Exposing the ‘Second Text’ of Maps of the Net

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Abstract

Maps have long been recognised as important and powerful modes of visual communication. In this paper we examine critically maps which are being produced to represent and promote information and communication technologies and the use of cyberspace. Drawing on the approach of map deconstruction we attempt to read and expose the ‘second text’ of maps of the Net. As such, we examine in detail a number of maps that display, with varying degrees of subtlety, the ideological agendas of cyberboosterism and techno-utopianism of their creators. A critical reading of these maps is important because they are widely reproduced and consumed on the

Internet, in business and governmental reports, and in the popular press, all too often without a detailed consideration of the deliberate and intended messages being communicated. As we illustrate, many of these maps not only promote certain ideological messages but are often also poor in terms of cartographic design, with many containing serious ecological fallacies. We restrict our analyses to maps at the global scale.

Introduction

From the earliest times people have tried to communicate and represent the spatial relations between societies and places on the surface of the Earth through a variety of media - cave paintings, drawings in the sand, models, maps, works of art, photographs and, in present times, with satellite images, computer generated virtual environments (Jacobson *et al*., in press). As a consequence, maps have been a central, often taken-for-granted, tool used to store and represent geographic knowledge concerning the world and beyond. They form an integral part of how we understand and explain the world. As such, they are a key area of school curricula, are used on a daily basis by many of the world's population to aid navigation, and are used as heuristic devises to provide understanding in news reports, advertising, government reports, travel guides and many other sources. The map then is one of the pre-eminent visual media for representing, interpreting and moderating the world.

The process of mapping is a method to visualise a world that is too large and too complex to be seen directly (MacEachren, 1995). As such, a map is a graphic tool that classifies, represents and communicates spatial relations (Bertin, 1983; Tufte 1983); a concentrated database of information on the location, shape and size of key features of the landscape and the connections between them (Hodgkiss, 1980). The power of a map lies in how it communicates spatial relations - how the information has been selected, abstracted, generalised and portrayed by the cartographer. Because of this process of creation, no map is an objective, neutral artefact as many subjective decisions are made about what to include, how the map will look, what the map is seeking to communicate (MacEachren, 1995; Monmonier, 1995, 1996). Maps then are never merely descriptive - they are heuristic devises which seek to communicate particular messages (Harpold, 1999). They are artefacts imbued with the values and judgments of the individuals who construct them and they are undeniably a reflection of the culture in which those individuals live. Understanding the rhetorical power underlying the construction of maps, identifying their 'second text', has become a central

concern in the field of cartography in the past ten or so years as cartographers engage in a reflexive practice aimed at improving maps as effective communication media (see Harley, 1989, 1992; Wood, 1992 for good introductions).

Over the last thirty years, rapid development and diffusion of information and communication technologies (ICTs) have led to the development of the Net. In order to make sense and market this growth, many visual representations and maps have been created to make the structures, data flows and information content of cyberspace visible and tangible, using all manner of graphic styles and cartographic metaphors (for overviews see Anders, 1998; Dodge, 2000; Dodge & Kitchin, in press; Holtzman, 1997; Jiang & Ormeling, 1997). Many of these maps, we argue, are significant components in the market-driven development of the Net being promoted by global capital. They are primarily produced for marketing and propaganda purposes by companies and consultants who have vested financial interests in the global expansion of cyberspace. In many of these cases, maps are being deployed in order to support the rhetoric of expansionists, to assert their global position, and to control the new electronic spaces that they are cultivating.

In the highly competitive business of Internet services and infrastructure provision the marketing map is an important tool to demonstrate the power of the company's network to potential customers. There are many examples available on most Internet network provider's web sites (e.g. UUNET backbone maps, see Figure 1). They employ all manner of cartographic styles to represent the topology of the network, but the most common is some form of arc-node representation on a geographic base map (e.g. in Figure 1 the key nodal points are shown as red hubs and the arcs represent the fibre-optic network links). The companies invest considerable and conscious effort in producing high-quality maps that present their networks in the best possible light. The two main ways to do this are first, to demonstrate the geographic reach of the network, emphasising all the distant places that are linked together, and second, to illustrate the tremendous capacity of the network 'pipes' to cope with huge user demand. In this way Internet marketing maps fit into a long tradition of 'persuasive' maps used by companies to promote their networks, be they shipping, airlines, railroads, or roads (Ackerman, 1993; Fleming, 1984; Monmonier, 1996; Tyner, 1983). As such, these maps, as a means to survey and control, are becoming as important in virtual terms as maps of the geographic world.

Click on Image to Enlarge

Figure 1: UUNET Global Internet Backbone Map from 1998 (Source: http://www.uu.net/).

In this paper we examine critically maps of the Net, building on the limited work of Brunn and Cottle (1997), Jackson and Purcell (1997) and Harpold (1999). In order to illustrate our arguments we focus our attention on maps drawn at the global scale that relate to Internet infrastructure, traffic flows and user demographics. It should be noted, however, that there are a number of other types of maps relating to the Internet. For example, there are a number of research-led and commercial attempts to map and spatialize (provide a geography to data that has no spatial elements) the information contained within web-pages (e.g. Chi *et al.* 1998), asynchronous media such as Usenet news (e.g., Smith, 1999) and synchronous media such as Internet Relay Chat (e.g. Donath *et al.,* 1999), and MUDs and virtual worlds (e.g. Anders, 1998). The construction and messages of these maps also need to be analysed critically (see Dodge and Kitchin, in press, for an initial reading).

