Net Risk: Environmental Information Design, Access, and Literacy

Kim Fortun
Department of Science and Technology Studies
Rensselaer Polytechnic Institute
110 8th Street
Troy, NY 12180 USA
518-276-2199
fortuk@rpi.edu

ABSTRACT

This paper describes work-in-progress to understand how information technology is both an environmental problem and an environmental resource. My research questions include the following: 1) How have environmental problems prompted the design of new information collection, processing and distribution systems? 2) What are the cultural and political effects of the massive amount of environmental information now available? 3) What is constraining access to environmental information? 4) What kinds of literacy are required for effective engagement with environmental information? 5) Can environmental ethics be updated to encourage critical engagement with information technology?

Keywords

environmental information, information design, information access, electronic literacy

PROJECT OVERVIEW

Information technology promises to open new avenues for science, commerce, education and even democracy itself. Simultaneously, the future is threatened by increasing environmental degradation, now associated with the electronics industry as well as with more traditional polluters. [1] And the promise of information technology is difficult to de-link from the promise of global economic growth, which can't be delinked from global environmental problems. [2] IT is an environmental problem, at both micro and macro levels.

Meanwhile, information technology is providing crucial resources for understanding and resolving environmental problems. Simulations are particularly important – to aid decision making on particular problems, as well as in prompting broad cultural change – such as that emergent from the work of the Club of Rome, which simulated global

In *PDC 2000 Proceedings of the Participatory Design Conference.* T. Cherkasky, J. Greenbaum, P. Mambrey, J. K. Pors (Eds.) New York, NY, USA, 28 November - 1 December 2000. CPSR, P.O. Box 717, Palo Alto, CA 94302 cpsr@cpsr.org ISBN 0–9667818–1–3

[1] Because computer manufacture was thought of as a "clean" industry, little attention was given to environmental impacts until the early 1980s. Now there are twenty-nine Superfund sites in Silicon Valley alone, due to contamination of groundwater caused by leakage of underground tanks storing toxic solvents, used by circuit board and semiconducter companies. Use of ozone-depleting chloroflurocarbons (CFCs) and perfluorocarbons (PFCs) for circuit board cleaning is also of concern. Semiconductor manufacturers continue to use 90% of the perflouroethane sold in the United States, despite invention of more benign applications by some companies. The EPA's Toxic Release Inventory (TRI) does, however, show improvement; in 1988 manufacturers of computer equipment, circuit boards and semiconductors reported total toxic releases of 18.3 million pounds; by 1992 there was a 29% reduction, to 13 million pounds. These improvements have multiple sources, including the design of new emissions recovery systems and widespread industry participation in the EPA's Energy Star program. Some argue that reductions in emissions recorded in the TRI are not reliable indicators of change given that data is self-reported, and rarely audited by the EPA, and given the possibility of "paper reductions," achieved by changes in the way releases are tracked and estimated. Significant groundwater pollution has also been identified in Japan. Toshiba has reported high levels of trichlorethylene in groundwater beneath its domestic plants, for example. Publicity of such findings have spurred Japanese electronics manufacturers to adopt the international ISO 14000 standard of environmental good housekeeping much faster than in other countries. Receiving an ISO seal of approval often entails fundamental changes in the way plants are managed, and installation of reporting systems (The Economist 1998). The Campaign for Responsible Technology (CRT) is an international network of environmental and labor activists working to promote sustainable practices in the electronics industry. CRT was initiated by the Silicon Valley Toxics Coalition.

[2] The small size and high value of computers has given the electronics industry particular flexibility in locating production and assembly operations far from design and management teams, since shipping costs are minimal. Flexibility also gives the electronics industry particular power in negotiations with national governments, with workers and with residents of plant communities. Concessions on environmental standards has been one way governments and other stakeholders have sought to attract or retain electronics production facilities.

futures with early systems modeling techniques. By interrelating the pathways of particular variables – resources, population, industrial output, food supply and pollution – the Club of Rome was able to provide daunting images of what happens when exponential growth runs up against the limits of a finite system. The book documenting their work sold 4 million copies in the first four years after it was published, in 1972. Despite the book's many shortcomings, an imagination for "the limits to growth" was given extraordinary momentum.[3]

Innovative mapping – particularly using Geographical Information Systems – has been another emergent effect of the interoperability of IT and the environment. Techniques for overlaying different kinds of knowledge – about watersheds, or toxic emissions to the atmosphere – have great potential. The maps produced by the Silicon Valley Toxics Coalition to show cumulative risk – by overlaying demographic data with cancer risk data -- are particularly good. Cumulative risk is a notoriously difficult phenomena to imagine, much less litigate. The Silicon Valley Toxics Coalition has found ways to draw it out, making cumulative risk much more accessible to public debate.

