

#### *1.2.4 Mapping*

And this, essentially is what maps give us, *reality*, a reality that exceeds our vision, our reach, the span of our days, a reality we achieve no other way. We are always mapping the invisible or the unattainable or the erasable, the future or the past, the whatever-is-not-here-present-to-our-senses-now and, through the gift that the map gives us, transmuting it into everything it is not ... *into the real*. (Wood 1992, 4-5)

In this research I take a broad view of what constitutes 'mapping'. Following Harley and Woodward (1987, xvi), I define it as the application of any graphic representation to facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world. The development of cartographic modes over millennia have provided in the Western cultural context uniquely powerful means by which to classify, represent and communicate information about areas that are too large and too complex to be seen directly. Well designed maps are relatively easy-to-interpret within their own socio-cultural milieu, and constitute concentrated repositories of information about the location, shape and size of key features of a landscape and the connections between them. More recently, it has been recognised that the process of spatialisation can provide an interpretable structure to other types of non-geographic data. In essence, maps and spatialisations exploit the mind's ability to more readily see complex relationships in images, providing a clear understanding of a phenomena, reducing search time, and revealing relationships that may otherwise not have been noticed. As a consequence, they form an integral part of how people understand and explain the world.

It is now widely recognised that mapping is a process of creating, rather than revealing, spatial knowledge. This applies to cyberspace cartographies as well.

Throughout the process of map creation a large number of subjective, often unconscious, decisions are made about what to include and what to exclude, how the map will look, and what message the map-maker is seeking to communicate. In this fashion, maps necessarily become imbued with the social norms and cultural values of the people who construct them. Commonly these norms and values reflect dominant power relations in the society, especially because individuals and institutions with power commission a great deal of cartographic production.

Maps are used in diverse ways by diverse audiences as the work that maps perform is contingent on the times and places in which they are consumed. Maps are situated and selective re-presentations of spatial knowledges. They are not objective, neutral artefacts, but a view point onto the world from a particular perspective. This thesis is concerned with understanding the nature of these view points and perspectives into cyberspace revealed through case studies of how and why Internet infrastructures have been mapped.

### **1.3 Theoretical approach**

The research undertaken on the cartographies of cyberspace, their design, authorship, dissemination and circulation, draws theoretically on concepts from two domains: semiotics of map design and critical cartography. The fusion of these two conceptual domains provides the means to interpret the nature of maps from two distinct, but I would argue complementary, ‘viewpoints’ – an ‘interior’ view for reading the signs *within* the map, and an ‘exterior’ gaze revealing the power from the *around* map.

The conceptual basis of a semiotic reading of map representations is to describe how the cartographic design works in terms of both the denotative signs created by mapmakers to express meaning explicitly, and their multiple possible connotative interpretations by users of the map. As MacEachren (1995, 331) explains “[t]his is the difference between knowing that a line on a map is a boundary and what boundaries stand for in various political, community, or other contexts (i.e., what it means to establish and defend a ...dividing line).” As an

analytical strategy, making this distinction between denotative and connotative signs has been shown to be effective for understanding how maps work at multiple levels of meanings, some which can be quite subtle but nonetheless influential (cf. work of Vujakovic (1999a, b) reading the connotation embedded in geopolitical maps in the media). As MacEachren's boundary line example illustrates, interpreting the connotative meanings of signs has potential to generate insights into how maps emotively effect people's perceptions and modifies the understanding of space denotatively represented (although not always in the way intended by the cartographer or the institution publishing and endorsing the map). As such this analytical focus on connotative meanings is complementary with the second methodological approach employed in the thesis involving the deconstruction of maps to understand how they work as sources of power, as asserted by the critical cartography paradigm.

Broadly speaking, the goal of critical cartography as a field of enquiry is to challenge normative and conventional mapping practice (focused on technique) by employing poststructuralist approaches to deconstruct and denaturalise cartography's scientific truth claims and to demonstrate how maps are socially constructed and historically contingent (focused on political readings). The map when viewed critically, is recognised as always partial and provisional ordering of spatial knowledges, and the outcome of processes actively shaped by the choices, intentions and ideologies of map-makers and cartographic institutions.

Both semiotic interpretation and critical deconstruction see maps as cartographic texts which are more than functional, they are imbued, both, with subjective meaning and with power to do work in the world. These approaches are conceptually aligned to broader cultural re-reading of images following the 'crisis of representation' in contemporary scholarship. New visual methodologies that have emerged for analysing representations are interested in more than just the site of the image itself, seeking to untangle the full web of relationships of meaning and power in the design of signs, in the methods of production, the mode of dissemination, and contingent intertextual interpretations as they circulate and get read and re-read.

