

mind•full: a brainsnack for future leaders with ethical appetites

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communications technologies

Advanced communications technologies have exploded into the world. From cellular phones to the Internet and the World Wide Web, these technologies have changed the way we work and live. As the twenty-first century approaches, it appears the communications revolution will continue to shape our world dramatically. We are now capable of communicating instantaneously and cheaply with people worldwide. Each day more people are demanding access to these technologies. Meanwhile, technical experts are creating new possibilities at a dizzying rate.

Information can pass through phone, cable, satellite, and other wireless carriers. With the increased demand for communications technologies, there is an important debate over how to route data from one point to another and who will provide the necessary infrastructure. This dialogue continues in both the public and private spheres. The outcome of these discussions ultimately will determine who will have access to information, the diversity of that information, and how much that access will cost.

Not everyone benefits from these and other advances. Those with the technology have access to a wealth of information, whereas those without run the risk of being shut out from the information age. Many businesses, groups, and nonprofit organizations are working to address these discrepancies by creating networks in public libraries and other community centers and by developing new technologies that will make access cheaper and more readily available.

Some critics also worry that these new technologies are fragmenting society or are too intrusive. Others believe they are bringing people together and creating new and vibrant on-line communities. There is little argument, however, that communications technologies will continue to play an increasingly important role in society.

The mission of Student Pugwash USA is to promote the socially responsible application of science and technology in the 21st century. As a student organization, Student Pugwash USA encourages young people to examine the ethical, social, and global implications of science and technology, and to make these concerns a guiding focus of their academic and professional endeavors.

The **mind•full** series encourages readers to explore crucial ethical dilemmas associated with the application of science and technology.

STUDENT



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U S A

go figure!

Although the use of communications technologies is expanding rapidly, only one of every three people on the planet has placed a phone call, according to Harper's Index. In the United States, people are relying more on electronic media to receive their news and entertainment. The US federal government has worked to promote and fund the National Information Infrastructure (NII), an effort to integrate the hardware, software, and skills necessary for a large-scale network. These efforts, in addition to immense amounts of private investment, have made the United States one of the most highly connected countries in the world. Still, only a small percentage of the population use these new technologies regularly. Today, these users tend to be younger and wealthier, although these demographics may change as more schools and businesses go on-line.

US media usage, hours per person

	Television	Newspapers*	Internet**
1990	1,470	175	1
1991	1,495	169	1
1992	1,510	172	2
1993	1,535	170	2
1994	1,560	169	3
1995	1,575	165	7
1996 (proj)	1,595	163	11
1997 (proj)	1,610	161	16
1998 (proj)	1,625	160	21

*Daily newspapers only. **Consumer on-line services only.

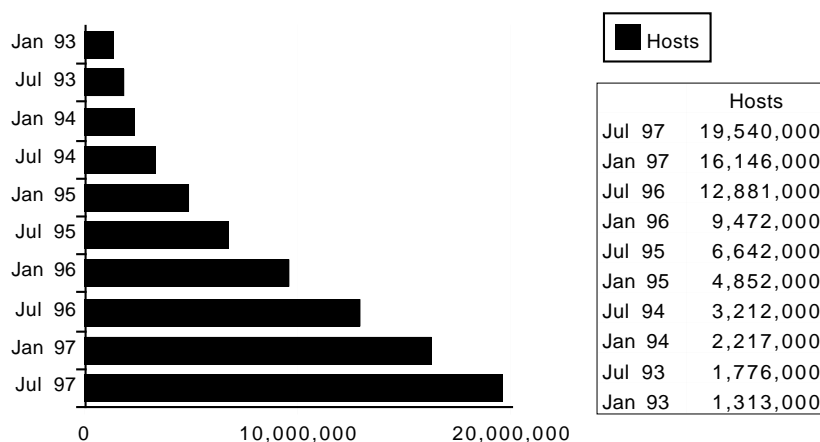
Source: "Media Usage and Consumer Spending: 1990 to 2000," *Statistical Abstract of the United States 1997*. Washington DC: US Department of Commerce, 1997, p. 565.