Collection and distribution of environmental data has also been given extraordinary momentum by information technology. The U.S. Emergency Planning and Right-to-Know Act of 1986 mandated the creation of the Toxic Release Inventory (TRI), a pollution database that was the first federal database that Congress said must be released to the public in a computer-readable format. The effects of distributing TRI data have been enormous – sparking environmental initiatives within corporations, in the communities where hazardous production facilities are located, and by national and international environment groups.[4]

The first round of US TRI data was submitted in July 1988. The President of Monsanto was so taken aback by the figures disclosed that he pledged to reduce emissions by ninety percent over the next five years. The next year, the Chemical Manufacturers Association initiated their Responsible Care program. "Responsible Care" is a "public commitment" to run safe plants voluntarily – beyond compliance with the law. The National Wildlife Federation responded to Responsible Care by denouncing purported progress on emissions reduction as "phantom reductions" attributable to new accounting measures and creative information manipulation. Environmentalism became a struggle over how things would be categorized, counted and represented – graphically, as well as politically.

At the outset, engagement with TRI data was an onerous task – inducing extraordinary information overload due to the sheer quantity of the data suddenly available. As a result, use of TRI data was limited to well-funded environmental groups and to a few particularly persistent community activists. As the Internet has developed, however, so has the usability of the TRI. Today, the TRI has wide distribution across space and social strata – delimited, of course, by the fact that many people most subject to environmental risk do not have access to the Internet at all.

A website found at scorecard.com is illustrative. The site, developed and maintained by the Environmental Defense Fund, allows viewers to type in their zip code and pull up the toxic emission flows that surround them. The relational database relied on to support this web page is enormous and complexly linked to the interactive possibilities afforded by the Internet. Emission data is put in context and "packaged" for usability; communication with the EPA, with a local environmental group or with the polluting company itself is only a click away. The "packaging" of environmental data on Scorecard is particularly interesting. Viewers are not only told how many pounds of toxics were released in a given year by a given facility. They also are told about probable risk – body system by body system – based on a hazard ranking system that relates all chemicals to the risk of benzene, a know carcinogen – to indicate "cancer potential;" or to tolu-

3 Kevin Kelly explicates one problem with the Club of Rome Model: "The Limits to Growth model treats the world as a uniformly polluted, uniformly populated, and uniformly endowed with resources. This homogenization simplifies and uncomplicates the world enough to model it sanely. But in the end it undermines the purpose of the model because the locality and regionalism of the plant are some of its most striking and important features. Furthermore, the hierarchy of dynamics that arise out of differing local dynamics provides some of the key phenomena of Earth. The Limits to Growth modelers recognized the power of subloops – which is, in fact, the chief virtue of the Forrester's system dynamics underpinning the software. But the model entirely ignores the paramount subloop of the world: geography. A planetary model without geography is... not a world. Not only must learning be distributed throughout a simulation; all functions must be. It is the failure to mirror the distributed nature – the swarm nature – of life on Earth that is this model's greatest failure" (Kelly 1994: 445).

4 Agenda 21, the guidelines for sustainable development agreed to at the 1992 United Nations Conference on Environment and Development, recognized the importance of community right-to-know and recommended that all nations establish pollution monitoring systems modeled on the U.S. TRI. Programs similar to the U.S. TRI have been initiated in Indonesia, the Philippines, Mexico and Columbia. "Information strategies" for pollution control have become a major focus at the World Bank, UNEP and OECD (Tietenberg & Wheeler 1998; Afsah, Laplante & Wheeler 1996). In July 2000, government signatories to the Aarhus Convention (the UN/ECE Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters) met in Dubrovnik, Croatia to expand the scope of the Convention to address Chemical Right-to-Know. Attendees made the decision to develop a legally binding instrument that would guide the creation of national Pollutant Release and Transfer Registers in the UN/EEC region, as recommended by Chapter 19 of Agenda 21. Attendees also agreed to form a UN Task Force to address electronic access to environmental information and the digital divide facing nations of the UN Economic Commission for Europe region.

ene, a developmental toxin – to indicate "non-cancer risk."

The Environmental Defense Fund itself took a risk doing this – developing proximate but useful ways of configuring data widely acknowledged to be resistant to certain interpretation. EDF doesn't claim that their representations of risk are beyond question, despite having submitted their ranking systems to the peer review of the journal *Environmental Science and Technology.* Scorecard visitors are encouraged to learn "What we Don't Know About Chemical Safety and Harm" within the Scorecard site itself. EDF has staged information has something between "the truth of the matter," and something that doesn't matter – because tied to the real in uncertain terms. Thus, EDF has used information technology to collate and distribute data but also as an opportunity for strategic re-definition of "information" itself.