Deconstructing Maps

As noted, it has long been recognised that the power of maps to communicate complex spatial relations can be manipulated to provide particular impressions to readers. Maps and their makers are situated within broader historical and political contexts and are thus embodied and selective representations. While they might purport to being objective, mimetic devises, they are ultimately constructed for particular purposes and

embodied with certain values. As Monmonier, in his book ‘How to Lie with Maps’, comments:

In showing how to lie with maps, I want to make readers aware that maps, like speeches and paintings, are authored collections of information and are also subject to distortions arising from ignorance, greed, ideological blindness, or malice."(Monmonier 1996, p. 2)

As such, while many people accept the Mercator view of the world, centred on the Atlantic, as the ‘proper’ map of the world (see Figure 2) it is merely one particular cartographic representation, containing a number of subjective design decisions, distortions and ideological biases. For example, the Mercator map distorts factors such as area and shape in order to allow all rhumbs (a line of constant bearing) to appear as straight lines. It was created in 1569 to aid the navigation of mariners. It thus had a large effect on the safety of shipping trade and was used to great effect in the expansion of colonial powers. While the map suggests that Greenland is approximately the same size as Africa, in reality Greenland would fit inside Africa several times. This distortion is well illustrated by Figure 3.

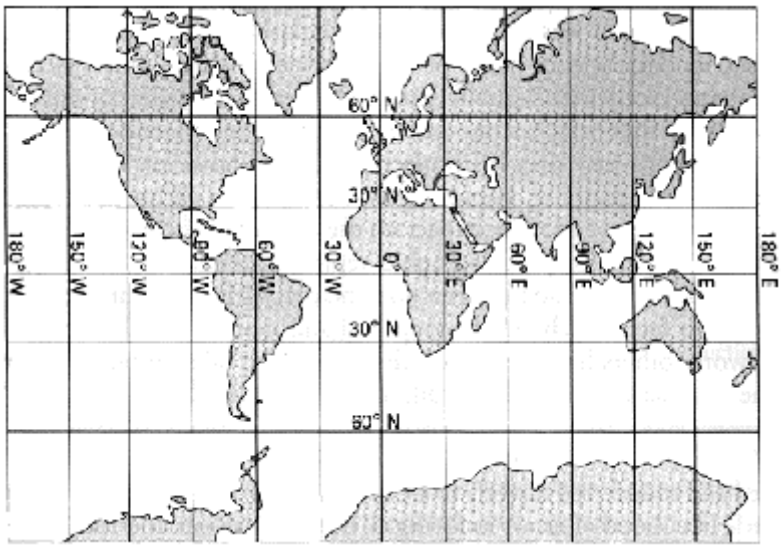
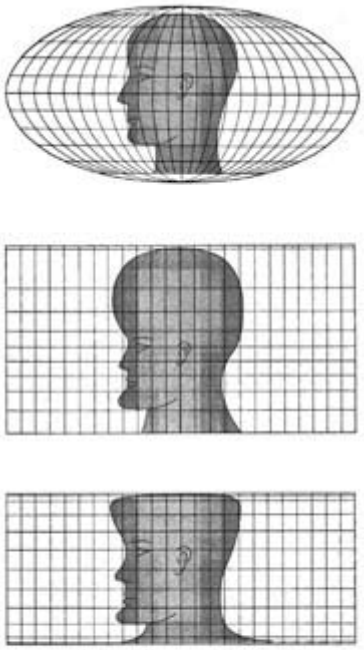


Figure 2: The 'standard' Mercator projection (Source: Dorling & Fairbairn 1997, p. 37).



A head drawn on the Mollweide projection (top) has been transferred to Mercator's projection (center) and to the cylindrical equal-area projection with standard parallels at 30° (bottom). Just because the profile looks most natural on Mollweide's projection, that projection is not necessarily "better." The natural profile could have been drawn on any projection and then plotted on the others.

Figure 3: The distortion affects on shape from different map projections (Source: Robinson *et al.* 1995, p. 69).

Harpold (1999) argues that maps of the Interet similarly contain considerable, conscious and unconscious, bias and distortion:

I propose that these depictions of network activity are embedded in unacknowledged and pernicious metageographies - sign systems that organize geographical knowledge into visual schemes that seem straightforward …., but which depend on historically and politically inflected misrepresentation of underlying material conditions. (Harpold 1999).

Maps of the Internet are systems of power-knowledge. As such, we should be careful to look beyond the data generated to question, in a broad sense, for whom a particular map was made, by what organization, why it was produced, and what the implications of its message are. Two of the most serious distortions are the use of dominant Western, particularly Ameri-centric, world views to frame the data presented and the inherent propagation of ecological fallacies that are present in the most commonly used map designs.