Many of the key themes emerging in semiotic interpretation and critical deconstruction of the meanings and power of maps can equally be applied to the newly emerging cartographies of cyberspace, as to old paper maps of the 'real world'. Cyberspace maps, for all their cutting-edge graphical sophistication, can be conceptualised as texts with signs open to connotative readings and structures of power-knowledge that have important, and often overlooked, social implications for how cyberspace is perceived and consumed.

### *1.3.1 Cyberspace cartographies*

It is important not to subscribe to technological determinist notions whereby cyberspace cartographies are presented as autonomous tools and essentially benign agents operating outside of society, and which 'impacts' in predictable and universal ways, ignoring the problematic contingencies of readership and the unstable and partial connotative interpretation picked up.

If one views cyberspace cartography through a deterministic and uncritical lens then it can be seen as a logical and even 'natural' evolution of map representations, whose aim is to enhance knowledge of new virtual spaces, making online navigation (and commercial exploitation and governmental surveillance) more efficient and increasing the 'return-on-investment' in existing geospatial data by facilitating wider distribution on the Web. Making maps of cyberspace will make cyberspace a better place for business, governments and other elite institutions. However, I would argue the situation with cyberspace cartographies is much more contestable. Only certain maps of cyberspace get made and they show only certain aspects, in certain ways. They are not inherently 'good' and will certainly not be beneficial to all users and non-users of cyberspace. The mapping of cyberspace is not a benign act, instead particular maps are designed to serve certain interests.

Cyberspace cartographies do not emerge by themselves in a cultural or political vacuum. They are a product of particular individual endeavours, usually framed within institutional agendas. To really understand cyberspace cartographies, it is necessary to both interpret the semiotics of the signs within the representation and explain the power circulating 'around' the map representation itself. The

theoretical tools applied here to achieve this are a combination of semiotics and political economy, what one might consider a reading of both the ‘local’ and ‘global’ contexts in which cyberspace cartographies are design and consumed.

This theoretical approach to cyberspace mapping is applied to two significant case studies of maps of Internet network infrastructures in chapters five and six. The analysis has required a broad, contextual knowledge of cyberspace cartographies, synthesising materials from a wide range of sources, along with several short email interviews with map-makers to learn about their stated aims, and their professional and institutional contexts. The analysis also draws upon the wider cybergeography research I have undertaken, whose goal has been an empirically-driven auditing of the different types of cyberspace mapping, through comprehensive cataloguing and classification of artefacts, as well as providing technical and functionalist descriptions of their communicative properties (see discussion in appendix one).

The analysis is an academic critique and not a personal criticism of individuals or groups involved. It does not seek denigrate or disparage the diverse work of cyberspace cartographers, which I have found stimulating over the past ten years. It is also important to acknowledge that the ‘failings’ in many maps of cyberspace results from expedient design decisions by people not trained as cartographers and often working under pressure and not fully understanding the consequence of a particular cartographic choice, rather than the result of conspiracy to mislead or maliciously conceal a particular social reality<sup>8</sup>. Furthermore, this thesis does not provide a formal evaluation of cyberspace cartographies in terms of cognitive perception/usability testing, the customary methodological approach of researchers in the map communications paradigm, although this is in itself valuable work in regard to new map forms<sup>9</sup>. In some senses, it does not really matter if they look good or look bad in terms of normative design criteria or if they ‘work’ or do not ‘work’ as efficient

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<sup>8</sup> This equally applies to geographers who use inappropriate world maps in their textbooks (Vujakovic 2002b).

<sup>9</sup> For example, the Spacecast project lead by Sara Fabrikant and Dan Montello behavioural testing perceptions of spatialisations (latest results, see Fabrikant *et al.* 2004; Fabrikant and Montello 2008).

communication media, for my purposes they still yield insights into their connotative meanings and their socio-political workings.

Having said that, I do believe it is important to fully grasp the normative technical scope of the maps, in terms of how they were produced (e.g., what data was used, how it was gathered and processed, and so on) and how they are designed to be used. I think the critic does need to be fully conversant with the practicalities of the maps they are critiquing. A weakness with much of social and cultural ‘deconstruction’ of technological phenomena, in particular, is its failure to appreciate the genuine potentialities of the technology and tendency to overstate its capacity to change social relations.

