Netizens: An Anthology
Part IV - Contributions Towards Developing a Theoretical Framework

Chapter 16
The Expanding Commonwealth of Learning: Printing and the Net

by Michael Hauben

A revolution in human communications is happening. People around the world are connecting to each other via the new computer telecommunication networks now known as the Net. The Net, in a significant way, is a continuation of the important technological development of the printing press. The printing press might seem to be an unlikely choice for such a comparison considering the similarity that might be seen between the Net and, for example, television, the telephone, radio, or the news media. That is why it is important to compare the current networking developments with the history of printing to understand why the printing press should be seen as the forefather of the currently developing computer networks.

With the invention of the printing press in the second half of the fifteenth century, there arose print shops and printing trades. Printing and the distribution of printed works grew rapidly. In the last quarter of the twentieth century, a global computer network has emerged which gives users the ability to post and distribute their views and news broadly and inexpensively. Comparing the emergence of the printing press to the emergence of the global computer network will reveal some of the fascinating parallels which demonstrate how the Net is continuing the important social revolution that the printing press had begun.

The printing press developed out of a scribal culture surrounding the hand-copying of texts. This scribal culture could only go so far in furthering the distribution of information and ideas. Texts existed, but were largely unavailable for use by the common people. There were very few copies of books as each copy of a book had to be laboriously hand-copied from a previous copy. Relying on scribal culture for access to and distribution of knowledge caused many problems. Texts were often inaccurate as scribes made mistakes while copying them. Since a single scribe usually had access to only one copy of the text he was copying, he had no way to know if he was duplicating mistakes other scribes had made before him. The effect of copying mistakes, or non-exact copies, led to numerous "versions" of the same text. Also, scholars who wanted to use various texts had to travel in order to have a good variety of material to study. The majority of people could not afford, nor did they have the time to pursue scholarly pursuits. In her book,The Printing Revolution in Early Modern Europe: Elizabeth Eisenstein writes: “[one] needs to recall the conditions before texts could be set to type. No manuscript, however useful as a reference guide, could be preserved for long without undergoing corruption by copyists, and even this sort of ‘preservation’ rested precariously on the shifting demands of local elites and a fluctuating incidence of trained scribal labor…wear and tear...moisture, vermin, theft or threat.”[1] Under such conditions, scribal efforts did not preserve many

valuable texts. Plenty did not survive.

Just as the printing press essentially replaced the hand-copying of books in the Renaissance, people using computer networks are essentially creating a new method of production and distribution of creative and intellectual written works today.

Around the same time that computer communications networks started to emerge from computer communications research communities in the early 1970s, the personal computer (PC) was developed by students, hobbyists, and proponents of the free-speech movement on the West Coast of the United States. The personal computer became widely available at prices many people could afford. The PC made the power of the multipurpose computer available to a wider cross section of people who otherwise would not have had access to time on a larger minicomputer or mainframe computer which were then owned by universities, businesses and the government. The personal computer movement made computers available to the mass of people in the United States. As computers are multipurpose, they can be used to accomplish many things. A PC can be made to duplicate the functions of a printing press, with the user having little or no professional printing experience. In the past, a skilled printer combined movable type and engravings (woodcut, or otherwise) to mass produce copies of a page combining varied images (text, graphics, etc). The personal computer brings this power from the master printer to the average individual – both in price and availability. The personal computer (e.g., Apple II family, Commodore, Atari, TRS-80, etc. leading to the IBM PC family, the Apple Macintosh family, Amiga, etc.) linked to an electronic printer (first dot-matrix and daisy-wheel, later laser printers) and even more recently to scanners which convert images into usable data – make the production and reproduction of information a common task available to all. Even if one does not own a PC, one can rent time on one in a store. Copy shops (in themselves part of the continual process that made publishing ubiquitous) have begun to have PCs available to rent time on. These advances make the act of publication immensely easier. The personal computer, printers and scanners, however, do not solve the problem of distribution.

The recent development, standardization and interconnection of computers via computer communications networks help to solve the problem of distribution. Examples of on-line utilities include file transfer (ftp), remote login to other computers (telnet), remote execution of programs, electronic mail (e-mail), access to various information data bases (gopher, WWW), other information searching utilities (archie, veronica, Lycos), real-time chat (irc), and a distributed news service which allows people to share information publicly and become citizen reporters (Netnews). The two utilities most relevant to this revolution in human communication are e-mail and Netnews (or Usenet). E-Mail allows for the private and semi-private distribution of information and communications through messages to a particular person or persons, or to a designated set of people via electronic mailing lists. Netnews allows for the public dissemination of information, opinions and questions in an open forum. When a Netizen makes a contribution to any of the many defined subject areas (newsgroups), anyone from around the world who chooses to read that particular newsgroup will have a chance to read that message. Usenet's potential for inexpensive global distribution represents one major advance of Usenet beyond the printing press.

The printing press developed sometime in the 1460s and spread quickly throughout Europe. The broad distribution of presses ended the age of the scribal culture and ushered in the age of printing. "Unknown anywhere in Europe before the mid-fifteenth century," Eisenstein writes,

"printer's workshops would be found in every important municipal center by 1500."[2]

Eisenstein points out that the printing press dramatically increased the total number of books, while at the same time decreasing the number of hours of labor necessary to create books. She argues that this made the transition from hand-copied manuscripts to machine-produced books one of a revolutionary nature, and not evolutionary as claimed in much of the literature about this transformation.[3] Understanding how the printing press unleashed a communications revolution provides a basis to assess if the establishment of worldwide computer communication networking is the next communication revolution.

New communication technologies facilitate new ways of organizing information and of thinking. The invention of the printing press changed the way texts were handled. From its outset, the men who controlled the presses, the printers, experimented with ways to use the printing press to change texts. Textual techniques such as "graduated types, running heads…footnotes…table of contents…superior figures, cross references…"[4] are examples of the ways in which the press broke through some boundaries which had previously limited the production of books in scribal culture.

Moreover, the new technologies changed the way books were written. The establishment of printing shops in the major European cities formed a common meeting place for scholars and authors from across the continent. The great number of printing presses and printing shops enabled more people to write books and produce works that would be duplicated by the presses. When these new authors traveled they would gather in printing shops to meet other writers and scholars. Thus the printing press facilitated the meeting of minds pursuing intellectual pursuits. The interconnection of people led to the quickening of the development of ideas and knowledge. These progenitors of the printing trade were in the forefront of the sweeping intellectual changes which the presses made possible.[5] Similar connections among people are taking place on the Net today at a much faster rate. And, just as the printers were in the forefront of the printing revolution, so today the developers of computer communications software and hardware and netusers are the first to experience the increased connectivity with other people around the world afforded by the computer networks.

As printing spread, publishers realized the value of utilizing input from readers to improve their product. Since the press could turn out multiple copies of a first edition quickly, many people would see the first edition and could send by letter their comments, corrections and criticisms. Publishers and authors could then use this feedback to write and print second, and third editions, and so on. Mistakes would be caught by careful readers, and printers thus "were also able to improve on themselves." Eisenstein explains that copied mistakes and mistakes in copying common with scribal copies now could be caught by the increasing number of readers. She writes, "the immemorial drift of scribal culture had been not merely arrested but actually reversed."[6]

The Net likewise provides a ready mechanism for the interaction between authors and readers. On the Net, people often keep track of knowledge, such as lists of a musician's records (discographies), or FAQ files of answers to Frequently Asked Questions. Authors of these works often act as both editor and compiler. People send further information, which the keeper of the file often adds. This makes for a communal base of information which is often available to anyone minimally connected to the Net by at least electronic mail. The constant updating of information on the Net continues the tradition of revising intellectual work introduced by the printing press.

Eisenstein's description of how communal information was gathered is similar to how such procedures work on the Net. She writes: "But others created a vast network of correspondents and

solicited criticism of each edition, sometimes publicly promising to mention the names of readers who sent in new information or who spotted the errors which would be weeded out."[7] People who ask questions on the discussion sections of the Net (either Netnews or Mailing lists) often summarize the answers they receive and post this summary back to the Net. When doing this, many compilers include acknowledgments to the people who supplied the information. Also when people send in corrections to an FAQ, the keeper of the FAQ often makes a list at the end thanking these individuals.

Eisenstein details these networks of correspondence in an example of a particular text titled the "Theatrum".

By the simple expedient of being honest with his readers and inviting criticism and suggestions, Ortelius made his Theatrum a sort of cooperative enterprise on an international basis. He received helpful suggestions from far and wide, and cartographers stumbled over themselves to send him their latest maps of regions not covered in the Theatrum.[8]

On Usenet, too, making a contribution is an integral part of Netizen behavior. Netizens make a point of being helpful to others. Often the Net has made a positive difference in their lives and they return the favor by making their own contribution, perhaps by answering the questions of others or developing an archive. These individual and increasingly group contributions are what have built the Net from a connection of computers and computing resources into a vast resource of people and knowledge. People who use the Net have access to Net resources and can contribute to them. Thus the culture of the Net has been shaped by people actively contributing to the growth and development of the Net. The tale of the Theatrum shows there is a historical precedent in human nature for this "stumbling over oneself" in order to try and be helpful.[9]

The flow of information to the publishers of the Theatrum meant that at least 28 editions were published by the time of the publisher Ortelius' death in 1598.[10] In a similar way, Usenet is by its very nature constantly evolving. The basic element of Usenet is the post whose life is temporary. The Usenet software is designed to "expire" or delete messages after a certain time period. Without constant new contributions from people to Netnews, there would be no messages to read or discussions to take part in. So there is a constant evolution of Usenet. But, also the material in the more permanent information depositories is often updated so they evolve as well.

During the early days of the printing press, publishers' requests for information led to people starting their own research and work. "Thus a knowledge explosion was set off," Eisenstein exclaims.[11] The Net follows in the tradition of the press, by having one set of people asking questions, leading to another set of people conducting research. In this sense the Net can serve the role as a thinktank for the ordinary person. So the advanced possibilities the printing press made possible in the sixteenth century is being replicated many times more by the Net today. It is important to recognize and value Netnews for its contribution to human society and the advancement of knowledge.

Eisenstein observed that the art of printing opened people's eyes to their previous ignorance. She quotes the German historian, Johann Sleidan, in his "Address to the Estates of the Empire" of 1542, describing the impact printing had in Germany, "[The] art of printing [has] opened German eyes even as it is now bringing enlightenment to other countries. Each man became eager for knowledge, not without feeling a sense of amazement at his former blindness."[12] This sentiment has been echoed by many Netizens on Usenet and in other on-line conversations. People have been

amazed at what the Net made possible and how it was changing their lives.

Eisenstein comments in her book on the role of feedback to early authors and print publishers. She wrote that feedback helped to "define the difference between data collection before and after the communications shift. After printing, large-scale data collection did become subject to new forms of feedback which had not been possible in the age of the scribes."[13] Computer networks likewise make possible very easy and natural feedback. Once one reads a message (either public or private), a simple keystroke allows the composition of an answer or response, and another keystroke is often all it takes to send the response. This takes less effort than writing to a publishing house or calling a television station. Since responding to other messages becomes such a natural part of the on-line process, the procedure becomes almost automatic.