In relation to the first point, many maps focus their attention, either deliberately or unconsciously, on the developed West,

especially the USA. This focus all too easily relegates other parts of the world such as Africa metaphorically, and sometimes literally, to the edge of the map. Pushing countries to the periphery just re-enforces, visually at least, the existing world hegemony in relation to the Internet. The lack of representation of the ‘unwired’ masses on many of the maps is a particular concern of Harpold. He draws parallels to the colonial mappings of Africa as the 'Dark Continent' with a blank interior. The Western cartographers of the colonial era depicted the vast interior as lacking civilisation because it had not been explored and conquered by white Europeans. As we detail below, cartographers of the Internet are unwittingly repeating this pattern in their maps which portray less-connected nations that lack widespread availability of computers and high-speed network connections as empty and blank, as lacking a position or role in the developing information economy. In reality, however, many of these territories are key to the sustenance of the developing information economy providing sites of low-paid, low-skilled back-officing and the manufacture of computer and telecommunication components which are almost exclusively exported.

In relation to the second point, ecological fallacy is a well known phenomena in geography whereby the aggregate characteristics of a whole population are inappropriately ascribed to individuals within populations. This problem is commonly associated with choropleth mapping methods, which are much in use in mapping of the geography of Internet diffusion.

Research into the global diffusion of the Internet, such as the work of Batty and Barr (1994), Press (1997), Elie (1998), and Hargittai (1998), provide many interesting examples of analysis and maps containing cartographically-induced bias and distortion (see Figures 4-6 for examples). Although these papers contain much of value to those interested in the geography of the Internet, they all fall, to varying degrees of culpability, into the trap of ecological fallacy. That is, they encourage the reader through a lack of critical comment to assign the characteristics of nations onto the actual individuals of those countries. This is particularly so with the graphic representations typically employed - choropleth maps and scattergram charts. Choropleth maps promote an artificial sense of homogeneity within territorial units by masking internal variation and inequality. Moreover, they are usually compounded by the poor selection of a classification scheme to categorise the underlying attribute data. This can provide a distorted visual pattern on the map (Jenks & Caspall, 1971; Monmonier, 1996). The alternative is to display data using continuous shading or as a graduated symbol map which ties

data to more precise locations at the sub-national level (e.g., the World Internet map produced by Matrix Information and Directory Services (MIDS), Figure 7). The scattergram (or x-y chart) performs a similar pernicious role of presenting aggregated data in a way that emphasises differences between units, thereby masking the internal inequalities. Scattergrams are usually employed to show a positive relationship between two variables - in the case of the Internetet the variables are usually some measure of ‘wiredness’ (like PCs per capita) and a measure of economic development (often GDP). Figure 6 shows a typical example taken from Elie (1998). While it is difficult to suggest alternative graphic presentations to the scattergram, we would argue that they are often used uncritically and constructed without reflection concerning their message. As such, the data within scattergrams are often presented as unambiguous ‘facts’ when in fact they require captions and narrative descriptions to guide the reader’s interpretation of the pattern in the chart. These narratives, in turn, can fall into the trap of assigning a linear trend within the data as a de facto causal relationship between the two variables, but again this may not be the case.

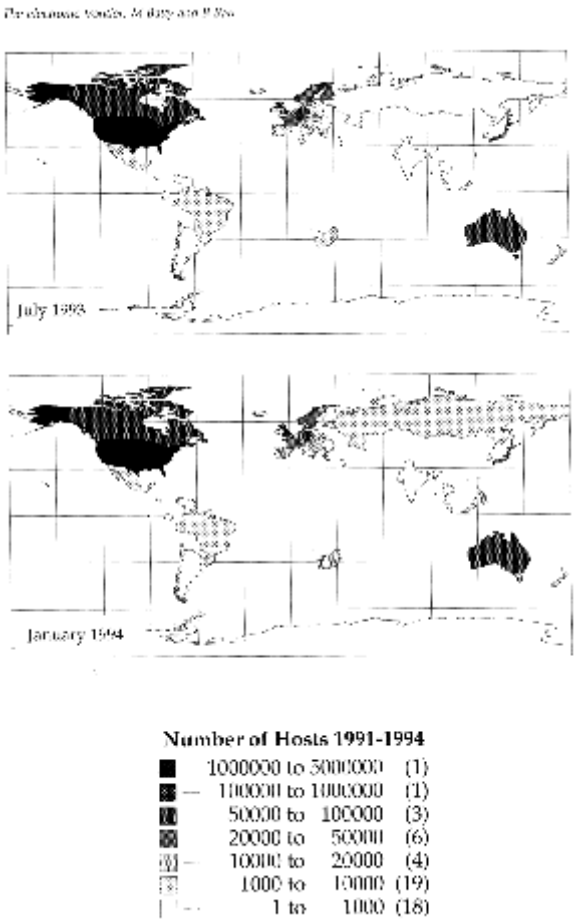


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Figure 4: A sequence of choropleth maps showing Internet diffusion over time at the national level (Source: Batty & Barr, 1994, p. 707).