It is also important here to acknowledge my own role as an agent in actively constructing cyberspace cartographies as a coherent research topic over the past ten years through a range of print publications and a website (see [www.cybergeography.org/atlas](http://www.cybergeography.org/atlas)). This is discussed in appendix one.

Lastly, while this thesis does not attempt to offer a ‘better’ practice of cyberspace mapping that in some way ‘answers’ the weaknesses highlighted by semiotic interpretation or the criticisms arising from critical deconstruction, it does offer up a positive and productive re-reading of what the Internet is made to look like by challenging the truth claims of its dominant cartographic imaginary and revealing something of the partial and unstable possible readings of the maps and thus the infrastructure itself.

#### **1.4 Structure of the thesis**

The thesis comprises five main chapters, with chapters two and three reviewing relevant literatures and discussing conceptual ideas for undertaking the analysis of cyberspace cartographies. Chapter four considers how the Internet has been made knowable and tangible through spatial metaphors and various network representations. Chapters five and six are in-depth case studies interpreting specific set of examples from the ‘maps of cyberspace’ mode. The empirics focus on the geographic representation of the Internet as a material network



infrastructure, examining examples, at the global scale, from two distinctive cartographic genres<sup>10</sup>: statistical maps and marketing maps.

Chapter two provides a substantive overview of the core elements of the research in terms of defining the nature of the map and discussing contemporary theories of mapping (particularly, the critical cartography paradigm).

Chapter three describes the three modes of cyberspace cartography, outlining their distinctive social relations, organisational settings and conceptions of space. I review the literature in the field, paying attention to the varying definitions, taxonomies and research questions relating to the cartographies of cyberspace.

Chapter four characterises Internet network infrastructures in relation to the problem of ‘invisibility’ and considers how they have been imagined using different spatial metaphors. The discussion then considers how the Internet is made into a tangible phenomena for scientific research by particular types of inscriptions of the network infrastructure. Using ideas from science and technology studies I argue that these network inscriptions work as a form of ‘virtual witnessing’ for ‘matters of fact’ about the Internet.

Chapter five is the first of the two case study chapters and it examines the genre of statistical cartography as deployed to map the worldwide globalisation of Internet infrastructure and use. The focus of the analysis is on global scale maps created to present different viewpoints on the scope and speed of the spread of the Internet internationally, particularly during the 1990s (a crucial phase in the maturation of the Internet, when its network infrastructure grew from technical novelty linking thousands of sites to a powerful communications medium directly connecting hundreds of millions of people). The principal actors in this mapping genre are academics, network activists and consultants, and

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<sup>10</sup> A genre here is a distinctive type of communicative event or text which is characterised in terms of its central purpose, its prototypical content and form, it being conventionally recognised and labelled as such by the discourse community of which it is a part (Thurlow and Jaworski 2003). Genres are conventionalised, yet their boundaries are always indistinct; they are powerful because they “establish particular ways of organizing and looking at the world” (Thurlow and Jaworski 2003, 584).

international agencies and NGOs, who are working to spread Internet connectivity worldwide. They have distinctly different perspectives on the potential role of ICTs and network connectivity for social and economic development – some pushing to get everyone onto the ‘information superhighway’ as soon as possible, whereas others are sceptical of the benefits of such a ‘digitising mission’ to wire up the world. While the map texts analysed are largely conventional in cartographic design terms, they nonetheless provide a revealing connotative window into how Internet globalisation is conceived and a way to think about the political implications of a global Internet that remains unevenly distributed.

Chapter six case study is an alternative view of the evolution of the Internet gleaned through the analysis of the commercial marketing map genre of cartography. The analysis of maps deployed as integral elements of the promotional strategies of large telecommunications corporations, examines how they work semiotically and politically to sell global network infrastructure. The chapter begins with a contextual history of network marketing maps and then evaluates the importance of cartography to a sample of fifty major telecommunications companies. The analysis then proceeds with a detailed consideration of the semiotic mapping strategies for displaying networks in an advantageous fashion, illustrated with a critical comparison of the promotional cartographies deployed by five of the most significant Internet network providers who promote their global spanning infrastructures. This is followed by a tracing of the role changing marketing maps used by WorldCom in the period of commercial take-off of the Internet through the second half of the 1990s when the Web spurred unprecedented levels of hype, culminating in the dot-com bubble at the end of the decade. The analysis shows how marketing maps have an active role in the promotional discourses that lead to large speculative, and selective, overbuilding of expensive new fibre-optic cable infrastructures across the globe.