Many people who use Usenet find television dull rather than thought provoking. Doug Thompson, a user of Usenet, wrote "TV is so bloody tame and boring in comparison to Usenet." Others, too, have described how they have completely stopped watching TV and reading the newspaper because of Usenet.

Eisenstein refers to the process of constant improvement which printing made possible, as observed by the Scottish philosopher David Hume, "The Power which Printing gives us of continually improving and correcting our Works in successive Editions appears to me the chief advantage of that art."[14] Eisenstein expands on this idea adding, "The future seem[ed] to hold more promise of enlightenment than the past."[15]

This promise of a better future is also seen by those on the Net. People on-line are being enlightened by the interconnection of peoples around the world. The Net helps people to make social connections which were never before possible, or which were relatively hard to achieve. Geography and time no longer are boundaries. Social limitations and conventions no longer prevent potential friendships or partnerships. In this manner Netizens are meeting other Netizens from far-away and close by that they might never have met without the Net.

Eisenstein reports that the printing press too helped people interact with other people who they would not have met before its invention. "Vicarious participation in more distant events was enhanced," she writes, "and even while local ties were loosened, links to larger collective units were being forged."[16] Improvement of information about other parts of the world "by the output of more uniform maps containing more uniform boundaries and place names" helped people to know more of the facts of the world. "Similar developments affected local customs, laws, languages, and costumes."[17]

The Net similarly provides people with a broader view of the world by introducing them to other people's ideas and opinions. The Net makes it possible to access more and differing viewpoints than were normally available in a person's daily life.

Much as printer's houses in the sixteenth century served as places to stop when traveling, computers and phone lines connect people around the world as in our times. Eisenstein describes how such print shops, "point to the formation of polygot households in scattered urban centers upon the continent." She observes that during the sixteenth century, "such printing shops represented miniature 'international houses.' They provided wandering scholars with a meeting place, message center, sanctuary, and cultural center all in one. The new industry encouraged not only the formation of syndicates and far-flung trade networks, similar to those extended by merchants engaged in the cloth trade, or in other large-scale enterprises during early modern times. It also encouraged the

formation of an ethos which was specifically associated with the Commonwealth of Learning – ecumenical and tolerant without being secular, genuinely pious yet opposed to fanaticism, often combining outward conformity to diverse established churches with inner fidelity to heterodox creeds."[18]

The social networks made possible by Usenet and the emergence of the printing press are very similar. Even though Netnews has no official guiding body, Netizens have developed social rules which control and mediate the medium. As the forum is democratic, there will be people who have nothing intelligent to add, or only want to be disruptive or offensive. Others will often debate these troublemakers and through argumentation and the posting of opposite opinions help others to make up their own minds as to the value of the original postings.

The printing press facilitated new cross-cultural networks which encouraged "forms of combinatory activity which were social as well as intellectual."[19] Differing ideas were more easily set against one another. The theories of Arabists were set against the theories of Galenists and those of Aristotelians against Ptolemaists. Eisenstein writes: "Not only was confidence in old theories weakened, but an enriched reading matter also encouraged the development of new intellectual combinations and permutations. Combinatory intellectual activity…inspires many creative acts."[20]

The Net helps people communicate with each other who might not have communicated before. Strangers meet each other because of interest in each other's ideas and this leads to new intellectual collaborations and combinations.

The connection of differing ideas and people meant the first century of printing is recognized for "intellectual ferment" and by what Eisenstein writes was a "somewhat wide-angled, unfocused scholarship."[21]

The new availability of different theories or opinions about the same topics led Eisenstein to conclude that the contribution a scientist like Copernicus was able to make was not that he produced a new theory, but rather he was "confronting the next generation with a problem to be solved rather than a solution to be learned."[22] Lastly on this subject, Eisenstein equates the quickening of science toward a "cognitive breakthrough of an unprecedented kind."[23] The Net is continuing and accelerating that advance.

The lure of being able to produce numerous copies of books cheaply, was that an author's words could be spread around the world. This proved to be powerful. Eisenstein quotes Maurice Gravier on the power the press presented to the Protestant reformers: "The theses…were said to be known throughout Germany in a fortnight and throughout Europe in a month…. Printing was recognized as a new power and publicity came into its own. In doing for Luther what copyists had done for Wycliffe, the printing press transformed the field of communications and fathered an international revolt. It was a revolution. The advent of printing was an important precondition for the Protestant Reformation taken as a whole; for without it one could not implement 'a priesthood of all believers.' At the same time, however, the new medium also acted as a precipitant. It provided the 'stroke of magic' by which an obscure theologian in Wittenberg managed to shake Saint Peter's throne.[24] This idea is repeated by the English writer Daniel Defoe (1660-1732), whom Eisenstein quotes, when he wrote "The preaching of sermons is speaking to a few of mankind, printing books is talking to the whole world."[25] The Net has opened up a channel for "talking to the whole world" to an even wider set of people than did printed books.

A social role which grew to be crucial in this new world of printing was that of the master

printer. His was the business of running a print shop, and finding and promoting potential authors. In the course of this work his workshop became a center of intellectual excitement. Eisenstein explains that the master printer's "workshop became a veritable cultural center attracting local literati and celebrated foreigners, providing both a meeting place and message center for an expanding Commonwealth of Learning."[26]

This development of an intellectual family started to bring the world closer together. "In the late sixteenth century," Eisenstein maintains, "for the first time in the history of any civilization, the concept of a Concordia Mundi was being developed on a truly global scale and the 'family of man' was being extended to encompass all the peoples of the world."[27] The hospitality which the printers provided to travelers and intellectuals helped to make this happen.

The Net continues in this tradition of uniting the world. It is easy to hold conversations and develop relationships with others from around the world. The Net speeds this transaction as the conversation is brought from the print shop into a Netizen's home. A major advancement which the personal computer and the Net make possible is accessibility of publishing. Anyone who owns a personal computer can develop and print their own books, pamphlets, signs, and so forth. The Net comes in to help with distribution.

Eisenstein talks about one result that standardization of printing brought about. "One might consider," she writes, "the emergence of a new sense of individualism as a by-product of the new forms of standardization. The more standardized the type, indeed, the more compelling the sense of an idiosyncratic personal self."[28] Similarly, because Usenet and mailing lists only present people via their ideas and writing styles, people have to write the way they want themselves to be viewed. Thus people develop their own styles. Reading posts can therefore at times be an enjoyable experience. A famous cartoon printed in the New Yorker magazine in 1993 show a dog at a computer. He says to another dog, "On the Internet, no one knows you're a dog." In fact, no one knows if you are white or black, yellow or purple, ugly or beautiful, short or tall. Discrimination based on appearance and visual impressions loses its basis. People can still be verbally harassed if they act stupid, or prove unhelpful to the Net. One problem, however, which has not yet been solved is harassment based on user name. For example, women with user names that are clearly identifiable as a woman's still receive some attention and sometimes harassment.

The printing revolution affected both tool making and symbol manipulation, which led to new ways of thinking. As Eisenstein notes, "The decisions made by early printers, however, directly affected both tool making and symbol making. Their products reshaped powers to manipulate objects, to perceive and think about varied phenomena." Computers, too, are in general directly affecting tool production and symbol manipulation. The tools on the Net are new tools – and thus lead to radical ways of thinking and dealing with information. People's thought processes can expand and develop in original ways. New ways of manipulating information, such as unix tools, hypertext media and search engines for searching distributed data sources foster new means of intellectual activity.

Printing made consultation of various texts much easier – no longer did someone have to be able to be a "Wandering Scholar" to gain access to various information. With the development of the Net, information access becomes much more varied and widespread. The local public library, along with libraries around the world, other data banks and knowledgeable people are becoming accessible via the Net, for some netusers even from their homes. Only a few libraries currently offer

electronic access to any of the actual texts of their holdings, but that is rapidly changing. Undertakings such as Project Gutenberg and various digital library initiatives are trying to make library resources available from any computer hooked into the Net.

Both the printing revolution and the Net revolution have been a catalyst for increased intellectual activity. Such activity tends to provide pressure for more democracy. When people have the chance and the means to start thinking, ideas of self-rule appear. Eisenstein describes how, "Puritan tradesman who had learned to talk to God in the presence of their apprentices, wives, and children were already on their way to self-government."[30] Many social and political questions are being discussed on Usenet newsgroups especially questions like censorship and Net access which affect the Net directly. Based on these discussions, Netizens are exerting pressure on their governments to form new democratic structures like the NTIA on-line conference.[31]

Mass production via printing makes it possible to have sufficient books so that everyone who wants a copy can borrow one from a library or buy one. Eisenstein presents Thomas Jefferson's view of this "democratizing aspect of the preservative powers of print which secured precious documents not by putting them under lock and key but by removing them from chests and duplicating them for all to see." According to Eisenstein, "The notion that valuable data could be preserved best by being made public, rather than being kept secret, ran counter to tradition, led to clashes with new censors, and was central both to early modern science and to Enlightenment thought."[32] The democratizing power and effect of the printing revolution, Eisenstein contends, is overlooked in most historical writings.[33]

With the advent of printing, the Law was affected by the onset of the ability to duplicate numerous copies of a single document cheaply. People saw that this capability would be helpful in making the Law available for the common person to read and understand, and therefore the common person would be able to watch carefully if it was administered fairly. John Liburne, a person who lived in England during the Stuart Monarchy felt that legal documents should be freed from the confines of Latin and old French so that "every Freeman may reade it as well as the lawyers." People like him also held that knowledge which had been esoteric, "rare, and difficult," should be transformed into a form where it could be useful to all. Eisenstein also quotes Florio, who made translations and dictionaries in English. He symbolized the democratic possibilities of the printing press saying, "Learning cannot be too common and the commoner the better…. Why but the vulgar should not know all."[34]

Legal decisions are now being made available on the Net so that anyone with a computer and modem and net connection will have access to them. Also there are legal newsgroups on Usenet like misc.legal where various laws are examined and discussed. This provides a helpful perspective for understanding the value of the Net. The culture that is currently characteristic of the Net supports the principle that much of it should be available openly for the rest of the world to use. There is a collective communal democratic aspect of it, too. The simple fact of the matter is that every single person who is connected to the Net and has Usenet access can make a post to Netnews and every net user can send electronic mail to any other person who is on-line.[35]

The scribal tradition restricted who made the choice of what was copied to the Church or those who had substantial property. "As long as texts could be duplicated only by hand, perpetuation of the classical heritage rested precariously on the shifting requirements of local elites."[36] With the spread of the printing press, the monopoly of these elites was broken. Netnews is a similar advance

over today's mass media. In the 'traditional' forms of mass media, the content is decided by the national 'elites'. However, on Netnews there is no control over the whole and the content is contributed to by every single person who is active on the Net.