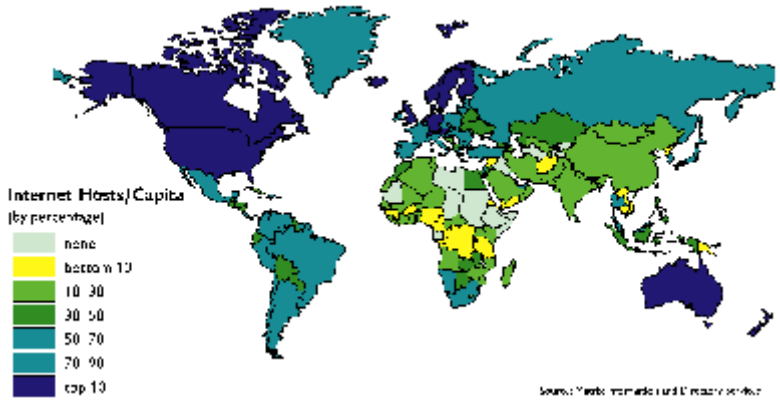

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Figure 5: Choropleth map of Internet hosts per capita, typical of many maps in this type of analysis (Source: Press, 1997, p. 12).

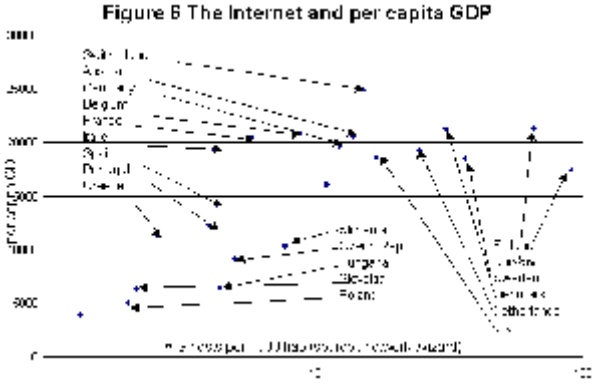

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Figure 6: Typical scattergram of national-level data used in Internet diffusion research (Source: Elie, M. (1998). *The Internet and global development*. INET'98 Conference, July 1998, Geneva, Switzerland. ISBN #1-891562-02-9. Available: http://www.isoc.org/inet98/proceedings/5d/5d_3.htm

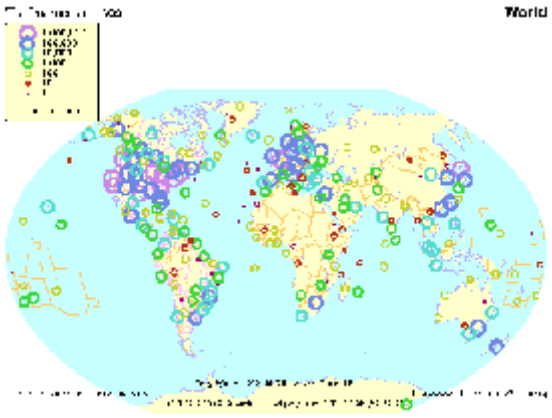

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Figure 7: Internet World Map produced by Matrix Information and Directory Services (MIDS), using data from July 1999. It uses a graduated symbol presentation of data to show global pattern. (Source: Matrix.Net: http://www.matrix.net)

In part, the ecological fallacies we have described are the result of having to map data collected at particular territorial scales. Because the data has no sub-scale variability there is little choice but to map it at the scale collected. Many of the maps of the Net are constructed using ‘off-the-shelf’ data that is readily

available at the country-level aggregation. In many studies of Internet diffusion the same data sources, like the World Bank, OECD, International Telecommunications Union, CIA world database and Network Wizards Internet data are used repeatedly. These organizations publish orderly tables of statistics at the national level that can be turned into choropleth maps with ease and little thought. If there is no commentary in the analysis warning of the possible dangers of ecological fallacies, as demonstrated below, then the people who consume the research can easily be misinformed. In the past year or so, a number of compendiums of Internet statistics and demographics aimed at the mass market have been published such as *The State of the Net: The New Frontier* (Clemente, 1998) and the *Internet Industry Almanac* (Juliussen and Petska-Juliussen, 1998). These provide, in our opinion, a carefully selected choice of data using specific territorial units.

In many ways national level data collection is a logical unit choice as there is no doubt that individual experiences and institutional decisions are shaped by national-level power structures through government legislation, deregulation, and subsidies. In some respects, however, it seems illogical to create maps that demarcate the Internet into the straightjacket of national borders, especially when the data displayed (e.g., infrastructure owned and operated by global corporations) has little to relationship to nation-states. The network technologies of cyberspace are forging connections and virtual groups that subvert the primacy of national boundaries (Poster, 1995; Thu Nguyen & Alexander, 1996), which are represented on maps by crisp lines. In reality these borders are relatively meaningless to data connections and flows which can be represented at a global scale without the use of borders. The question therefore is ‘how much sense do existing political borders of the material world make when mapping cyberspace?’ Clearly, for marketing maps of the Internet, the political borders of countries provide a powerful template, a familiar framework onto which the strange and potentially subversive world of cyberspace can be mapped and in some senses contained. That said, global-level data does need some level of categorization for effective display. What is needed, we believe, is for the selection of units to be actively and reflectively considered by both map-maker and map-user. Here, the level of map abstraction needs to be balanced against map meaning so that the rationale for unit selection is extended beyond ease of use.