US internet access, by percent, spring 1997

Total population	15.1
Male	18.3
Female	12.1
By age	
18 to 24 years old	21.5
25 to 34 years old	19.7
35 to 44 years old	19.2
45 to 54 years old	16.6
55 to 64 years old	7.7
65 years old and over	1.7
By household income	
Less than \$10,000	5.1
\$10,000 to \$19,999	4.6
\$20,000 to \$29,999	6
\$30,000 to \$39,999	15.8
\$40,000 to \$49,999	15.3
\$50,000 or more	26.9

are you wired . . .

internet hosts worldwide



Source: *Internet Domain Survey, July 1997*, Network Wizards. Available on the Web at www.nw.com/.

Source: Percent of people 18 years old and older who accessed the Internet in the 30 days prior to the survey, spring 1997. "Multimedia Audiences—Summary: 1997," *Statistical Abstract of the United States 1997*. Washington DC: US Department of Commerce, 1997, p. 566.

. . . for the 90s?

in control or out of it ?

All over the world leaders are taking actions to cope with the recent boom in communications technologies. These decisions will affect greatly who controls the speed with which we send and receive information and the diversity and quality of that information.

In the United States, the Telecommunications Act of 1996 became law and calls for extensive deregulation of the telecommunications industry, relaxed restrictions on concentration of media ownership, and a preference for private market forces over public oversight to ensure access to telecommunications services. Supporters of the Act believe that it will encourage competition, leading to lower prices and more consumer choice. Critics claim that the Act encourages already large corporations to pursue further mergers. They also assert that it allows businesses to form alliances with their rivals in other sectors, greatly reducing the possibilities that they ever will compete against each other. They believe it will create private, unregulated monopolies that will lead to higher prices and fewer choices for the consumer.

The rapid growth in communications technologies also has sparked a debate on what information should be allowed and what should be restricted. Some feel that harmful information is too readily available, especially to minors. Many states and some countries have passed laws or are planning to pass laws that make it illegal for their citizens to access or make available "indecent" material. Some feel that laws which restrict content are unjust and a violation of personal freedom. Mike Godwin, of the Electronic Frontier Foundation, argues that the Internet "looks like the fullest flower of First Amendment values the country has ever seen." Many argue that technologies, such as the "V-chip" for television and software like Net Nanny for the Internet, allow parents to filter what their children read and see.

Because of the global nature of the Internet, the policies and regulations of one country affect the privacy, security, and freedom of users around the world. Some governments, such as Malaysia, have adopted advanced Internet technologies for their national information infrastructures, while at the same time attempting to control the content of what is communicated. Author Neal Stephenson says this approach is like growing "some unstoppable exotic weed . . . inside a hothouse (because they want it to flourish) but in a pot (because they don't want it to escape into the wild)." The sentiment of many is that communications technologies are advancing too rapidly to regulate and that governments will have less control over how the industry developments.

nerds' words

bandwidth—a measure of the capacity of a communications channel to transmit information; for example, million of bits per second or Mb/s.

internet—the global collection of interconnected, multiprotocol computer networks including Federal, private, and international networks.

network—computer communications technologies that link multiple computers to share information and resources across geographically dispersed locations.

web—a reference to the World Wide Web, which is a subset of the Internet supported by a related set of protocols, services, and software tools including browsers.

wireless technologies—communications technologies that use radio, microwave, or satellite communications channels versus wire, coaxial or optical fiber.