Eisenstein compares this control of elites over what manuscripts were copied to the role of the printer and publisher who have it in their interest to unleash all sorts of books. Eisenstein writes: "The politics of censorship made [the printers] the natural opponents not only of church officials but also of lay bureaucrats, regulations and red tape. As independent agents, they supplied organs of publicity and covert support to a 'third force' that was not affiliated with any one church or one state. This third force was, however, obviously affiliated with the interests of early modern capitalists."[37]

These publishers were "the natural enemy of narrow minds," and "encouraged the adoption of a new ethos which was cosmopolitan, ecumenical, and tolerant without being secular, incredulous or necessarily Protestant…."[38] The Net has offered a parallel encouragement by providing a new kind of public space separate from either commercial purposes or religious or political limitations or ideas.

The printing press provided a new way for people to challenge the status quo. Eisenstein asks the question, "Did printing at first serve prelates and patricians as a 'divine art,' or should one think of it rather as the 'poor man's friend'?"[39] She answers it might have served in both roles, but that literacy seemed more "compatible" with the life of a peasant than that of a noble or lord.[40]

We can pose the same question about the Net. Should one think about the Net as a 'poor man's friend'? If we think of the Net as an alternative to the current media of Television, Radio, and Newspapers and Magazines – the answer is yes. People who have a lot of money can afford to own a segment of the mass media described above, and control the content of that media, whereas the Net is controlled by the mass of people connected to it, so it is 'the poor man's' version of the mass media.

The printing revolution fostered the spread of education. Books were used by apprentices and students to learn more than was offered by their teachers. The Net similarly makes multiple resources available for people interested in learning. People can access more information resources and, even more important, other people. This increased accessibility of people to each other means we can all gain and learn from the interests and knowledge of others, more so than from any single teacher.

The impact of the new print technology on science was enormous. Collaboration and cooperation over longer distances were made possible by the power of print. In particular, Eisenstein refers to the impact on the science of Astronomy. The change she sees happened within Copernicus's lifetime. "Copernicus was not supplied, as Tycho's successors would be, with precisely recorded fresh data," she notes. "But he was supplied, as Regiomontaus's successor and Aldus Manutius's contemporary, with guidance to technical literature carefully culled from the best Renaissance Greek manuscript collections, and for the first time, made available outside library walls.[41]

The progress of science is much faster because of the speed of communication afforded by the Net. Articles to be published in scientific journals are often available as electronic preprints – and thus have wider distribution earlier than was the norm before the Net. An outstanding example of this increased speed of scientific activity occurred when researchers all over the world tried to reproduce the result of the two University of Utah researchers who had announced that they had achieved cold fusion. A newsgroup sci.physics.fusion was very quickly set up and researchers' questions and results and problems were posted regularly and feverishly. As a result, what might

have taken years to retest and figure out was sorted out in a three or four month period. The physicists found the rapid exchange of data and results invigorating and encouraging and felt they were more productive and sharper in their work because of the Net. Also, they argued that the use of the Net saved much valuable research time which might have been wasted if the original claims had not been shown to have been faulty in such a short amount of time and to such a wide body of scientists.

The invention of the printing press, which led to many developments not possible before the power of printing, "laid the basis for modern science…and remains indispensable for humanistic scholarship." Eisenstein poignantly claims that printing is responsible for "our museum without walls."[42] As a storehouse of information and living information contained in other people, the Net could also be seen as a living "museum without walls." In her conclusion Eisenstein states that "Cumulative processes were set in motion in the mid-fifteenth century, and they have not ceased to gather momentum in the age of the computer printout and the television guide."[43] We, too, are in an age of amazing changes in communications technologies, and it is important to realize how these changes are firmly based on the extension of the development of the printing press which took place in the fifteenth and sixteenth centuries.

Notes for Chapter 16

1. Elizabeth L. Eisenstein, The Printing Revolution in Early Modern Europe, Cambridge University Press, Cambridge, 1993, p. 78.

2. Ibid., p. 12.

3. Ibid., p. 13.

4. Ibid., p. 22.

5. Ibid., p. 45.

6. Ibid., p. 73.

7. Ibid., p. 74.

8. Ibid.

9. See "The Net and the Netizens". ***

10. The Printing Revolution in Early Modern Europe, p. 74.

11. Ibid., p. 75.

12. Ibid., p. 150.

13. Ibid., p. 76.

14. Ibid., p. 77.

15. Ibid., p. 78.

16. Ibid., p. 95.

17. Ibid., p. 56.

18. Ibid., p.101.

19. Ibid., p. 45.

20. Ibid., p. 44.

21. Ibid., p. 45.

22. Ibid., p. 223.

23. Ibid., p. 225.

24. Ibid., p. 154.

25. Ibid., p. 157.

26. Ibid., p. 25.

27. Ibid., p. 182.

28. Ibid., p. 56.

29. Ibid., p. 64.

30. Ibid., p. 167.

31. See “The Net and the Future of Politics”, Chapter 13.***

32. The Printing Revolution in Early Modern Europe, p. 81.

33. Ibid., Chapter 1, “An Unacknowledged Revolution.”

34. Ibid., p. 165.

35. See Chapter 18, “The Computer as Democratizer.” ***

36. The Printing Revolution in Early Modern Europe, p. 125.

37. Ibid., p. 178.

38. Ibid., pp. 177, 178.

39. Ibid., p. 31.

40. Ibid.

41. Ibid., p. 209.

42. Ibid., p. 275.

43. Ibid., p. 276.

Chapter 17
'Arte' An Economic Perspective
The Role of 'Arte' in the Production of Social Wealth

by Ronda Hauben
rh120@columbia.edu

"In communications, computing makes it possible to switch and route over 100 million long distance telephone calls per day."
National Research Council, "Computing the Future"

"Can we expect, that a government will be well modeled by a people, who know not how to make a spinning-wheel, or to employ a loom to advantage?"
David Hume, "Of Refinements in the Arts"

"If computer-aided communication doubled the effectiveness of a man paid $16 per hour then, according to our estimate, it could be worth what it cost if it could be bought right now. Thus we have some basis for arguing that computer-aided communication is economically feasible."
J. C. R. Licklider and Robert Taylor,
"The Computer As Communicator"

Writing in the Great French Encyclopedia, Denis Diderot (1713-1784) pointed out the striking contradiction of modern society. Even though the wealth of society is produced by those who do the work of that society, they are the least respected and the study of the mechanical arts, which is necessary to make work most productive, is treated with disdain and disrespect. Diderot describes this dilemma: "Place on one side of the balance the real benefits of the most exalted sciences and the most honored 'arts' and on the other side those of the 'mechanical arts', and you will find that the esteem granted to both has not been distributed in the correct proportion of these benefits; and that people praised much more highly those men who were engaged in making us believe that we were happy, than those men actually engaged in doing so. What odd judgments we make! We demand that people be usefully employed and we scorn useful men."[1]

There is a similar tendency in our times, 250 years after Diderot wrote, to dismiss the study of the mechanical arts rather than encourage it. For example, in a study produced in 1992 by the National Research Council the increasing importance of computers and computing in the daily life of our society was documented.[2] Yet the study notes how the ratio of funding for computer science and engineering research has dropped by more than 20% since 1985.[3] Voices defending the social benefits from technological developments like the computer and the global computer network it makes possible need to be part of the public debate. Instead, there are numerous articles, books, journals, etc. that claim such developments are only harmful to society.[4] The social implications of new technological developments like the computer and the telecommunications networks are important and should not be dismissed as harmful as this literature implies. To gain some perspective on the principles at stake in this controversy, it is helpful to look back to early economic writers and their studies about the value to a society of 'arte'.

The 17th and 18th centuries were a period of profound social and economic change in Europe. This period was one of great transformation in the ability to produce the necessities and conveniences of life for a growing population. Accompanying this social transformation was a growing attention to the role that the mechanical arts, often referred to as 'arte', play in production.

Concern with the question of 'arte' was not new. Philosophers like Plato and Aristotle had identified this concept, considering it something important to be studied. For Plato, as he explains in his dialogue "Protagoras," the mechanical arts were akin to a gift from the gods, the sole advantage that humans had in their struggle for survival with the rest of the animal kingdom. They were the essential element which gave people the ability to survive in a hostile world.

Plato tells the story of how the gods Prometheus and Epimetheus were charged with populating the world with living creatures. They created a variety of life, giving to each species an advantage to help it to survive. By the time they came to create humans, they had exhausted the traits they could provide, "Man alone was naked and shoeless, and had neither bed nor arms of defense."[5] Prometheus, Plato explains, not knowing how else to be helpful to humans, "stole the mechanical arts from Hephaestus and Athene, and fire with them (they could neither have been acquired nor used without fire), and gave them to man."[6] Using this parable, Plato shows how only the mechanical arts, which differentiated humans from the rest of the animal kingdom, have made human life sustainable.

Aristotle demonstrates a similar high regard for 'arte' which is defined as "scientific knowledge and the corresponding skill of how to produce something in accordance with that knowledge."[7] In the "Nicomachean Ethics", Aristotle distinguishes art from nature and explains that "Every art is concerned with bringing something into existence and to think by art is to investigate how to generate something…of which the [moving] principle is in the producer and not in the thing produced."[8] He goes on to explain that 'arte' is concerned with things which do not have this [moving] or regenerating principle in themselves. 'Arte' describes the production of things that nature does not create on her own. Hence 'arte' requires the human creator and makes possible the manifold inventions not provided by nature.

Several British writers of the 17th and 18th centuries examined the role that 'arte' or the mechanical arts play in production. The mechanical arts were necessary for the production of the food, clothing and shelter needed to provide for a population that was moving from the land under feudalism into the towns and cities that would characterize the industrial revolution. The annual production of such food, clothing, shelter and other necessities and conveniences of life was seen as one of the pressing concerns in this time of change.