Deconstructing Maps of the Net

An exemplar hegemonic map of the Internet is the map entitled *The Network Society Map*, produced in 1997 by World Link. It is a large poster world map (measuring 32" x 54" - see Figure 8). The subtitle on the map states that it was produced "*… on the occasion of the 1997 Annual Meeting of the World Economic Forum in Davos, Switzerland.*" The map was also sponsored by Hewlett Packard and Novell, two major multinational IT companies. The purpose of this map is stated explicitly, "*The Network Society Map aims to show how well prepared 49 of the largest and most dynamic economies are to compete in the network society.*" A typical array of measures of national technological 'progress,' such as phone lines, PCs and Internet hosts per capita are used to rank the 49 countries highlighted. The map is well drawn cartographically (using standard conventions), has high production values as befitting its target audience, and uses an interesting donut-type symbol located within each country to represent the data (shown on the inset in Figure 8).

The Network Society Map exhibits, with little subtlety, many of the key conceits present in hegemonic maps of the Internet. First is the selection of criteria employed by the cartographer to measure and map the 'preparedness' of the countries for competition with each other. The criteria are wholly concerned with technological superiority, with no wider social or cultural dimensions. The measures are also presented at the national level and this imposes a sense of order and unrealistic internal homogeneity within the countries. Within even the richest, most technologically developed nations access to PCs and the Internet is far from uniform, with significant inequalities between different sections of the population. Differential access to and use of the Internet has been demonstrated in terms of class, gender, education, wealth and race (Keller, 1996; Schön *et al.,* 1999), with increasing political concern over the possible emergence of a 'digital divide' (McCullagh, 1999). For example, evidence of racial inequalities was provided by Hoffman and Novak's analysis of the so-called "World White Web" (Hoffman & Novak, 1998), differences by class and education have been highlighted in the "falling through the Net" studies by the U.S. NTIA (McConnaughey *et al.* 1995, 1998, 1999), and finally differential access as a function of income was demonstrated by Moss and Mitra (1998). There is also significant geographical inequality in the deployment of Internet infrastructure such as fibre-optic networks, routers and domain names even within the leading 'wired' nations like the U.S.A . (Gorman & Malecki, 2000; Moss & Townsendm 2000; Zook, 2000). All this real variation and inequality is masked in maps like The Network Society Map in the desire to show

technological progress.

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Figure 8: The Network Society Map produced by World Link, January 1997 (Source World Link: http://www.worldlink.co.uk).

Another important conceit of the *Network Society Map* is that much of the world is left unmeasured, unmapped. The unmapped people are therefore left out of the new world of the Network Society. The selection of only 49 countries, which are mainly in the West, forcibly excludes vast swathes of the globe from the map and by inference from the Network Society. This is particularly noticeable for Africa. As noted earlier, many African countries are actively involved in the production and development of the information economy, albeit in a different capacity to those in developed nations (i.e., as manual labour providing raw materials or manufacturing rather than service provision).

It is difficult to find alternative, more meaningful criteria for measurement than that employed by the creators of the Network Society map, but it can be achieved. Perhaps the most notable improvement in national level data generation has been the six-dimensional framework developed by the Mosaic Group to track Internet diffusion (Mosaic Group, 1998; Press 1999; Press *et al.,* 1999). The six criteria they developed are as follows:

(i) *Pervasiveness* (based on users per capita and the degree to which non-technicians are using the Internet)

(ii) *Geographic dispersion* (measure of the concentration of the Internet within a country, ranging from none, to a single city, to nation-wide availability)

(iii) *Sectoral absorption* (measure of the degree of utilization of the Internet in the education, commercial, health care and public sectors)

(iv) *Connectivity infrastructure* (based on international and intranational backbone bandwidth, exchange points, and last-mile access methods)

(v) *Organizational infrastructure* (based on the state of the Internet service provider industry and market conditions)

(vi) *Sophistication of use* (a measure characterizing usage, ranging from conventional to highly sophisticated and driving innovation)

(from Press, 1999, p. 34)

These criteria are measured through the distribution of a questionnaire survey to individual respondents within nations. Each criterion is rated by respondents using an ordinal value from zero to four. In this manner, technological development is measured using the qualitative knowledge of those 'on the ground,' and is summarised as a quantitative national 'score' that has a more nuanced meaning than a simple telephone lines per 100,000 population measure.

Other maps fall into the same traps as the 'Network Society Map' and we briefly deconstruct two more to further illustrate our arguments. The first example is *The Wired World Atlas* which was presented as a six-page, fold-out spread in WIRED magazine in November, 1998 (Conners Petersen, 1998). WIRED magazine is often considered the bible for the true cyberspace convert. The magazine cover promoted the map as *"Globally Wired: Your Foldout Guide to Every Nation's Tech Wealth,"* which reveals the agenda of the map. The ideological aim and statistical method employed in The Wired World Atlas are essentially the same as The Network Society Map, employing the same kind of positivist measurement of national 'Tech' progress. However, the WIRED map does use a more sophisticated cartographic style in keeping with the design pretensions of the magazine. The WIRED map is also an improvement in that at least it covers most of the nations of the world, mapping some 140 odd countries.