Definitions taken from *High Performance Computing and Communications: Advancing the Frontiers of Information Technology*, a Report by the Committee on Computing, Information, and Communications. Washington, DC: National Science and Technology Council, 1997. Available on-line at www.hpcc.gov.

links in the chain

Ever since Samuel Morse declared "What has God wrought!" in the first message he sent on the wires stretching between Washington and Baltimore, people have been trying to find faster, more efficient ways to communicate with each other across great distances. Telegraphy, the practice of constructing or operating telegraphs, was one of the great technical challenges of the 19th century. Today, creating the infrastructure, or the "pipes," to handle the immense amounts of data being transmitted remains a huge technical challenge. What gets built and who owns it plays an important part in how the information age will evolve. Here are only a few ways the world is being connected.

digits count

Most information sent over the Internet is fundamentally digital in form, even though the phone lines that carry that information use analog technology. Analog circuitry, however, is very slow and cumbersome for the digital communications that take place over the Internet. ISDN will fix that problem. ISDN is an end-to-end digital network that sends data at speeds of 144,000 bytes per second to 1,544,000 bytes per second. It is fully capable of handling both analog and digital voice. ISDN is being installed in businesses, schools, and homes but remains a relatively expensive option.

salute the flag

The FLAG project (the Fiber-optic Link Around the Globe) is taking connectivity to new lengths. FLAG links extend from the United Kingdom to Japan, connect three continents and twelve countries, and represent the longest undersea fiber-optic cable ever constructed. FLAG extends more than 27,000 kilometers and provides 120,000 64 kilobit per second digital circuits along its route. Although FLAG was originally conceived before the boom in Internet usage, it plays an important role in increasing global bandwidth and making intercontinental communication faster and more reliable.

bouncing off satellites

Many parts of the world do not have sufficiently advanced infrastructures to support today's new communications technologies. One method for providing universal access is through a satellite system that would allow people in even the most remote places to communicate. Two ventures, Iridium and Teledesic, will provide telephone and Internet connections to people anywhere on the globe.

Iridium is a satellite-based, wireless, personal communications network designed to permit any type of telephone transmission—voice, data, fax, or paging—to reach its destination anywhere on earth. Developers of Iridium hope the system will simplify communications for users who work, travel, and live in areas where it is difficult to get a reliable phone connection.

Teledesic is a privately funded effort to provide Internet access through a low-Earth-orbit satellite network by the year 2002. The goal of the project is to create a global network that would provide affordable, worldwide, "fiber-like" access to telecommunications services such as broadband Internet access, high-quality voice, and other digital data needs to individuals anywhere on the planet.

stop pushing!?!

The new buzz phrase among those in the know is "push media." Push media will send content to you instead of you "pulling" information on your own, as is commonly done today on the World Wide Web. Depending on your interests, the content "pushed" to you could include such things as news, academic articles, weather reports, and, of course, advertisements. Push media will become more prevalent as the Internet expands beyond the personal computer to television, personal-digital-assistants, and home appliances. Push media will know what content to send based on keywords you type, Web sites or television stations you visit, or even what street you are walking or driving on. Many of these technologies can be programmed by you, but as they develop you might have less control over what content is being "pushed" your way. The development of push media may lead to an information glut and privacy concerns as people continually are bombarded by news reports, sports scores, sales announcements, restaurant suggestions, and endless advertisements.

(anything but a) conclusion

Accurately predicting how new communications technologies will evolve during the coming years is an almost impossible task. There are endless possibilities and countless applications for their use. There is no question, however, that they will play a dominant role in our society. They will change the way we work, play, and live. Questions concerning access, cost, ownership, and the diversity of content available will continue to be at the center of debate. How these technologies develop and how we use them, however, will depend on whether we approach them passively or if we actively address issues concerning use, ownership, development, content, and regulation.

How do **you** answer the **tough questions**



Some critics say that new communication technologies are breaking apart important traditional communities, while proponents argue that they are creating new, vibrant, "virtual" communities. In what ways do communications technologies create communities and in what ways do they weaken them? How have communications technologies changed your culture?