Sir William Petty (1623-1687) who has been called "The Father of Political Economy" isolated four economic categories as being crucial for the production of social wealth. They were labor, land (i.e. nature), arte and stock. Petty maintained that the two essential categories were labor and land, and that labor was the active element and nature the passive element. He wrote "Labor is the Father and active principle of wealth as Lands are the Mother."[9] Though human beings could survive without 'arte', Petty believed that 'arte' was an important component of life, making it possible to produce more with less labor. "Art," he explains is "equal to the labor and skill of many in producing commodities."[10]

In order to increase the production available, Petty saw only two alternatives. "People must either work harder or introduce labor saving processes." These labor saving processes, according to Petty, save the labor of many hands and provide more riches for society. "One man by art may do

as much work as many without it."[11] He gives several examples: "viz one Man with a Mill can grind as much Corn as twenty can pound in a Mortar; one Printer can make as many Copies, as a Hundred Men can write by hands; one Horse can carry upon Wheels, as much as Five upon their Backs; and, in a Boat, or upon ice, as Twenty…."[12] For Petty, the choice facing society was to have "hands…laboring harder, or by introducing the Compendium and Facilitations of Art," to have a few workers doing the work of many.[13]

Petty refers to the example of Holland which had the advantage of being able to use windmills instead of hand labor and thereby the "advantage of the labor of many thousand Hands is saved, for as much as a Mill made by one Man in half a year, will do as much Labor as four Men for five years together."[14] Petty reasoned that the use of 'arte' to save human labor was a continuing benefit to society. He demonstrated the long term social advantage gained from 'arte' over simple labor by an illustration comparing the production by 'arte' with that of simple labor. "For if by such Simple Labor, I could dig and prepare for Seed a hundred acres in a thousand days; suppose then, I spend a hundred days in studying a more compendious way, and in contriving Tools for the same purpose; but in all the hundred days dig nothing." If he now needs only the remaining nine hundred days to dig two hundred acres of ground, "then," Petty concludes, "I say, that the Art which cost but one hundred days Invention is worth one Man's labor forever; because the new Art, and one Man, performed as much as two Men could have done without it."[15]

The social advantage of 'arte', according to Petty, is that a large portion of the population is freed from having to produce the goods needed by society and thus available for other important work, especially for scientific pursuits. The remaining people, Petty writes "may safely and without possible prejudice to the Commonwealth, be employed in Arts and Exercises of pleasure and ornament; the greatest whereof is the Improvement of natural knowledge."[16]

Petty's work is part of a body of economic literature written during the 17th and 18th centuries which set out to scientifically define 'arte'. In "'Art' and 'Ingenious Society'", E. A. J. Johnson gathers several descriptions of 'arte' and looks at what Petty and other 17th and 18th century economic commentators considered as the role of 'arte' and the effect it has had on the development of society.[17]

David Hume (1711-1776), one of the economists Johnson discusses, echoes Plato's emphasis on the importance of 'arte' in distinguishing human beings from other animals. "There is one fundamental difference between man and other animals," Hume wrote, "…Nature has 'endowed the former with a sublime celestial spirit, and having given him an affinity with superior beings, she allows not such noble faculties to lie lethargic or idle, but urges him by necessity to employ, on every emergence, his utmost art and industry'."[18]

In this sense "Art" is, according to Johnson, "an ennobling faculty, implanted by Nature, which separates man from the rest of the zoological world by making greater production possible."[19] Writers like Petty and Hume saw 'arte' as the ability to utilize science and technology to abridge labor, and thus as a wondrous faculty peculiar to humans as part of the animal kingdom.

Other literary figures, like Daniel Defoe (1660-1731) in Plan of the English Commerce and writers of economic tracts like The Advantages of the East India Trade to England Consider'd (1707), provide examples of the environmental and economic benefits which accompany the increased use of tools and machines to abridge the labor necessary for production. In Russia, Defoe explains, where "Labor was not assisted by Art" there was "no other Way to cut out a large Plank,

but by felling a great Tree and then with a multitude of Hands and Axes hew away all the Sides of the Timber, till they reduced the middle to one large Plank." The Swedes or Prussians, on the other hand, Defoe observes, "could cut three or four, or more Planks of the like Size from one Tree by the Help of Saws and Saw Mills." The Consequence is "that the miserable Russian labored ten times as much as the other [the Swedes and the Prussians] for the Same Money."[20] Not only does 'arte' make it possible for more goods to be produced by less labor, but 'arte' also makes it possible to produce more planks of lumber from each tree. When 'arte' is used, fewer trees need to be cut down. And higher wages can be paid to those using the most modern technology as they produce more goods with less labor than those who use backward production techniques.

John Cary, in An Essay on the State of England in Relation to its Trade (1695) observes that because of 'arte' the price of many manufactures like glass bottles, silk stockings, sugar, etc. went down even though the wages of the workers were not cut. "But then the question will be, how this is done?" he asks, and he answers "It proceeds from the Ingenuity of the Manufacturer, and the Improvements he makes in his ways of working, thus the Refiner of Sugars goes thro' that operation in a Month, which our Forefathers required four Months to effect." And "the Distillers draw more Spirits, and in less time…than those formerly did who taught them the Art."[21]

Cary lists other examples of how improvements in 'arte' have led to changes in production that have increased the goods available to the population, though they cost less labor and so are cheaper. He writes: "The Glassmaker hath found a quicker way of making it out of things which cost him little or nothing; Silk Stockings are wove instead of knit; Tobacco is cut by Engines instead of Knives; Books are printed instead of written;…Lead is smelted by Wind-Furnaces, instead of blowing with Bellows; all which save the labor of many Hands, so the Wages of those employed need not be lessened."[22] Cary also observes that the price of goods has come down, even though their desirability has improved.[23] After showing how a similar trend has occurred in the Navigation trades, Cary concludes, "New Projections are every day set on foot to render making our Manufactures easy, which are made cheap…not by falling the Price of poor People's Labor." He shows how these advances lead to a general environment of improved methods of production.[24] And, he notes, these improvements not only lessen the number of laborers needed to do the work, but also make possible the payment of higher wages. According to these early British economists, government has a role to play to support the development of technology. "It should therefore," writes Johnson, "be the duty of the state to increase 'art'."[25]

Understanding 'arte' as the means of mechanical or scientific abridgement of labor, it is useful to look at the effect 'arte' has had on the life and health of society. Several essays written by David Hume consider the role 'arte' plays in determining whether a society flourishes or decays, and thus whether the society can produce the wealth needed to support its people. Hume observes the correlation between a society's support for the mechanical arts and its political and intellectual achievements.[26] "The same age," writes Hume, "which produces great philosophers and politicians, renowned generals and poets, usually abounds with skillful weavers and ship-carpenters."

Hume maintains that a vibrant intellectual environment is the product, not the cause of social support for mechanical invention and the mastery of mechanical techniques. "Another advantage of industry and of refinements in the mechanical arts, is that…Minds…being once aroused from their lethargy, are put into fermentation, turn themselves on all sides and carry improvements into every art and science."[27] Thus attention to the mechanical arts stimulates ferment in all other intellectual

areas.

Not only does the ferment stimulated by mechanical activity and invention lead to a renaissance in intellectual development, but it also affects sociability. Hume writes: "The more these refined arts advance, the more sociable men become: nor is it possible that, when enriched with science, and possessed of a fund of conversation, they should be contented to remain in solitude, or live with their fellow citizens in that distant manner, which is peculiar to ignorant and barbarous nations. They flock into cities; love to receive and communicate knowledge; to show their wit or their breeding; their taste in conversation or living, in clothes or furniture…."[28]

This ferment leads to the development of social organizations, Hume explains: "Particular clubs and societies are everywhere formed: Both sexes meet in an easy and sociable manner: and the tempers of men, as well as their behavior, refine apace. So that, beside the improvements which they receive from knowledge and the liberal arts, it is impossible but they must feel an increase of humanity, from the very habit of conversing together and contribute to each other's pleasure and entertainment."[29]

He summarizes, "Thus industry, knowledge, and humanity, are linked together by an indissoluble chain…."[30]

People personally benefit from the development of technology and industry; more importantly, however a public benefit is achieved. Hume writes: "Laws, order, police, discipline; these can never be carried to any degree of perfection, before human reason has refined itself by exercise, and by an application to the more vulgar arts, at least of commerce and manufacture. Can we expect, that a government will be well modeled by a people, who know not how to make a spinning-wheel, or to employ a loom to advantage?"[31]

Similarly, Hume connects bad government with ignorance in the mechanical arts, "Not to mention that all ignorant ages are infested with superstition, which throws the government off its bias, and disturbs men in the pursuit of their interest and happiness."[32] Furthermore, he relates the development of political liberty to the development of technology. "The liberties of England," Hume writes, "so far from decaying since the improvements in the arts, have never flourished so much as during that period."[33]

He finds a symbiotic relationship between the progress of the mechanical arts in a society and the possibility of good government. In societies which encourage the mechanical arts to develop, larger sections of the population have the time and know how to fashion a more democratic and responsive government. Where technological development is discouraged, a greater part of the population has to spend all of its time producing for subsistence and has no time to devote to the oversight of the government.

Hume traces the development of government in England, attributing changes to the level of technological development of the nation's industry. He describes how the House of Commons in England evolved from the growth and expansion of industry: "The lower house is the support of our popular government; and all the world acknowledges, that it owed its chief influence and consideration to the increase of commerce, which threw such a balance of property into the hands of the commons. How inconsistent then is it to blame so violently a refinement in the arts, [mechanical arts] and to represent it as the bane of liberty and public spirit!"[34]

Hume's defense of technology against its detractors has a familiar ring. His writings provide a foundation for a critique of those who dismiss the benefits of the computer because of a supposed

loss of privacy or supposed increase in the potential for government control over the lives of its citizens. Hume's writings provide a theoretical basis to challenge any efforts to blame the computer for such problems and instead point an arrow to the democratic achievements of the last part of the 20th century that are the result of computer technology.

One of the most exciting of these achievements is the development of Usenet, the worldwide computer conferencing news network that makes possible democratic and uncensored debate and communication on thousands of subjects for computer users around the world. Hume's observation that 'arte' leads to intellectual ferment and the possibility of a more democratic set of institutions is being demonstrated by the dramatic applications that have developed as a result of the widespread use of computer technology.

Writing in the 18th Century, Hume described the intellectual ferment that accompanied the development of technology. Hume's observations provide a helpful perspective to use to view the phenomenal growth of technological achievements like Usenet. This intellectual ferment is the needed support for the development of technology and the development of technology make possible the needed political and social changes that are required to have the technology function. The study of economic writers of the 17th and 18th centuries who discuss the importance of 'arte' provides a helpful theoretical foundation for assessing the significance of such practical developments for our times.

Notes for Chapter 17

1. "Art", in The Encyclopedia: Selections, edited and translated by Stephen J. Gendzier, New York, 1967, p. 60. A modern example of such 'arte' is provided by Carl Malamud in Exploring the Internet (New Jersey, 1992), p. 100. He writes: "The system takes raw timber and figures out the most efficient way to saw up the log to produce the most lumber. In an economy where 30 to 40 percent of GNP is based on forestry, this system proved quite popular." The French title of The Encyclopedia is Encyclopedie ou Dictionnaire raisonne des sciences, des arts, et des metiers. It first appeared in France between 1751 and 1772.

2. Computing the Future, edited by Juris Hartmanis and Herbert Lin, Washington, DC, 1992, pp. 13-16.

3. Ibid., p. 3.

4. See for example, Bob Ickes, "Die, Computer, Die," *New York Magazine*, Vol. 28 no. 29, July 24, 1995, pp. 22-26. For references to some of this literature see "Questioning Technology," The Whole Earth Review, No 73, Winter, 1991.

5. From "Protagoras", in the *Works of Plato*, Vol. I, The Franklin Library, Philadelphia, 1979, p. 81.

6. Ibid.

7. Aristotle's Selected Works, translated by Hippocrates G. Apostle and Lloyd P. Gerson, 1986, p. 676.

8. Ibid., "Nicomachean Ethics", 1140a lines 6-23.

9. "A Treatise of Taxes and Contributions", in The Economic Writings of Sir William Petty, ed. Charles Hull, 1899, Reprinted, Augustus Kelley, Fairfield, New Jersey, 1986, Vol. I, p. 68.

