libraries cannot make the assumption that today's map librarians have the skill or will to participate in a digital geographic information world. Many map librarians opted for their career path because of their love for traditional librarianship and maps. Tomorrow's map librarians will require a new blend of skills, a blend that combines understanding of geographic information with skills in handling sophisticated digital information technologies. Managing this human resource transition will not be easy.

Summary

The map is in rapid transition, moving from analog map sheets to virtual digital databases. Map libraries must embrace the virtual medium or risk becoming obsolete in the post-technology world. Map libraries will change to become "*geographic and associated information resource centers*". This implies little conceptual change if you think of the "*map*" as "*geographic information*", and of "*libraries*" as "*resource centers*". It does, however, imply considerable change in the physical nature of the facility and in its mode of operation.

Will we need map librarians in the future? The map librarian of the future will be the *expert* who knows best where to find what in a bewildering world, who can help us to understand the galloping technology surrounding the virtual map world, and who can shed insight on a digital map's reputation, quality and legal world. Digital browsers will become as good as a mediocre map librarian. But no digital data browser will match an expert map librarian who is up-to-date on what is going on in the geographic information world. So there will always be a continued need for *expert* map librarians. However, these experts could be accessed in tomorrow's sophisticated digital world without the need for an elaborate physical map library facility.

So will we need physical map libraries in the future? The primary role of the physical map library will switch from storing paper maps to facilitating digital geographic and associated information search and access, with a focus on "just-in-time" service. The physical facility will specialize in hardware, software and network gadgets not easily accessible to the average home or office computing installation. While physical map libraries therefore have an opportunity to be an important part of tomorrow's geographic information service provision, they will not be essential. A map library's continued existence cannot be guaranteed, it must be earned.

To make a successful transition, map librarians and their map libraries must be pro-active and visionary in the provision of geographic and associated information access and services. They must be advocates of change and direction. In today's political, corporate and fiscal climates, map libraries need to find opportunities to team up, to form partnerships, and to diversify to achieve WIN/WIN situations. Those of us who know of map libraries and reading rooms face options. To do nothing implies the risk of a gradual demise of many of our traditional map libraries into oblivion.

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online mapping

Cyber Rights and Cyber Maps

Jeremy Crampton
Department of Anthropology & Geography
Georgia State University
Atlanta, Georgia, 30303

An examination of the articles in this and related journals quickly gives the impression of a number of exciting and cutting–edge developments in Web–based mapping. During the 1990s, as the Internet doubled in size every 18 months in compliance with Moore's Law, cartographers and GIS companies alike began to explore previously unrealizable goals of distributing maps and applications (such as ESRI's Ar-

cIMS) via the Internet. Although the dot–com collapse of 2000 necessitated a rethinking of the business plans among "purely" Internet based companies (who take their orders only over the Web and do not have an appreciable physical presence, as opposed to the "clicks and bricks" companies) it seems that every week brings something new to be grateful for (or worried about). And the Dow and NASDAQ are still at an (almost) all time high, and retail e–commerce sales alone for the 2001 1st quarter were $7 billion, up 33.5% over 1st quarter 2000 (Census Bureau, 2001).

While I am as appreciative about technological advances as the next person; for example teaching Internet GIS with ArcIMS 3 since Fall of 2000, there does seem to be a voice missing from the conversation about Web–based mapping. We have been so concerned about "cyber maps" that we have perhaps forgotten about "cyber rights".

The notion of rights is one that is familiar to most readers. In the United States, during the 1960s civil rights were brought to prominence successfully by leaders such as Martin Luther King (now resting just a few blocks from where I write this). In Europe, "May 1968" is synonymous with the student protests for social justice. These movements and their achievements were all the more remarkable because they arose from the will of the people, rather than from government legislation (at least initially). Today, a country without equal rights (human or civil) is in fact and almost by definition, unjust. A good example is the United Na-tions Development Report that ranks the world's countries by how many rights its citizens enjoy (see http://www.undp.org/hdro/).

On the other hand, rights are quite problematic for some commentators––even unjust. But how can equal rights be unjust? It's worth thinking about this. The answer lies in two implicit characteristics of rights in general: namely who gets to define the rights in question, and that rights are "inalienable", or if you prefer the words of Jefferson in the Declaration of Independence "We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness". Both of these ideas, that rights are inalienable or an inherent part of being human, and how rights are applied, can and have been challenged. The most interesting of these is when the two implicit parts of rights are joined: *rights are fine in theory, but when they get operationalized they suffer*. Thus when rights move from the absolute to the practical, they also become subjectified, politicized, and somewhat inflexible. Whose rights become *the* rights? After all, Jefferson owned slaves.