The story of EDF and its Scorecard project has an interesting twist. In spring 2000, a website co-sponsored by EDF and the Chemical Manufacturers Association – CMA -- went on-line. The argument supporting this collaboration is straightforward. According to Fred Webber, President of CMA, CMA and EDF have a common goal: protecting public health. Critics point out that public health is not the only or primary goal of the chemical industry. They also have voiced concern that this collaboration is part of a trend to privatize the collection and interpretation of environmental data, lessening the role of regulatory authorities like the EPA. At issue are the kinds of collaborations that are necessary and appropriate in an age of informated environmentalism. EDF and CMA insist that criticism of what has been called "crony environmentalism" is obsolete. Their insistence on the importance of new kinds of collaborations is difficult to dispute. To keep pace with the complexity of today's environmental problems, the social as well as conceptual structure of environmentalism will have to be retrofitted. This does not mean, however, that any collaboration is a good collaboration (Fortun & Cherkasky 1998).

Much can be learned about the potential problems of industry-environmentalist collaborations from the history of environmental risk right-to-know legislation in the United States. The first right-to-know legislation, passed in response to the 1984 Bhopal disaster, was passed in 1986, as Title III of the Superfund Amendments and Reauthorization Act (SARA). Passage of Title III has had a significant even if contradictory effect. Corporate engagement with environmental issues has been recognizably different from earlier periods. Instead of a straightforwardly antagonistic approach to environmental issues. corporations have become proactive about the environment, cooperative and expressly interested in why the public has to say. One example is the Responsible Care program initiated by the Chemical Manufacturers Association in 1989. Controlling citizen skepticism has been a formidable challenge from the outset. In response, the chemical industry has refined more inclusive risk decision-making. Citizens advisory boards have been established, to compliment a range of public outreach initiatives. Diverse "stakeholders" have been enrolled in discussion. But the chemical industry has remained in control of how these discussions proceed. Many people argue that if the chemical industry has made great strides in risk reduction in the last fifteen years, it is because they have learned to control risk information. Information itself has become the focal hazard, and the pivot around which risk reduction endeavors have revolved.

Right-to-know legislation overall has been an insufficient solution to environmental problems. Information is NOT power. But the politics of environmental information has recently taken a quite dramatic turn. The 1990 Clean Air Act extended citizen right-to-know about environmental risk, mandating that companies produce and distribute "worst-case scenarios" for 66,000 facilities around the United States. A worst-case scenario would be the equivalent of a Bhopal disaster, involving the total release of the contents of a storage tank of toxic chemicals into the atmosphere. The worst-case scenarios are supposed to provide information on the radius in which people would be affected, the potential mortality rate, evacuation plans, and risk management procedures. Some companies have already volunteered "more likely scenarios," that could happen even without multiple systems failures – as happened in Bhopal.

In June 1999, high risk facilities were supposed to have their worse-case scenarios ready for distribution. In August 1999, Clinton signed the Chemical Safety Information, Site Security and Fuels Regulatory Act – which blocks posting on the Internet any information about a facility's "offsite-consequence analysis" -- worst-case scenarios. The chemical industry argues that this legislation was needed to prevent dangerous information from falling into the hands of terrorists. Industry provided the calculations: posting the data on the Internet will increase the threat of an attack on US chemical plants by a "factor of seven." The calculation was done by applying numerical values to pieces of information of potential use to someone planning an attack.

Information is the hazard here. The risk is outside the company's fence-line, beyond their control and responsibility. Risk reduction is possible through what is called a "controlled multi-media approach." The most specific proposal to realize such an approach is to establish reading rooms at the plants, where people can access the information, after providing appropriate identification. Critics have argued that this proposal would tragically localize a problem with global dimensions. What is taken "off-line" is the possibility of environmental networking that could produce an effective response to catastrophic environmental risk.

Spatially distributed collective response to environmental risk is now being squashed just as it is becoming possible. In response, environmentalists must articulate how and why information *is* power, or at least a right – while also developing a repertoire of critical techniques for producing and evaluating information, and for iterating information into material change. Innovative design of environmental information systems is crucial, as is political work to ensure access to environmental information. Most challenging, perhaps, will be the development of electronic literacy skills for engaging environmental information. Simulations, GIS maps and massive data repositories easily overwhelm criticism. Their claim to comprehensiveness can be as much of a problem as an advantage. People in all sectors of society need to learn to read their assumptions and limits, as well as their explanations.