10. "History of Trade", Petty Papers, Vol. I, London, 1927, p. 211.

11. “Political Arithmetick”, *The Economic Writings*, Vol. I, p. 249.

12. Ibid., pp. 249-250.

13. “Verbum Sapienti,” *The Economic Writings*, Vol. I, p. 118.

14. “Political Arithmethic,” *The Economic Writings*, Vol. I, p. 256.

15. “The Political Anatomy of Ireland,” *The Economic Writings*, Vol I, p. 182.

16. “Political Arithmetick,” *The Economic Writings*, pp. 270-271.

17. “‘Arte’ and ‘Ingenious Society’” is a chapter in Predecessors of Adam Smith by E. A. G. Johnson, 1937, reprint, Augustus Kelley, New York, 1960.

18. Predecessors of Adam Smith, p. 264.

19. Ibid.

20. A Plan of English Commerce, 1730, Reprint, Augustus Kelley, New York, p. 36.

21. Predecessors of Adam Smith, pp. 145-6.

22. Ibid., p. 146.

23. Ibid. Cary writes, “The variety of our Woollen Manufactures is so pretty, that Fashion makes a thing worth both at Home and Abroad twice the Price it is sold for…. Artificers by Tools and Laves fitted for different Uses make such things as would puzzle a Stander by to set a price on according to the worth of Men’s Labor; the Plummer by new Inventions casts a Tun of Shott for Ten Shillings, which an indifferent Person could not guess worth less than Fifty.”

24. Ibid., pp. 147-148. Cary writes, “Pits are drained and Land made Healthy by Engines and Aquaeducts instead of Hands; the Husbandman turns up his Soil with the Sallow, not digs it with his Spade; Sowes his Grain, not plants it; covers it with the Harrow, not with the Rake; brings home his Harvest with Carts, not on Horseback; and many other easy Methods are used both for improving of Land and raising its Product, which are obvious to the Eyes of Men versed therein, though do not come within the Compass of my present Thoughts.”

25. Ibid., p. 266.

26. These essays are from Political Discourses, Edinburgh, 1752. Several of the essays have been reprinted in D. Hume, Writings on Economics, E. Rotwein ed., Madison, 1955 , reprinted 1970.

27. “Of Refinement in the Arts,” Writings on Economics, p. 22.

28. Writings on Economics, p. 22.

29. Ibid., pp.22-23.

30. Ibid., p. 23.

31. Ibid., p. 24.

32. Ibid.

33. Ibid., p. 27. Hume explains, “If we consider the matter in a proper light, we shall find, that a progress in the arts is rather favorable to liberty, and has a natural tendency to preserve, if not produce a free government. In rude unpolished nations, where the arts are neglected, all labor is bestowed on the cultivation of the ground; and the whole society is divided into two classes, proprietors of land, and their vassals or tenants. The latter are necessarily dependent and fitted for slavery and subjection; especially where they possess no riches, and are not valued for their knowledge in agriculture; as must always be the case where the arts [mechanical arts] are neglected.”(p. 28)

He also observes that in a land based society, tyranny is the norm, writing, “The former naturally erect themselves into petty tyrants; and must either submit to an absolute master, for the sake of peace and order; or if they will preserve their independence, like the ancient barons, they must fall into feuds and contests among themselves, and throw the whole society into such confusion, as is perhaps worse than the most despotic government.”

34. Ibid., p. 29.

Chapter 18
The Computer as a Democratizer

by Michael Hauben

"...only through diversity of opinion is there, in the existing state of human intellect, a chance of fair play to all sides of the truth."
John Stuart Mill, "On Liberty"

"In a very real sense, Usenet is a marketplace of ideas."
Bart Anderson, Bryan Costales, and Harry Henderson, Unix Communications

Political thought has developed as writers presented the theoretical basis behind the various class structures from aristocracy to democracy. Plato wrote of the rule of the elite Guardians. Thomas Paine wrote why people need control of their governments. The computer and the Net connect to this democratizing trend through facilitating wider communications from individual citizens to the whole body of citizens.

James Mill (1773-1836), the Scottish philosopher, who was the father of John Stuart Mill, took a look at the principles of democratic government in his article "Liberty of the Press" in the Supplement to the *Encyclopedia Britannica* (1825). He wrote about the question of a government that works as it should – or the advantage and gain of the people instead of the advantage and gain for those in control. Mill saw that the government will be necessarily corrupted if the chance exists. Those in the position to rule would abuse their power for their own advantage. Mill felt, "If one man saw that he might promote misrule for his own advantage, so would another; so, of course would they all."[1] Mill believed that people needed a check on those in government. People need to keep watch on their government in order to make sure that it is working in the interest of the many. This led Mill to conclude that there is a crucial need for a press to watchdog over government. "There can be no adequate check without the freedom of the press," he wrote. "The evidence of this is irresistible."[2]

What Mill often phrased as freedom of the press, or liberty of the press, is more precisely defined as an uncensored press. The uncensored press provides for the dissemination of information that allows the reader or thinker to do two things. First, a person can size up the issue and honestly decide his or her own position. Second, as the press is uncensored, this person can make his or her distinctive contribution available for other people to consider and appreciate. Thus what Mill calls "freedom of the press" makes possible the free flow and exchange of different ideas.

Thomas Paine, in The Rights of Man, describes a fundamental principle of democracy. Paine writes, "that the right of altering the government was a national right, and not a right of the government."[3] Mill also expresses that active participation by the populace is a necessary principle of democracy. He writes: "Unless a door is left open to the resistance of the government, in the largest sense of the word, the doctrine of passive obedience is adopted; and the consequence is, the universal prevalence of the misgovernment, ensuring the misery and degradation of the people."[4]

Another principle to which Mill links democracy is the right of the people to define who can responsibly represent their will. However, this right requires information to make a proper decision.

Mill declares: "We may then ask, if there are any possible means by which the people can make a good choice, besides liberty of the press? The very foundation of a good choice is knowledge. The fuller and more perfect the knowledge, the better the chance, where all sinister interest is absent, of a good choice. How can the people receive the most perfect knowledge relative to the characters of those who present themselves to their choice, but by information conveyed freely, and without reserve, from one to another?"[5]

Without information being available to the people the candidates for office can be either as bad as the incumbents or worse. Therefore there is a need to prevent the government from censoring the information available to people. Mill explains: "If it is in the power of their rulers to permit one person and forbid another, the people may be sure that a false report, – a report calculated to make them believe that they are well governed, when they are ill-governed, will be often presented to them."[6]

After electing their representatives, democracy gives the public the right to evaluate their representatives in office. The public continually needs accurate information as to how their representatives are fulfilling their role. Once these representatives have abused their power, the principles established by Paine and Mill require the public to replace those abusers. Mill also clarifies that free use of the means of communication is an extremely important principle in order for democratic government to exist.

"That an accurate report of what is done by each of the representatives, a transcript of his speeches, and a statement of his propositions and votes," Mill writes, "is necessary to be laid before the people, to enable them to judge of his conduct, nobody, we presume, will deny. This requires the use of the cheapest means of communication, and, we add, the free use of those means. Unless every man has the liberty of publishing the proceedings of the Legislative Assembly, the people can have no security that they are fairly published."[7]

Ignorance, Paine calls the absence of knowledge and says that man with knowledge cannot be returned to a state of ignorance.[8] Mill shows how the knowledge man thirsts after leads to a communal feeling. General conformity of opinion seeds resistance against misgovernment. Both conformity of opinion and resistance require general information or knowledge. Mill explains: "In all countries people have either a power legally and peaceably of removing their governors, or they have not that power. If they have not that power, they can only obtain very considerable ameliorations of their governments by resistance, by applying physical force to their rulers, or, at least, by threats so likely to be followed by performance, as may frighten their rulers into compliance. But resistance, to have this effect, must be general. To be general, it must spring from a general conformity of opinion, and a general knowledge of that conformity. How is this effect to be produced, but by some means, fully enjoyed by the people of communicating their sentiments to one another? Unless the people can all meet in general assembly, there is no other means, known to the world, of attaining this object, to be compared with freedom of the press."[9]

Mill champions freedom of press as a realistic alternative to Rousseau's general assembly, which is not possible most of the time. Mill expands on the freedom of the press by establishing the criteria that an opinion cannot be well founded until its converse is also present. Here he sets forth the importance of developing one's own opinion from those that exist. Mill writes: "We have then arrived at the following important conclusions, – that there is no safety to the people in allowing anybody to choose opinions for them; that there are no marks by which it can be decided beforehand,

what opinions are true and what are false; that there must, therefore, be equal freedom of declaring all opinions both true and false; and that, when all opinions, true and false, are equally declared, the assent of the greater number, when their interests are not opposed to them, may always be expected to be given to the true. These principles, the foundation of which appears to be impregnable, suffice for the speedy determination of every practical question."[10]

The technology of the personal computer, of international computer networks, and of other recent contributions embodies and makes it feasible to implement James Mill's theory of liberty of the press. The personal computer makes it affordable for most people to have an information access and broadcast station in their very own home. The international computer networks that exist make it possible for people to have debates with others around the world, to search for data in various data banks, and to allow people to post an opinion or criticism for the whole world to see.

If a person is affiliated with a university community, works at a business which pays to connect to the Internet, is connected to a community network or Free-Net, or pays a fee to a commercial access provider, he or she can connect to an internetwork of computer networks around the world. A connection to this international network empowers a person by giving him or her access to e-mail, Usenet news and perhaps ftp and telnet capabilities. E-mail makes it possible to send and receive messages electronically to and from people around the world who have electronic mail boxes. Usenet is the public message and news posting system that allows its users to be part of world wide debates and discussions.[11] These systems begin to make possible some of the activity James Mill saw as necessary for democracy to function.

The importance of Usenet also exists in that it is an improvement in communications technology from that of previous telecommunications. The predecessors to computer networks were the Ham Radio and Citizen Band Radio (CB). The computer network is an advance in that it is easier to store, reproduce and utilize the communications. It is easier to continue a prolonged question and answer session or debate. The newsgroups on Usenet have a distribution designation which allows them to be available to a variety of areas - local, city, national, or international. This allows for the person posting the message to determine how broadly or narrowly it will be available. The problem with the Internet is that in a sense it is only open to those who either have it provided to them by a university or company that they are affiliated with, or who pay for it. This limits part of the current development of the computer networks. Until free or very low cost access is universally available, the Net will be short of its potential.