The same critique is possible against cyber mapping. The vision implicit in Internet GIS, MapQuest and the like is a positive one. Providing mapping and GIS services over the Internet will surely stimulate interest in cartography as a practice and as a part of business, increasing demand for jobs for the spatially trained (the OpenGIS Consortium likes to say that 80% of all business data has a locational component). The idea is fine in theory but how does it play out? I will argue that "cyber rights" are currently enjoyed by very few people around the world, and will continue to be so for the foreseeable future.

In the rush to embrace the Internet it is often forgotten just how few people can get access to it. Globally, somewhat under 7% of the world's population can and do use the Internet. That is to say, *ninety–three percent* of people in the world are without Internet access! Given that over a billion people live on less than a dollar a day, this shouldn't be too surprising. Regionally, the picture is even more revealing, as Table 1 shows.

This table reveals how regions with lower levels of access generally are also growing more slowly than regions with higher levels of access, with the exception of South America. This is the geography of the digital divide. North America (Canada and the USA) is still the predominant center of the Internet, both in terms of

	Percent Access to Internet 2000	Total Persons (M) 2000	GAGR (%) 1997–1999 1999
North America	48.5	167.12	63.6
Europe	17.5	113.14	46.2
Asia/Pacific	7.1	104.88	48.8
Middle East	4.9	2.4	n.a.
Latin America	2.5	16.45	111.2
Africa	0.5	3.11	30.9
Global	**6.7**	**407.1**	**59.5**

Table 1. The digital divide by region, 2000. (Source: NUA, http://www.nua.ie/surveys/how_many_online/index.html and World Bank, http://www.worldbank.org/data/databytopic/GNPPC.pdf). All figures approximate and represent adults and children with access to the Internet. Figures vary within region. CAGR = compound annual growth rate of hosts per region.

numbers and as a percentage of all people online. However, the global share of users in these two countries is now well below half, at about 40% by year–ending 2000 (about 1/3 in the United States). This is a decline from effectively 100% in the early 1990s. So the Internet is itself getting less concentrated. *But it is not flowing out evenly*. Vast areas of the world, especially in Africa, the Middle East (where there are cultural and religious barriers to adoption) and Asia are effectively not online. Within the United States there have now been four reports by the Department of Commerce on the digital divide, the most recent, "Falling through the Net" appearing in October 2000 (NTIA & ESA, 2000). In the case of African Americans as a whole the differential in Internet access is as much as 18 percent (23.5% vs. 41.5% access rate nationally, summer 2000). Furthermore, figures show that the differential is *widening*, rather than narrowing. According to the report, the gap between African American and national access rates has widened by 3 percent in two years. Critically, these differentials cannot be entirely accounted for by income or education. When Black households are normalized for income and education and their Internet access rate is estimated, these two factors account for only about one half of the actual differences.

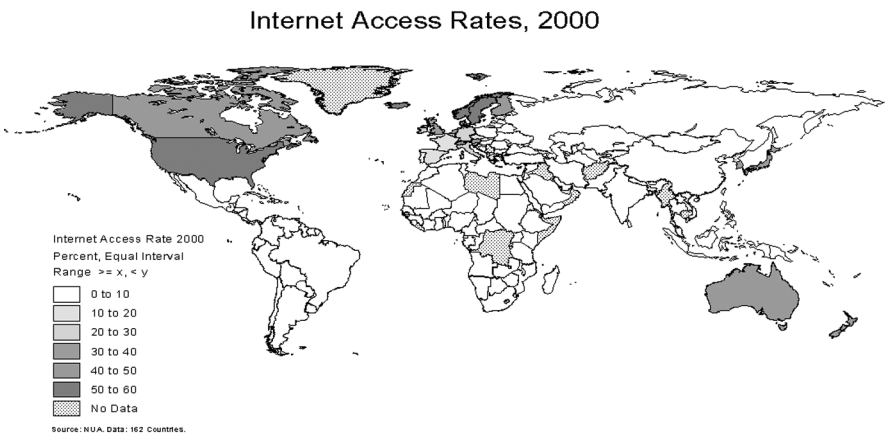

Figure 1. Internet Access Rates for 2000 by country. (Source: NUA, http://www.nua.ie/surveys/how_many_online/index.html. Map by author.)