The heart of The Wired World Atlas is a double-page cartogram map of the world. Figure 9 shows one half of the cartogram covering the Americas, half of Europe and Africa. Using this cartographic technique countries are represented as regular shaped blocks which are proportionally sized and shaded according to their national-level television and phone penetration score. The use of the cartogram approach is arguably somewhat more progressive in its representation of the world than a strictly geographic approach. It certainly produces a striking visual impression of a tiny Africa being

overwhelmed by huge, overbearing European blocks. The data is once again though wedded to Western, positivist measures of progress, failing to reveal the vital role that many developing nations play in supplying and supporting the information economy of developed nations.

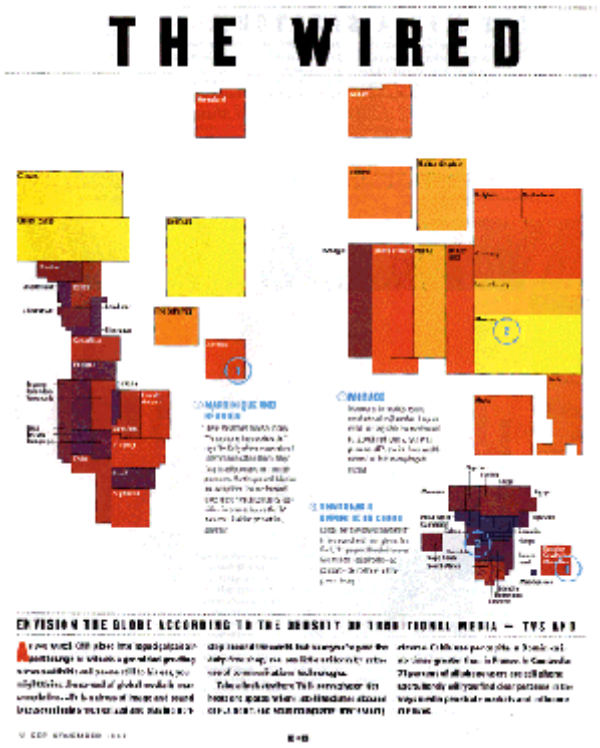

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Figure 9: The Wired World Atlas. (Source: WIRED magazine, November 1998, p. 162)

The next example we consider are the *International Connectivity* maps produced by Larry Landweber. These are simple choropleth world maps with countries classified into four categories ranging from no public network connectivity to full Internet link. Landweber's maps are some of the most widely reproduced geographic maps of the Internet. He started mapping the global diffusion of connectivity back in 1991 and Figure 10 shows his earliest available map from September 1991 and his final one produced in June 1997. A series of sixteen maps are available, tracing the global diffusion of the Internet at the national-level.
Like softwarem each of his maps has a version number.

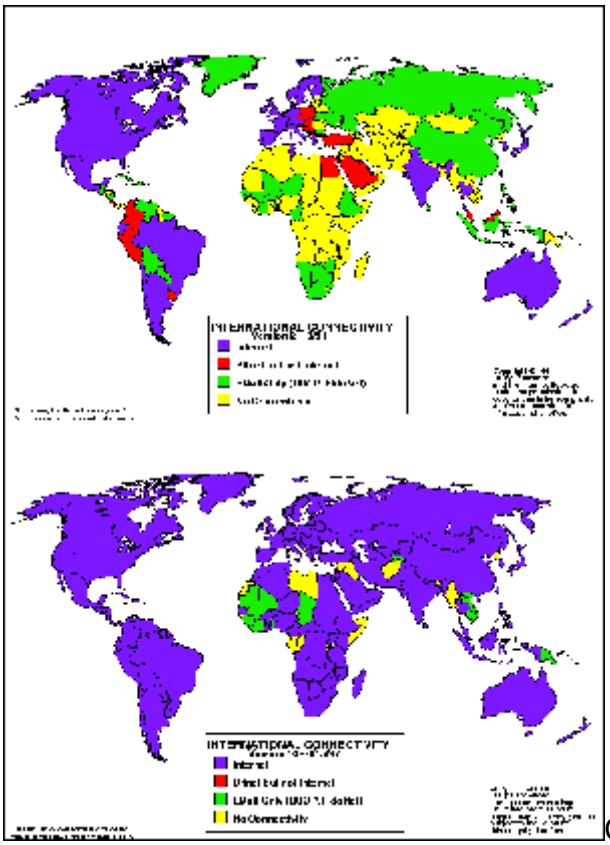

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Figure 10: International Connectivity maps from September, 1991 and June, 1997 produced by Larry Landweber. (Source: ftp://ftp.cs.wisc.edu/connectivity_table/)

The maps provide a conceptually simple, one might say simplistic, picture of the geography of the Internet. They are free to use and are endorsed by the Internet Society, one of the key institutions guiding the development of the Internet. However, the maps suffer from gross problems of ecological fallacy, which are compounded by the constricting classification employed which forces countries into one of four categories. An uncritical reading of these International Connectivity maps provides a very distorted view of the global spread of the Internet.