An example of a step toward universally available and affordable access is the community computing system called Free-Net in Cleveland, Ohio. Cleveland Free-Net is operated by Case Western Reserve University as a community service.[12] Anyone with a personal computer and a modem (a device to connect to other computers over existing phone lines) can call a local phone number to connect to the Free-Net without charge accept for the phone call. If members of the public do not own computers, they can use the Free-Net at some branches of the Cleveland Public Library. Besides Usenet, Cleveland Free-Net provides free access to a variety of community information and local discussion forums. Cleveland Free-Net is just one example of the community computer networks that are becoming much more readily available to broad sectors of society. As part of its newsgroups and discussion forums Cleveland Free-Net offers Supreme Court decisions, discussion of political issues and candidates, and debate over contemporary laws. Free-Nets like the one in Cleveland demonstrate that it is now possible to meet the requirements of more democracy which

include the "use of the cheapest means of communication, and, we add, the free use of those means."[13]

This is an exciting time to see the democratic ideas of some great political thinkers beginning to be practical. James Mill wrote that for government to serve the people, it must be watched over by the people utilizing an uncensored press. Freedom of the press also makes possible the debate necessary for people to form well founded opinions. Usenet and e.g., Cleveland Free-Net are contemporary examples of the uncensored accessible press required by Mill. These networks are also the result of hard work by many people aspiring for more democracy. However, to keep these forms developing and spreadinq requires constant work from those dedicated to the hard fight for democracy.

Notes for Chapter 18

1. "Essay on Liberty of the Press, Essays on Government, Jurisprudence, Liberty of the Press, and Law of Nations, (reprint) New York, 1967, p. 20.

2. Ibid., p. 18.

3. "The Rights of Man" in Two Classics of the French Revolution, New York, 1989, p. 341.

4. "Essay on Liberty of the Press," p. 13.

5. Ibid., p. 19.

6. Ibid., p. 20.

7. Ibid.

8. "The Rights of Man," p. 357.

9. "Essay on Liberty of the Press," p. 18.

10. Ibid., p. 23.

11. Usenet consists of many newsgroups which each cover a broad, yet specific set of topics. People who utilize Usenet typically pick certain newsgroups or topics to focus on. Every group has several items of discussion going on at the same time. Some examples of newsgroups include serious topics such as talk.politics.theory, – people "talking" about current issues and political theory, sci.econ – people discussing the science of economics, soc.culture.usa – people debating questions of Unites States society; and recreational topics (which might also be serious) such as alt.rock-n-roll – discussing various aspects of rock music, rec.sport.hockey – a discussion of hockey and rec.humor - jokes and humor. The discussions are very active and provide a source of information that makes it possible to meet James Mill's criteria for both more oversight over government and a more informed population. In a sense, what was once impossible, is now possible; everyone's letter to the editor is published. What is important is that Usenet is conducted publicly, and is mostly uncensored. This means that everyone can both contribute and gain from everyone else's opinion.

12. See for example, "Freenet helps Case Western fulfill its Community-Service Mission," by Beverly T. Watkins in Chronicle of Higher Education, April 29, 1992, p. A21.
13. "Essay on Liberty of the Press," p. 20

Bibliography
List of Sources

Aboba, Bernard. The Online User's Encyclopedia: Bulletin Boards and Beyond. Addison-Wesley. Reading, Massachusetts. 1993.

Abramson, Jeffrey B. "Electronic Town Meetings: Proposals for Democracy's Future". Aspen Institute Communications and Society Program. Washington, D.C.

Aizu, Izumi. Cultural Impact on Network Evolution in Japan: Emergence Of Netizens. Institute for HyperNetwork Society. Tokyo. 1995. http://www.glocom.ac.jp/Publications/Aizu/nete&c.html

Anderson, Bart, Brian Costales, and Hart Henderson. Unix Communications. SAMS. Camel, Indiana. 1991.

Anderson, Robert H., Tora K. Bikson, Sally Ann Law, and Bridger M. Mitchell. Universal Access to E-mail: Feasibility and Societal Implications. Rand. Santa Monica, California. 1995.

Aristotle. Aristotle's Selected Works. Translated by Hippocrates G. Apostle and Lloyd P. Gerson. 1986.

ARPANET Completion Report Draft. September 9, 1977.

Baran, Paul. On Distributed Communications Networks. Rand Corporation. Santa Monica, California. September, 1962.

Baran, Paul, Sharla P. Boehm, and Joseph W. Smith. *On Distributed Communications*. Vol. I through XI. Memorandum. Rand Corporation. Santa Monica, California. August, 1964.

Banes, Sally. Greenwich Village 1963: Avant-Garde Performance and the Effervescent Body. Duke University Press. Durham, North Carolina. 1993.

Bellovin, Steve M. and Mark Horton. "Usenet - A Distributed Decentralized News System." Unpublished manuscript. 1985.

Bernstein, Alex and M. de V. Roberts. "Computer versus Chess-Player." *Scientific American*, Vol. 198 no. 6. June 1958. Pp. 96-105.

Brooks, Jr., Frederick P. The Mythical Man-Month: Essays on Software Engineering. Addison-Wesley. Reading, Massachusetts. 1972.

Brooks, Jr., Frederick P. "No Silver Bullets." In *Unix Review*. November, 1987. Pp. 41ff.

Bush, Vannevar. “As We May Think.” In The *Atlantic Monthly*. No 176. 1945. Pp. 101-108.

Cerf, Vinton G. “An Assessment of ARPANET Protocols.” Infotech Education Ltd. Stanford University. Palo Alto, California. (nd). 21 pages.

Cerf, Vinton G. “Requiem for the ARPANET.” Poem in Users’ Dictionary of Computer Networks. By Tracy LaQuey. Digital Press. Bedford, Massachusetts. 1989.

Collyer, Geoff and Henry Spencer. “News Need Not Be Slow.” In USENIX Conference Proceedings. Washington, D.C. Winter 1987. Pp. 181-190.

“Computing in America IV.” In *Personal Computing* (Special Issue). October, 1989. Pp. 170-172.

Corbato, Fernando J. Interview by Arthur L. Norberg. 18 April 1989 and 14 November, 1990. Cambridge, Massachusetts. Charles Babbage Institute. Center for the History of Information Processing. University of Minnesota. Minneapolis, Minnesota.

Corbato, Fernando J., Robert M. Fano, Martin Greenberger, Joseph C. R. Licklider, Douglas T. Ross and Allan L. Scherr. “The Project MAC Interviews.” Interviews by John A. N. Lee and Robert Rosin. In *IEEE Annals of the History of Computing*. Vol. 14 no. 2. 1992.

Corbato, Fernando J., Marjorie Merwin-Daggett, and Robert C. Daley. “An Experimental Time-Sharing System.” In Proceedings-Spring Joint Computer Conference. Vol. 21. AFIPS. San Fransisco, California. May 1-3, 1962. Pp. 335-344.

Corbato, Fernando J. and Victor A. Vyssotsky. “Introduction and Overview of the Multics System.” In Proceedings-Fall Joint Computer Conference. Vol. 27. Part 1. AFIPS. Las Vagas, Nevada. November 30, 1965. Pp. 186-202.

Crocker, Stephen D. RFC-3: Documentation Conventions. April 3, 1968.

Crocker, Stephen D. “The Origins of RFCs.” In RFC-1000: RFC Reference Guide. By J. Reynolds and J. Postel. 1987.

Crocker, Stephen D. “Re: RFC1000 (Partial response to part 1).” E-mail message to Com-Priv mailing list (com-priv@psi.com). Nov 27, 1993.

Crocker, Stephen D. “Re: RFC1000 (End of response to part 1).” E-mail message to Com-Priv mailing list (com-priv@psi.com). Nov 27, 1993.

Crocker, Stephen D. “Subject: Re: RFC1000 (Response to part 2).” E-mail message to Com-Priv mailing list (com-priv@psi.com). Nov 27, 1993.

Daniel, Stephen, James Ellis, and Tom Truscott. "Usenet - A General Access UNIX Network." Duke University. Durham, North Carolina. Summer 1980.

Diderot, Denis. The Encyclopedia: Selections. Edited and translated by Stephen J. Gendzier. J. & J. Harper Edition. New York. 1967.

Dolotta, T. A. and J. R. Masey. "An Introduction to the Programmer's Workbench." In Proceedings Second International Conference on Software Engineering. San Francisco, California. October 13-15, 1976. Pp. 164-168.

Dolotta, T. A., R. C. Haight and J. R. Masey. "The Programmer's Workbench." In *Bell System Technical Journal*. Vol. 57 no. 6. Part 2. Murray Hill, New Jersey. July-August, 1978. Pp. 2177-2200.

Eisenstein, Elizabeth L. The Printing Revolution in Early Modern Europe. Cambridge University Press. Cambridge. 1983.

Elias, Peter. Twenty-Fifth Anniversary Project MAC Time Line. Chart. MIT Laboratory for Computer Science. Massachusetts Institute of Technology. Cambridge, Massachusetts. 1988.

Fano, Robert. Transmission of Information. MIT Press and John Wiley & Sons. New York. 1961.

Fano, Robert M. Interview by Arthur L. Norberg. 20-21 April 1989. Cambridge, Massachusetts. Charles Babbage Institute. Center for the History of Information Processing. University of Minnesota. Minneapolis, Minnesota.

Fano, Robert, and Fernando Corbato. "Time-sharing on Computers." In Information, A Scientific American Book. W. H. Freeman. San Francisco, California. 1966. Pp. 76-95.

Federal Research Internet Coordinating Committee. "Program Plan for the National Research and Education Network." May 23, 1989.

Felton, William A., Gerald L. Miller and J. Micheal Milner, "A Unix System Implementation for System/370." In *AT&T Bell Laboratories Technical Journal*. Vol. 63 no. 8. Part 2. October, 1984. Pp. 1751-1767.

Fitzsimon, Martha and Lawrence T. McGill. "The Citizen as Media Critic." In *Media Studies Journal*. Vol. 9 No. 2. Spring 1995. Pp. 91-101.

Geipel, Gary L., A. Tomatz Jarmoszko, and Seymour Goodman. "The Information Technologies and East European Society." In East European Politics and Society. Vol. 5 no. 3. 1992. Pp 394-438.

Glaser, E. L., J. F. Couleur and G. A. Oliver. "System Design of a Computer for Time Sharing

Applications." In Proceedings-Fall Joint Computer Conference. Vol. 27. Part 1. AFIPS. Las Vagas, Nevada. November 30, 1965.

Greenberger, Martin. Editor. Management and the Computer of the Future. The MIT Press. Cambridge, Massachusetts. 1962.

Hall, Dennis E., Deborah K. Scherrer and Joseph S. Sventek. "A Virtual Operating System." In *Communications of the ACM*. Vol. 23 no. 9. September, 1980. Pp. 495-502.

Hauben, Michael. "Interview With Staff Member Michael Hauben on the Occasion of the 10th Anniversary of the Personal Computer." In *Amateur Computerist*. Vol. 4 no. 2/3. Winter/Spring 1992. Pp. 10-14.

Hauben, Michael. "Common Sense: The Net and the Netizens." In *Amateur Computerist*. Part 1 in Vol. 5 no. 3/4. Summer/Fall 1993. Pp. 11-13. Part 2 in Vol. 6 no. 2/3. Fall/Winter 1994/1995. Pp. 22-35.