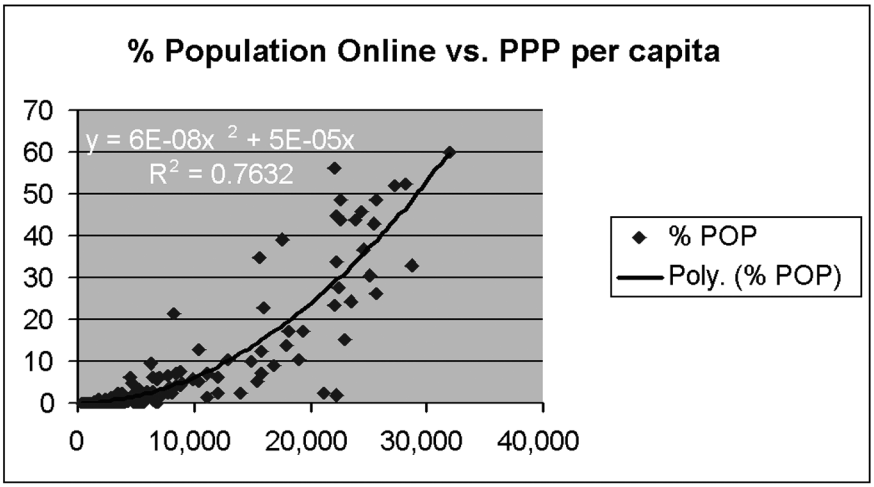

Figure 2. The relationship between income and Internet connectivity is non–linear. In this scatter plot, income is measured through purchasing power parity (PPP) and connectivity through percent online. (Sources: NUA, World Bank, http://www.worldbank.org/data/databytopic/GNPPC.pdf).

Globally, Figure 1 shows that the Internet is still concentrated in the US, Europe and Australia and Japan (only four countries in 2000 had majority access to the Internet out of about 175 for which there is data; they are [in order] the USA, Sweden, Norway, and Iceland). Even within these countries, it is important to note that access may only be available in the capital. Although most countries in the world now have Internet access, this is misleading. In Africa for example, the best-connected country (South Africa) has only 4% of its population online (in May 2000), and there is a continent wide average of just half a percent (Table 1). By the beginning of the 21st century only 1 out of 200 people had Internet access in Africa (Jensen, 2001). According to the latest UNDP *Human Development Report* (UNDP, 2000) sub–Saharan Africa has 0.27 Internet hosts per 1,000 people, compared to 112.77 for the United States and a global average of 7.42 (a host can connect more than one person).

Given that income is usually held to be the primary predictor of access, and to a lesser extent, education, is it possible to detect any variance between "standard of living" and access? In order to answer this question we can derive a straightforward scatter graph matching standard of living with Internet access (Figure 2). As this graph shows, income accounts for about 75% of the variability in Internet access, but the relationship is non–linear. In other words, adding more income ceases to have an effect on connectivity at a certain threshold level (about $21,000 in PPP international dollars; all the countries with incomes greater than this are in Europe or North

America, except for Hong Kong, Singapore, and French Polynesia, i.e., former colonies). We can also identify two separable groups or clusters of countries, those with higher incomes and connectivity (though more similar in income than connectivity) and those with effectively non–access (under 10% and even under 5% access). If we wanted to go further with this, we could also create a map to show which countries have greater than predicted access, predicted access, or lower than predicted access.

An R^2 of 76%, although reasonable, does not tell the whole story. That is to say, another quarter of the variability is not accounted for by income. Candidate variables that could be tested include attitudes to the Internet (perceiving it as irrelevant due to a historical lack of similar technology in the country or a lack of "killer apps"), lack of physical or cyber–infrastructure to provide access, and some related variables such as literacy and educational attainment rates.

But the digital divide is not just a technological problem alone and cannot be captured just by measuring "percent online". It is really better to think of it as a divide in opportunity for being part of the information economy (worth hundreds of billions of dollars in the US alone). This is therefore not just a question of technology; there are at least three divides in the information economy; technological, political, and social–economic. These divides are not independent. For example, the United Nations observed in its 1996 Development Report that there has been a significant concentration of wealth into fewer and fewer hands since the 1960s, so that by 1991 more than 85% of the world's population received only 15% of its income, and the net worth of the 358 richest people (the dollar billionaires) equaled the income of the poorest 45% of the world, or some 2.3 billion people (cited in Harvey, 2000, pp. 42–43). This concentration of wealth has occurred at precisely the same time as the best and most exciting deployment of technology in human history. Matthew 25:29 has never looked so apposite.

Why are these differentials important? For that half of Americans, which have access to the Internet, it is clear that it is used in a wide variety of ways. These include business transactions, job searches, online voting, information searches and retrieval, entertainment, and educational advancement. For the other half of America, those who are digitally divorced, it is equally clear that they are increasingly disadvantaged. In some instances there have been reports of "cyber redlining" by companies in terms of where broadband is first installed or where some online companies are prepared to deliver goods. Even without active discrimination those without access are relatively disadvantaged in using information and knowledge that is available to others.

I would conclude by noting that it is not inappropriate to be excited by technological advance, or the deployment of mapping applications on scales never before seen. But I would suggest that all technology comes with a social (and political) larger context in terms of who gets it, how it is used, and who benefits. It is just as appropriate to resist the negative effects of technological deployment, as it is to embrace the positive ones. What that resistance might look like I would not presume to say in this short discussion, but it seems clear enough that a solely technological "fix" without a social/political thrust, would be inadequate.

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