Environmental ethics needs to be updated to address these challenges. Technology – particularly information technology – needs to be engaged as both a problem and as a resource. The environmental problems created by information technology operate on many scales – on the environment itself, and on the ways knowledge about the environment is created and used for decision-making. The ways that information technology is a resource for environmentalism are also complex. Information technology makes it possible to grasp phenomena distributed over space and time, and to imagine future scenarios. [5]

Information technology facilitates collaborative work to solve environmental problems, in ways that take advantage of many kinds of expertise. Information technology has made it possible to reduce the energy, materials and wastes associated with many industrial products. And information technology has made it possible to address tensions between the environment and poverty reduction-- by linking poor communities to each other, to information that could have positive effects on everything from population growth to natural resource degradation, and to microcredit programs that sidestep the inefficiencies and biases built into many older programs (Hammond 1999). [6]

[5] The Casino 21 project in the United Kingdom is an interesting example of how information technology is facilitating new linkages between scientists and citizens, to understand phenomenon distributed across space and time. In this project, scientists are enrolling citizens in concern about climate change through a distributed computing project that uses personal computers to process the enormous amounts of data required for climate research. Casino 21 is modeled on the highly successful distributed computing project carried out by researchers involved in the Search for Extraterrestrial Intelligence at Berkeley.

[6] A different line of argument would highlight how concern about the environment has driven cutting edge development of information technology. A particularly grandiose example is the ultra-high-speed parallel computing system known as the Earth Simulator, which will enable modeling and simulation of geophysical, climate and weather related phenomena. The Earth Simulator project was initiated in 1997 by the Science and Technology Agency of Japan. NEC received a contract to manufacture the Earth Simulator Ultra Computer in May 2000, and it is expected to be operational in March 2002, in Yokohama, Kanagawa, Japan. A NEC press release states that "it is expected to be the most powerful computer in the world at that time" (NEC 2000).

The complex relationship between the environment and information technology demands an equally complex ethical agenda. The "anti-technology" credo traditionally associated with environmental ethics won't suffice (Scoones 1999). Environmentalists around the world are now recognizing the problems with such a credo – because of the need for high-tech tools for understanding and solving environmental problems; because low-cost, high-tech communication is an important way to redress the geographic and political marginalization of social groups most affected by environmental problems; because an "anti-technology" approach can alienate people concerned about economic development in both developed and developing countries. The challenge is to build on the insights of these environmentalists, turning environmental ethics from concern about the purely natural to something even more complex. Ecological, social and information systems must be pictured in dynamic relation– in ways that reveal how different systems cross-cut and reciprocally qualify each other.

REFERENCES

1998. "Toxic Waste in Japan: The Burning Issue," *The Economist.* July 25.

Afsah, S., B. Laplante and D. Wheeler. 1996. "Controlling Industrial Pollution: A New Paradigm." World Bank, Policy Research Department. Working Paper No. 1672. May.

Fortun, K. and T. Cherkasky. 1998. "Toward a Politics of Collaboration," *Science as Culture* Vol. 7, No. 2.

Hammond, A. 1999. "A Vision: A World that is Genuinely Better, not just Wealthier,"*IMP*. October.

Kelly, K. 1994. *Out of Control: The New Biology of Machines, Social Systems and the Economic World.* Reading, MA: Addison-Wesley Publishing Company.

Scoones, I. 1999. "New Ecology and the Social Sciences: What Prospects for a Fruitful Engagement?" *Annual Review of Anthropology.* 28:479-507.

Tietenberg, T. and D. Wheeler. 1998. "Empowering the Community: Information Strategies for Pollution Control," paper presented at the Frontiers for Environmental Economics Conference, Airlie House, Virginia. October 23-25.

AUTHOR BIOSKETCH

Kim Fortun received her Ph.D. (Cultural Anthropology) from Rice University in 1993. At Rensselaer, she teaches courses on the environment, on information technology, on globalization and on social science research methods. Fortun's research focuses on the transfer of technology across national, cultural and disciplinary borders. Her first book, *Advocacy After Bhopal,* focuses on the transfer of Green Revolution technology into poor communities in India and the United States. The book is based on three years of research in India, supplemented by fieldwork in the US environmental justice movement. The book examines how national legal frameworks deal with multinational corporate activity, and other ways globalization implicates governance. The book also examines the development of "right-to-know" legislation in the United States, as a way to deal with both routine and catastrophic environmental risk. This legislation created the Toxic Release Inventory (TRI), a pollution data base that was the first federal data base that the U.S. Congress said must be released to the public in a computer-readable format. The effects of information technology on the environment itself, and on the way the environment is understood and managed is the focus of Fortun's current research. Through interviews, Fortun is researching the transfer of information technology into the scientific study of the environment, into government agencies responsible for protecting the environment, and into non-governmental agencies and communities working for sustainable economic development. Her goal is to help build an ethical agenda for the environment that leverages information technology, while acknowledging the environmental problems created by information technology.