Hauben, Michael. "The Vision of Interactive Computing and the Future." In *Amateur Computerist*. Vol. 6 no. 2/3. Fall/Winter 1994/1995. Pp. 3-6.

Hauben, Michael and Ronda Hauben. "The Netizens and the Wonderful World of the Net: On the History and the Impact of the Internet and Usenet News." Online manuscript. January 10, 1994. URL http://www.columbia.edu/~hauben/project_book.html

Hauben, Ronda. "UNIX and Computer Science." In *Amateur Computerist*. Unix Issue. Vol. 6 no. 1. Winter/Spring 1994. Pp. 1-5.

Hauben, Ronda. "From ARPANET to Usenet News" In *Amateur Computerist*. Part 1 in Vol. 5 no. 3/4. Pp. 1-10. Part 2 in Vol. 6 no. 1. Winter/Spring 1994. Pp 14-6. Part 3 in Vol. 6. no. 2/3. Pp. 19-20.

Heart, Frank, Alexander A. McKenzie, John McQuillian, and David Walden. The ARPANET Completion Report. BBN Report 4799. Washington, D.C. January 4, 1978.

Hugo, Victor. Notre Dame of Paris. Translated by John Sturrock. Penguin Books. London. 1978.

Hume, David. Political Discourses. Edinburgh. 1752.

Hume, David. Writings on Economics. Edited by Eugene Rotwein. University of Wisconsin Press. Madison, Wisconsin. 1970.

Information, A Scientific American Book. W. H. Freeman. San Francisco, California. 1966.

Ingram, John Kelly. A History of Political Economy. 1888. Reprinted by Augustus Kelley Publishers. New York. 1967.

In Memoriam: J.C.R. Licklider: 1915-1990. Digital Systems Research Center. Digital Equipment Corporation. Palo Alto, California. August 7, 1990.

Internet Society. *Internet Society News*. Vol. 2 no. 1. Reston, Virginia. Spring 1993.

Ivanov, Peter. "Interview with John Lions," In *UNIX Review*. October, 1985. Pp. 50-58.

Ivie, Evan L. "The Programmer's Workbench - A Machine for Software Development." Unpublished Report. AT&T Bell Laboratories. May 19, 1975.

Ivie, Evan L. "The Programmers Workbench -- A Machine for Software Development." In *Communications of the ACM*. Vol. 20 no. 10. October, 1977. Pp. 746-753.

Johnson, E. A. J. Predecessors of Adam Smith. 1937. Reprinted by Augustus Kelley Publishers. New York. 1960.

Johnson, Stephen C. "UNIX: The Language Forms." In USENIX Association Winter Conference Proceedings. Washington, D.C. January 21-23. 1987. Pp. 16-20.

Johnson, Stephen C. and Dennis. M. Ritchie. "Portability of C Programs and the UNIX System." In The *Bell System Technical Journal*. Vol. 57 no. 6. Part 2. July-August, 1978. Pp. 2021-2048.

Johnstone, Ian, and Steve Rosenthal. "Unix on Big Iron." In *UNIX Review*. October, 1984. Pp. 22-26.

Kahin, Brian. RFC-1192: Commercialization of the Internet: Summary Report. November, 1990.

Kemeny, John G. Man and the Computer. Charles Scribner's Sons. New York. 1972.

Kernighan, Brian W. and P. J. Plauger. Software Tools. Addison-Wesley. Reading, Massachusetts. 1976.

Kernighan, Brian W. and Rob Pike. The Unix Programming Environment. Prentice-Hall. Englewood Cliffs, New Jersey. 1984.

Kernighan, Brian W. and Rob Pike. "Program Design in the UNIX Environment." In *AT&T Bell Laboratories Technical Journal*. Vol. 63 no. 8. Part 2. October, 1984. P. 1595-1631.

Kernighan, Brian W. and John R. Mashey. "The Unix Programming Environment." In Computer. April, 1981. Pp. 12-24.

Kleinrock, Leonard. “On Communications and Networks.” In *IEEE Transactions on Computers*. Vol. C-25 no. 12. December, 1976. Pp. 1320-1329.

Lasch, Christopher. “Journalism, Publicity, and the Lost Art of Argument.” In *Media Studies Journal*. Vol. 9 no. 1. Winter 1995. Pp. 81-91.

Lasch, Christopher. The Revolt of the Elites and the Betrayal of Democracy. W. W. Norton and Company. New York. 1995.

Lee, J.A.N. “Claims to the Term Time-Sharing.” In *IEEE Annals of the History of Computing*. Vol. 14 no. 1. 1992. Pp. 16-17.

Lesk, Michael. “Can UNIX Survive Secret Source Code?.” In *Computing Systems*. Vol. 1 no. 2. Spring 1988. Pp. 189-199.

The Legacy of Norbert Wiener: A Centennial Symposium. Massachusetts Institute of Technology. Cambridge, Massachusetts. October 8-14, 1994.

Licklider, J.C.R. “Man-Computer Symbiosis.” In *IRE Transactions on Human Factors in Electronics*. Vol. HFE-1. March, 1960. Pp. 4-11. Also reprinted in In Memoriam: J. C. R. Licklider: 1915-1990. Report 61. Systems Research Center. Digital Equipment Corporation. Palo Alto, California. August 7, 1990. Pp. 1-19.

Licklider, J. C. R. and Robert Taylor. “The Computer as a Communication Device.” In Science and Technology: For the Technical Men in Management. No. 76. April, 1968. Pp. 21-31. Also reprinted in In Memoriam: J. C. R. Licklider: 1915-1990. Report 61. Systems Research Center. Digital Equipment Corporation. Palo Alto, California. August 7, 1990. Pp. 21-41.

Licklider, J. C. R. and Albert Vezza. “Applications of Information Networks.” In *Proceedings of the IEEE*. Vol. 66 no. 11. November, 1978. Pp. 43-59. (Also listed as pp. 1330-1346.)

Licklider, J. C. R. Interview by William Aspray and Arthur L. Norberg. Tape recording. Cambridge, Massachusetts. 28 October 1988. OH 150. Charles Babbage Institute. University of Minnesota. Minneapolis, Minnesota.

Lions, John. A Commentary on the UNIX Operating System. The University of New South Wales. (nd).

Lions, John. “Spreading UNIX around the World: An Interview with John Lions.” By Ronda Hauben. In the *Amateur Computerist*. Unix Issue. Vol. 6 no. 1. Winter/Spring 1994. Pp. 1, 5-7.

Malamud, Carl. Exploring the Internet: A Technical Travelogue. Prentice Hall. Englewood Cliffs,New Jersey. 1992.

Marill, Thomas and Lawrence G. Roberts. “Toward a Cooperative Network of Time-Shared Computers.” In *Proceedings Fall Joint Computer Conference*. Vol. 29. 1966. Pp. 425-431.

McCarthy, John. “John McCarthy’s 1959 Memorandum.” In *IEEE Annals of the History of Computing*. Vol. 14 no. 1. 1992. Pp. 20-23.

McCarthy, John. “Information.” In Information, A Scientific American Book. W. H. Freeman. San Francisco, California. 1966. Pp. 1-16.

McIlroy, M. Doug. “Unix on My Mind.” In Proc. Virginia Computer Users Conference (Blacksburgh). Vol. 21. September, 1991. Pp. 1-6.

McIlroy, M. Doug. “A Research UNIX Reader: Annotated Excerpts from the Programmer’s Manual, 1971-1986.” Computing Science Technical Report, No. 139, AT&T Bell Laboratories. Murray Hill, New Jersey. June, 1987.

McIlroy, M. Douglas, Elliot N. Pinson, and Berkley A. Tague. “Foreward.” In *Bell System Technical Journal*. Vol. 57 no 6. Part 2. July-August, 1978. Pp. 1899-1904.

McKenzie, Alexander A. and David C. Walden. “ARPANET, the Defense Data Network, and Internet.” In *The Encyclopedia of Telecommunications*. Vol. 1. Edited by Fritz E. Froehlich, Allen Kent and Carolyn M. Hall. Marcel Dekker. New York. 1991. Pp. 341-376.

McKusick, Marshall Kirk. “A Berkeley Odyssey: Ten Years of BSD History.” In *Unix Review*. Vol. 3 no. 1. January, 1985. Pp. 30-44, 108-114.

Mill, James. Essays on Government, Jurisprudence, Liberty of the Press and Law of Nations. Reprinted by Augustus Kelley Publishers. New York. 1986.

Mohr, August. “The Genesis Story.” In *Unix Review*. Vol. 3 no. 1. January, 1985. Pp. 18-28, 117.

Morgan, Lewis Henry. Ancient Society or Researches in the Lines of Human Progress from Savagery through Barbarism to Civilization. Charles H. Kerr. Chicago. 1877.

National Research Council. Computing the Future: A Broader Agenda for Computer Science and Engineering. Edited by Juris Hartmanis and Herbert Lin. National Academy Press. Washington, DC. 1992.

Office of the Inspector General. “Review of NSFNET.” National Science Foundation. Washington, DC. March 23, 1993.

Office of Science and Technology Policy. “The Federal High Performance Computing Program.” Washington, DC. September 8, 1989.

O'Neil, Judy Elizabeth. The Evolution of Interactive Computing Through Time-Sharing and Networking. Ph.D. Thesis. University of Minnesota. Minneapolis, Minnesota. June, 1992.

Paine, Thomas, "The Rights of Man," In Two Classics of the French Revolution, Anchor Books, Doubleday. New York, 1989.

Perlis, Alan J. *Introduction to Computer Science*. Harper and Row. New York. 1972.

Petty, Sir William. The Writings of Sir William Petty. Edited by Charles Hull. London. 1899. Reprinted by Augustus Kelley Publishers. New York. 1986.

Petty, Sir William. The Petty Papers. Edited by the Marquis of Lansdowne. Cheswick Press. London. 1927.

Pierce, John R. "Communication." In *Scientific American*. Vol. 227 no. 3. September, 1972. Pp. 31-41.

Plato. *Works of Plato*. Vol. I. The Franklin Library. Philadelphia. 1979.

Pool, Ithiel de Sola. Technology Without Boundaries: On Telecommunications in a Global Age. Edited by Eli M. Noam. Harvard University Press. Cambridge, Massachusette. 1990.

Proceedings of the NTIA Virtual Conference. URL http://ntiaunix2.ntia.doc.gov:70/11s/virtual.

Quarterman, John S. The Matrix: Computer Networks and Conferencing Systems Worldwide. Digital Press. Bedford, Massachusetts. 1990.

Ritchie, Dennis M. "UNIX: A Retrospective." In The *Bell System Technical Journal*. Vol. 57 no. 6. Part 2. July-August, 1978. Pp. 1947-1969.

Ritchie, Dennis M. "The Evolution of the UNIX Time-Sharing System." In *AT&T Bell Laboratories Technical Journal*. Vol. 63 no. 8. Part 2. October, 1984. Pp. 1577-1593.