Today anyone with a computer and a domain name can put up a Web site. Do you think it is important to verify the validity of this information? Why? If yes, who do you think should oversee this fact-checking? Are you more likely to question the validity of information found on the Web than heard on the radio or read in a magazine? Why?



Should we make advanced communications systems available to all? If yes, whose responsibility is it to make those technologies available—government, business, schools, or citizen groups? In what ways do you think these technologies can bridge the distances between developed and developing countries? In what ways do you think they will cause even greater disparities?

What is the public's role in developing communications technologies? Should we solely rely on the classic economic model of supply and demand to gauge the likes and dislikes of the public or should there be an alternative, less market-based, form of participation? What would that participation look like? How would that participation be organized?



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• There has been a lot of debate concerning
 • the posting of "indecent" material on the
 • Internet, especially when minors can view it.
 • Should there be restrictions on what
 • material people can put on the Web? Why or
 • why not? Who decides what is decent and
 • what is indecent? What type of security
 • measures can be taken to prevent minors
 • from accessing adult Web sites? Should the
 • federal or state government mandate such
 • security measures?

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Many have heralded new communication technologies as revolutionary tools for education. How can educators use communications technologies effectively? What potential dangers exist if technology becomes the principle educator? Do you think people will be more inclined to use technology for entertainment or educational purposes?

How have communications technologies affected the quality of life? How have they fallen short of their potential benefits to humanity? What factors, if any, have caused this shortfall?



In what ways do new communications technologies help the environment? How can they be harmful? What responsibility do businesses have to make sure their products have a low environmental impact?

Some have argued that the "CNN effect," or the rapid transfer of information, has caused political leaders and decision makers to create policy too hastily. Is this rapid pace of diplomacy helpful or harmful? Are there ways to avoid the impacts of instant access to information and quick decision making?



How can we use communications technologies to protect human rights both domestically and internationally? In what ways can these technologies violate a person's human rights?

off the monitor (a.k.a. books)

- "Access and the Internet," *mind•full: a brainsnack for future leaders with ethical appetites*, Vol. I, No. 3, April 1996, Russell M. Villa-Singleton—Student Pugwash USA's third *mind•full* ever! Available at www.spusa.org/pugwash/.
- *Communication by Design: The Politics of Information and Communication Technologies*, Robin Mansell and Roger Siverston (editors)—a look at the politics, governance, and standards by which communication policies are designed. Oxford: Oxford University Press, 1996.
- *Computers in the Human Context: Information Technology, Productivity and People*, Tom Forester (editor)—insists that we stop for a moment and really look at what we are doing in regards to communications technologies. Cambridge, MA: MIT Press, 1989.
- *Computing, Information, and Communications: Technologies for the 21st Century*, National Science and Technology Council—a government report that maps out the future of computing, communications, and information technologies in the US. Washington, DC: Office of Science and Technology Policy, 1997.
- *Digerati: Encounters with the Cyber Elite*, John Brockman—brings together 33 of today's cutting-edge thinkers in a kind of roundtable discussion about the social, political, economic, cultural, and psychological changes brought about by the Net. San Francisco: Hardwired, 1996.
- *Escape Velocity: Cyberculture at the End of the Century*, Mark Dery—explores the dark side of the information age with predictions about what cyberculture might evolve into in the new millennia. New York: Grove Press, 1996.
- *Information and Communication Technologies: Visions and Realities*, William H. Dutton and Malcolm Peltu (editors)—illuminates the social and economic implications of advances in information and communication technologies. Oxford: Oxford University Press, 1996.
- *The Road Ahead*, Bill Gates—Mr. Gates's ponderings on how future technologies will change our lives. Comes with a pretty fancy CD-ROM. New York: Viking, 1995.
- *Silicon Snake Oil: Second Thoughts on the Information Highway*, Cliff Stoll—explains why, in the author's opinion, the Internet is more hype than hip. New York: Anchor Books, 1995.
- *Snow Crash*, Neil Stephenson—(novel) an edge-of-your-seat science fiction romp that thrusts you through a future world of dueling avatars, mind-altering computer viruses, Sumerian lore, and high-speed pizza delivery. New York: Bantam Books, 1992.
- *What Will Be: How the New World of Information Will Change Our Lives*, Michael Dertouzos—the director of the MIT Laboratory for Computer Science ponders on how future technologies will change our lives. No fancy CD-Rom included, but worth reading. New York: HarperCollins, 1997.
- *Wired Magazine*—every issue examines the future trends of communications technologies and the culture that surrounds them.