For example, due to the limited range of categories nations appear to be technologically similar to each other when in reality the level and sophistication of Internet availability is very different. Countries are coloured blue if they have permanent international links to the Internet, but these links may be a single (expensive, low bandwidth) satellite link in the capital city or numerous high-capacity fibre-optic cables linking many parts of the country to the Internet. On the September 1991 map, the three nations that constitute North America are all shaded blue, indicating they are in the same group because they all have

Internet connectivity, yet it is inapptopriate to claim that Mexico's Internet capability is equivalent to that in USA and Canada. In the final map produced by Landweber in June, 1997, a large proportion of the nations of the world are shaded as having full Internet connectivity. However, despite their belonging to the same category, Petrazzini and Kibati (1999) demonstrate that USA, Argentina and Kenya have very different Internet status, noting that end-user access costs (adjusted for purchasing power) were nine time higher in Argentina than the USA, and a staggering 413 times more expensive in Kenya as compared to the USA. To the unwary eye all the blue areas appear equivalent, which is patently not the case. Moreover, Landweber's maps ascribe a single value to a whole territory, suggesting that everywhere (and everyone) within this area has equivalent levels of Internet connectivity. Again, this is clearly not the case, with the maps promoting an artificial sense of homogeneity and masking variation and inequality within territorial units. Holderness thus comments on Landweber's last map, "*Almost the whole world, it seems from a casual inspection of this map, has turned Internet-coloured. The sun never sets on the Internet; it appears to reach everywhere except some war-torn corners of the world.*" (Holderness, 1998, p. 39). Holderness has attempted to reconfigure the Landweber map (Figure 11) to remove some of the grossest distortion by fading non-metropolitan regions outside of the OECD countries and greying out the uninhabited deserts, tundra and icefields.

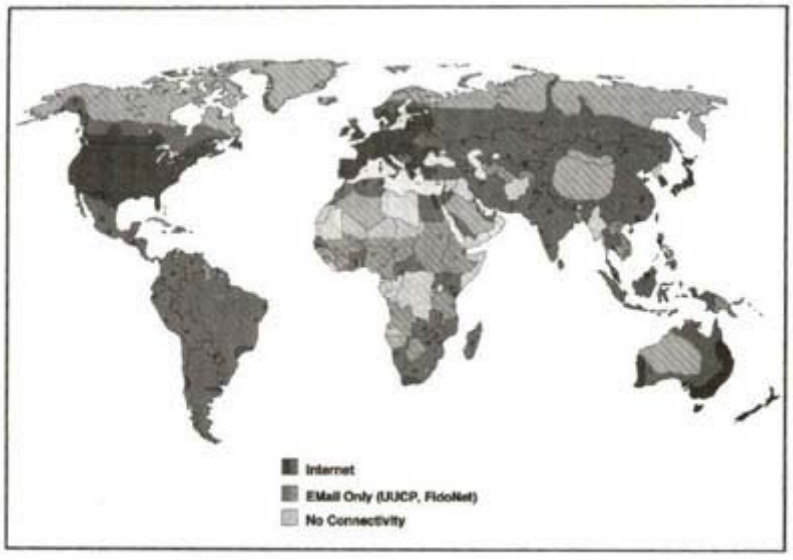


Figure 3.2 Landweber's map adjusted by the author
Source: Landweber 1996

Figure 11: Adjustment of Landweber's International Connectivity map by Holderness (Source: Holderness, 1998, p. 41).

A True Map of Cyberspace?

As our analysis highlights it is clearly impossible to produce a single true, objective map of the Internet. As such, there will always be a range of maps produced, for a range of purposes. However, map readers can be educated into reading beyond the ideological messages as intended to interrogate the 'second text', and map designers can themselves improve their designs significantly to eradicate unintentional ecological fallacies. In addition, we would suggest that maps of the Net can be improved by being imbued with the rich, individual experiences of the Net, extending beyond mechanistic per capita measures, scattergrams and shaded maps.

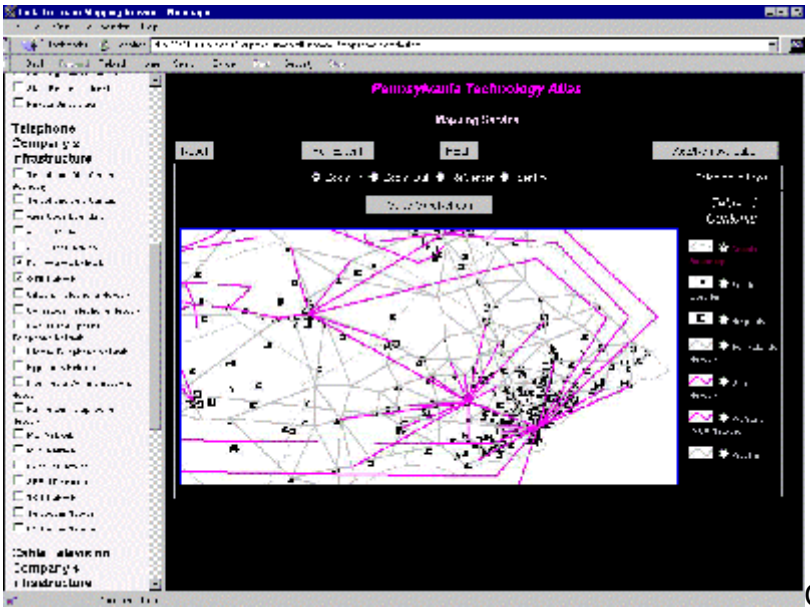
Fundamental to this project is to encourage the development and use of more meaningful measures of the Internetet beyond the simplistic penetration scores of the hardware like phone lines and computers. Measures are needed that reveal what people are doing with cyberspace technologies and how technology and information is being adopted and adapted into people's everyday lives. For example, the existing analytical approaches and mappings completely fail in their representation of the African experience of the Internett. The result, at present, leaves Africa largely as a blank, the 'dark continent' of old. The blankness on Western-centric maps of the network society masks the fascinating richness and diversity of the Internet's percolation through Africa (see Barlow, 1998; Hall, 1998; Oguibe, 1996 for example). We also need to loosen the geopolitical shackle of the nation-state as a unit of analysis and look at the local, contingent forces that affect the patterning of the Internet within countries (see the MOSAIC Project for progressive work in this direction). As Harpold says:

> *"Sustained, progressive critique of the metageographies of Internet diffusion and traffic must look beyond the limited (and limiting) visual vocabularies of national-political identity, and base its investigations on new schemes for representing the archipelagic landscapes of the emerging political and technological world orders."* (Harpold 1999).

Using the network facilities of the Internet to measure itself provides another interesting opportunity to explore new modes of representation. Notable work in this regard is being undertaken by the Co-operative Association for Internet Data Analysis (CAIDA) and the Internet Mapping Project at Bell Labs-Lucent Technologies (Burch & Cheswick, 1999; Claffy *et al.,* 1999). At present, however, this work is limited to technical measurements of network structure and performance, and as such does not provide social assessments of Internet diffusion. It is also possible to use Internet tools called traceroutes to

explore the connectivity of nodes to the Internet, thus revealing the network linkages and speeds (see Dodge, 1999 for an introduction to traceroutes). These projects are significant because they provide alternative data sources to the limited selection of ‘off-the-shelf’ data and allow measurements to be generated from local scales up to the global arena.

Another potentially interesting way forward to a more progressive mapping of the Internet, is to utilize the interactive power of the Internet to let readers create their own maps. Crampton suggests that part of the progressive cartographic research agenda that can flow from map deconstruction work is to "*… emphasize the importance of multiple perspective and multiple maps."* (Crampton, 2000). Online GIS is one possible route that can provide the means for users to create their own multiple maps. An interesting example is the *Pennsylvania Technology Atlas* which uses a basic online GIS that allows users to produce thematic maps of the technology infrastructure in the state. Although the system is limited, the user does have control over which data to map and the ability to pan, zoom and interactively enquire. Figure 12 shows an example of the maps produced by the Atlas. Of course, the tools of the GIS and the data provided will inherently set the limits of what is possible for the user to do, but it still could offer users the power to choose their projection, classification and symbology. It also offers the user the ability to explore the data and critically examine the results in ways not possible with a fixed, single map mode of conventional cartography. There are also clear links in this approach to the work on public participation in GIS that aims to reconfigure the technology, and how it is used, in ways that empower communities rather than dominating them. While this package is limited to the state scale, we see no reason why it could not be extended to other spatial scales both more global and more local.



Click on Image to Enlarge

Figure 12: The Pennsylvania Technology Atlas (Source: http://www.technology.state.pa.us/atlas/).

While there are, as yet, few examples of more appropriate, subtle, nuanced or 'progressive' mappings of the Inyernet we believe that more sophisticated mappings will appear in the coming years. As can be shown in other spheres of human activity the powerful tend to be first to promote their agendas through cartography. It takes time for 'alternative' voices to deploy maps in answer, but experience demonstrates that this does occur. For example, the *State of the World Atlas* by Michael Kidron and Ronald Segal, first published in 1981, has over time added a number of different subjects to its contents, many of which portray data usually excluded from maps created by governments for obvious reasons in that it might highlight political failure or portray the nation in a unflattering way. The fifth edition covers topics such as greenhouse gases, global warming, abortion, birth control, domestic violence, international drugs trade, state 'terror' (legal status of capital punishment), and the treatment of homosexuality. Other atlases and maps address issues of health inequalities, poverty, access by the disabled (Kitchin, 1999), crime and fear, war and genocide (e.g., The Atlas of the Holocaust, Gilbert, 1983), and environmental issues, across a range of different scales.

Conclusion

All maps, throughout history, are distorted and selected representations designed to meet the purposes of the

cartographers and their paymasters. Maps of the Internet are no different in this respect. At present, however, critical readings of these maps are few and far between. As such, there is a need for academic analysts to read critically the 'second text' of the maps of the Internet that are being produced and consumed today, deciphering the conscious and unconscious ideological messages they portray. In part this is to demonstrate the role of capital in shaping the Network Society but also to alert the unwary map designer to the inherent dangers of national-level analysis and mapping using choropleth maps, and the map user of the dangers of accepting maps at face value, highlighting issues such as ecological fallacies. In other words, maps of the Internet need to be more actively and reflectively considered by both map-maker and map-user if more nuanced, sophisticated and less misleading maps are to be produced.

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