Ritchie, Dennis M. "The Development of the C Language". ACM. Presented at the Second History of Programming Languages Conference. Cambridge, Massachusetts. April, 1993. 16 pages.

Ritchie, Dennis M. and Ken Thompson. "The UNIX Time-Sharing System." In *Communications of the ACM*. Vol. 17 no. 7. July, 1974. Pp. 365-375.

Roberts, Lawrence G. "The Evolution of Packet Switching." In *Proceedings of the IEEE*. Vol. 66 no. 11. November, 1978. Pp. 1307-1313.

Roberts, Lawrence G. "The ARPANET and Computer Networks." In A History of Personal

Workstations. Edited by Adele Goldberg. ACM Press. New York. 1988. Pp. 143-167.

Roberts, Lawrence G. Interview by Arthur L. Norberg. 4 April 1989. San Mateo, California. Charles Babbage Institute. The Center for the History of Information Processing. University of Minnesota. Minneapolis, Minnesota.

Rochkind, Marc. "Interview with Dick Haight." In *Unix Review*. May, 1986. Pp. 54-65.

Sandberg, Jared. "Oklahoma City Blast Turns Users Onto Internet for Facts, Some Fiction." *Wall Street Journal*. April 20, 1995. P. A6.

Shannon, Claude E. "The Mathematical Theory of Communication." In *Bell System Technical Journal.* Vol. 27. July, 1948. Pp. 379-423. And October, 1948. Pp. 623-656.

Shannon, Claude E. "A Chess-Playing Machine." In *Scientific American*. Vol. 182 no. 2. February, 1950. Pp. 48-51.

Snow, C.R. "The Software Tools Project." In *Software – Practice and Experience*. Vol. 8. September-October, 1978. Pp. 585-99.

Spafford, Eugene. "USENET Software: History and Sources." In news.admin.misc. Usenet newsgroup.

Spencer, Henry. "Interview with Henry Spencer: On Usenet News and C News." In *Amateur Computerist*. Vol. 5 no. 1-2. Winter/Spring, 1993. Pp. 1-10. Reprinted in Internet Secrets. John R. Levine and Carol Baroudi. Editors. IDG Books. Foster City, California. 1995. Pp. 65-76.

Stecklow, Steve. "Computer Users Battle High-Tech Marketers Over Soul of Internet." *Wall Street Journal*. September 16, 1993. P. 1.

Stefferud, Einar et al. "Quotes from Some of the Players." Compiled by Daniel P. Dern. In *ConneXions - The Interoperability Report*. Vol. 3 no. 10. Interop Company. Foster City, California. October, 1989. Pp. 15-26.

Stone, Alan. Wrong Number. Basic Books. New York. 1989.

Stoneback, John. "The Collegiate Community." In *Unix Review*. October, 1985. Pp. 24-7 and 46-48.

Strachey, Christopher. "Time-sharing in Large Fast Computers," In Proc. Int'l. Conf. on Information Processing, UNESCO, Paris, 15-20 June, 1959. UNESCO. Paris. 1960. Pp. 336-341.

Strandh, Sigvard. The History of the Machine. Dorset Press. New York. 1989. (Copyright 1979. AB NORDBOK.)

Tague, Berkley. “Automating Telephone Support Operations: An Interview with Berkley Tague.” By Ronda Hauben. In *Amateur Computerist*. Unix Issue. Vol. 6 no. 1. Winter/Spring, 1994. Pp. 7-13.

Taylor, Robert W. Interview by William Aspray. 28 February 1989. Palo Alto, California. Charles Babbage Institute. The Center for the History of Information Processing. University of Minnesota. Minneapolis, Minnesota.

Thompson, Ken. “Unix Implementation.” In The *Bell System Technical Journal*. Vol. 57 no. 6. Part 2. July-August, 1978. Pp. 1931-1946.

“Time-Sharing and Interactive Computing at MIT - Part 1: CTSS.” Special Issue of *IEEE Annals of the History of Computing*. Vol. 14 no. 1. Editor-in-Chief John A. N. Lee. 1992.

“Time-Sharing and Interactive Computing at MIT - Part 2: Project MAC.” Special Issue of *IEEE Annals of the History of Computing*. Vol. 14 no. 2. Editor-in-Chief John A. N. Lee. 1992.

Truscott, Tom. “Invitation to a General Access Unix Network.” Duke University. Durham, North Carolina. 1980.

“The UNIX System.” Issue of *AT&T Bell Laboratories Technical Journal*. Vol. 63 no. 8. Part 2. October, 1984.

“Unix Time-Sharing System.” Issue of The *Bell System Technical Journal*. Vol. 57 no. 6. Part 2. July-August, 1978.

Usenet History Archives. ftp://weber.ucsd.edu/pub/usenet.hist/.

Volovic, Thomas S. “Encounters On-Line”. In *Media Studies Journal*. Vol. 9 No. 2. Spring, 1995. pp. 113-121.

Vyssotsky, Victor. “Putting UNIX in Perspective: An Interview with Victor Vyssotsky.” By N. Peirce. In *Unix Review*. Vol. 3 no. 1. January, 1985. Pp. 58-70, 102-106.

Warner, Fara. “Experts Surprised Intel Isn’t Reaching Out To Consumers More.” *Wall Street Journal*. December 14, 1994.

Watkins, Beverly T. “Freenet Helps Case Western Fulfill Its Community-Service Mission.” In Chronicle of Higher Education. April 29, 1992. P. A21.

Wiener, Norbert. *Collected Works of Norbert Wiener with Commentaries*. Vol. 4. Edited by P. Masani. The MIT Press. Cambridge, Massachusetts. 1985.

Wiener, Norbert. Cybernetics: Or Control and Communication in the Animal and the Machine. The

Technology Press. John Wiley and Sons. New York. 1948.

Wiener, Norbert. *I Am A Mathematician: The Later Life of a Prodigy*. The MIT Press. Cambridge, Massachusetts. 1956.

Wiener, Norbert. God & Golem, Inc.: A Comment on Certain Points where Cybernetics Impinges on Religion. The MIT Press. Cambridge, Massachusetts. 1964.

Wiener, Norbert. "A Scientist's Dilemma in a Materialist World." October, 1957. In *Collected Works of Norbert Wiener with Commentaries*. Vol. 4. The MIT Press. Cambridge, Massachusetts. 1985. Pp. 707-709.

Wiener, Norbert. "Challenge Interview: Norbert Wiener: Man and the Machine". June 1959. In *Collected Works of Norbert Wiener with Commentaries*. Vol. 4. The MIT Press. Cambridge, Massachusetts. 1985. Pp. 712-717.

Woodbury, Gregory G. "Net Cultural Assumptions." Reprinted in *Amateur Computerist*. Vol. 6 no. 2/3. Winter/Spring, 1994-5.

Ziegler, Bart and Jared Sandberg. "On-Line Snits Fomenting Public Storms." *Wall Street Journal*. December 23, 1994.

Glossary of Acronyms

AFIPS	American Federation of Information Processing Societies
ANS	Advanced Networks and Services
ARPA	Advanced Research Projects Agency
ARPANET	Advanced Research Projects Agency Network
AT&T	American Telephone and Telegraph Company
AUP	Acceptable Use Policy
AVAIL	Availability of network access
AWK	Aho, Weinberger, Kernighan (Unix Utility)
BASIC	Beginners All Purpose Symbolic Instruction Code
BBN	Bolt, Beranek and Newman, Inc.
BBS	Bulletin Board System
Berknet	Berkeley Network
BESYS	Bell Operating System
BIS	Business Information Systems (At Bell Labs)
BITnet	Because It's Time Network
BLN	Bell Labs Network
BRL	Ballistics Research Laboratory
BSD	Berkeley Systems Distribution of Unix
BTL	Bell Telephone Laboratories
CBI	Charles Babbage Institute
CCC	Computer Chess Competition
CCN	College Campus Net (UCLA)
CCR	Command and Control Research
CPU	Central Processing Unit
CS	Computer Science
Csnet	Computer Science Network (later Computer and Science Network)
CTSS	Compatible Time-Sharing System
DEC	Digital Equipment Corporation
DEL	Decode-Encode Language
DoD	United States Department of Defense
E-mail	Electronic Mail
EUUG	European Unix Users Group
FA	From ARPANET
FCC	Federal Communications Commission
FJCC	Fall Joint Computer Conference (AFIPS)
FIDOnet	FIDO Bulletin Board System Network

Free-Net	Free access community Network (now a registered trademark of the National Public Telecommunications Network)
ftp	file transfer protocol
GECOS	General Electric Comprehensive Operating System (later GCOS)
grep	global/regular expression/print (Unix command)
honeydanber	Honeyman, David A. Nowitz, Brian E. Redman's Version of UUCP
IAB	Internet Activities Board
IBM	International Business Machines Corporation
IETF	Internet Engineering Task Force
IMP	Interface Message Processor
INWG	International Network Working Group
IPTO	Information Processing Techniques Office
Internet	Internetwork of Networks
IRC	Internet Relay Chat
JCL	Job Control Language
K-12 Net	Kindergarten to 12th grade Network
listserv	Electronic mailing list server
MAC	Man And Computer, Multi-Access Computer
MC	Mathematisch Centrum (Amsterdam, The Netherlands)
MERIT	Michigan Education Research Instruction Triade
MILnet	Military Network
MIT	Massachusetts Institute of Technology
MOO	MUD, Object Oriented
MUD	Multi-User Dungeon
MULTICS	MULtiplexed Information and Computing Service
MUSH	Multi-User Shared Hallucinations
NAC	Network Analysis Corporation
NCP	Network Control Program or Network Control Protocol
Netiquette	Network users etiquette
Netnews	Network news
Netizen	Network Citizen, net.citizen
NII	National Information Infrastructure
NIL	Network Interchange Language
NNTP	Network News Transfer Protocol
NREN	National Education and Research Network

NSF	National Science Foundation
NSFnet	National Science Foundation Network
NTIA	National Telecommunications Information Administration
NWG	Network Working Group
NYPSC	New York Public Service Commission
PWB	Programmer's Workbench
REDEFUS	Redefine Universal Access
RFC	Request For Comment
RFP	Request For Proposal
RFQ	Request For Quotation
RJE	Remote Job Entry
RLE	Research Laboratory for Electronics
rn	read news
SDC	System Development Corporation
SJCC	Spring Joint Computer Conference (AFIPS)
SRI	Stanford Research Institute
TCP/IP	Transmission Control Protocol/Internet Protocol
TIP	Terminal IMP
UCB	University of California at Berkeley
UCLA	University of California at Los Angeles
UCSD	University of California at San Diego
UCSB	University of California at Santa Barbara
UNC	University of North Carolina
UNSW	University of New South Wales
Usenet	Users network
USG	Unix Support Group
UUCP	Unix to Unix CoPy
V6	Version 6 (Unix)
V7	Version 7 (Unix)
VMSnet	Virtual Memory System network
WWW	World Wide Web