check it out !

on the big monitor (a.k.a. movies)

- *Hackers*—Typical "hacksploitation" with a good plot and good characters.
- *Johnny Mnemonic*—goofy film starring Keanu Reeves as a futuristic courier with a "wet-wired brain."
- *The Net*—Sandra Bullock is a brainy software engineer caught in a Hitchcock-esque web of international intrigue.
- *WarGames*—a Cold War classic. Matthew Broderick connects into a top secret-supercomputer and innocently starts the countdown to World War III.

cyberspace

top picks

- HotWired (*Wired* magazine provides a great source of technical information, articles on technology and culture, and "dream" job listings)—www.hotwired.com
- No Back Roads: A Web Documentary (a look at how the Internet and the World Wide Web are influencing rural America)—www.nobackroads.com

what's your net worth?

best of the rest

- The Benton Foundation (works to realize the social benefits made possible by the public interest use of communications)—www.benton.org
- Center for Democracy and Technology (works to develop and advocate public policies that advance constitutional civil liberties and democratic values in new computer and communications technologies)—www.cdt.org
- Computer Professionals for Social Responsibility (the ultimate source for the cs major with a conscience)—www.cpsr.org
- Data Communications on the Web (the magazine on the Web with lots of great articles, a job board, and good technical data)—www.data.com
- Graphic, Visualization, and Usability Center's Eighth WWW User Survey (loads of information about who's on-line)—www.gvu.gatech.edu/gvu/user_surveys/survey-1997-10/
- Electronic Frontier Foundation (a nonprofit civil liberties organization working to protect privacy, free expression, and access to public resources and information on-line)—www.eff.org
- National Coordination Office for Computing, Information, and Communications (the government clearinghouse with lots of good resources available)—www.hpcc.gov
- National Information Infrastructure (NII) Virtual Library—nii.nist.gov
- Next Generation Internet (NGI) Initiative (the US government takes a look at the future of the Internet)—www.ngi.gov
- Teledesic (learn more about Teledesic at their official Web site)—www.teledesic.com

This **mind•full** was written by David Andersen, Student Pugwash USA's national chapter coordinator. Special thanks to Eric Roberts, the Charles Simonyi Professor for Innovation in Teaching at Stanford University and a member of Student Pugwash USA's Board of Directors, for his comments. Any errors are the responsibility of Student Pugwash USA.

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but wait, there's more!

- **mind•full: a brainsnack for future leaders with ethical appetites.** Volume one available, includes: international weapons trade; emerging infectious diseases; access and the Internet; public's role in science; future of nuclear weapons; water quality and availability; war and disease; renewable energy. Volume two issues available: pugwash conferences; exploring human genetics; and science, technology, & culture. Coming this spring: beyond nuclear weapons; and rethinking nuclear energy.
- **Jobs You Can Live With: Working at the Crossroads of Science, Technology, and Society.** The fifth edition of the Student Pugwash USA internship directory. It highlights approximately 200 organizations that work to promote the ethical use of science and technology and provides suggestions on how to go about the internship and job search.
- **Science, Technology, and Ethical Priorities: Proceedings of Student Pugwash USA's Ninth International Conference.**
- **Pugwatch.** The chapter newsletter.
- **Chapter Organizing Guide.** Newly updated, provides chapter members with an A to Z guide to getting a campus-based chapter up and running.

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