Harvard Journal of Law & Technology
Volume 10, Number 1 Fall 1996

THE DIGITAL REFORMATION: TOTAL FREEDOM, RISK, AND RESPONSIBILITY*

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I. INTRODUCTION

It's an honor and a privilege to be invited to speak at this august institution. I must admit to having been a little worried about speaking here when I first got the invitation.

Worried because Harvard is, of course, an exceedingly learned institution and because the other speakers are illustrious, to say the very least. I became even more worried in the last couple of days because, unlike some of those speakers, I didn't come here to sell you anything. I will instead attempt to address the topic of the conference, "the Internet and society," and see where we get.

I was worried about speaking here, but I'm even more worried about some of the pronouncements that I have heard over the last few days, and in the last few months, on the subject of the Internet. I am worried about pronouncements of the sort: "In the future, we will do electronic banking at virtual ATMs!," "In the future, my car will have an IP address!," "In the future, I'll be able to get all the old *I Love Lucy* reruns — over the Internet!," or "In the future, everyone will be a Java programmer!"

This is bunk. I'm worried that our imagination about the way that the 'Net changes our lives, our work, and our society is limited to taking current institutions and dialing them forward — the "more, better" school of vision for the future. We've taken these existing institutions, simply put the words "virtual," "electronic," or "cyber" in front of them, and pretended that that is the apex of the future.

We have seen this kind of prediction in the past. To take an example from the 1950s: "In the future, housework will be easy because all your furniture will be waterproof." This appeared in *Popular Mechanics* magazine.[1] The future is not so cooperative: we do not have domed cities; there are no jetpacks; videophones are closer to myth than reality; and for the most part,

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* Adapted from the keynote address to the Harvard Conference on the Internet and Society presented on May 30, 1996.

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1. JOSEPH J. CORN & BRIAN HORRIGAN, YESTERDAY'S TOMORROWS: PAST VISIONS OF AMERICAN FUTURE 83 (1984) (citing a 1950 issue of Popular Mechanics) [an illustration from the book was available in Fall 1996 at <http://www.milk.com/wall-o-shame/waterproof.html>].

our furniture isn't waterproof. Furthermore, no one, back at that time, was thinking about stagflation, two-income households,[2] or a 50% divorce rate.[3] Those predictions were visions of some other, kinder and gentler future than the much-stranger one in which we now live.

And that is my concern: not whether the breathless prediction of industry pundits will or will not come true. My concern is that we face a much more disruptive, a much less benign, and a much scarier future than we are being told. The future is not something that simply happens to us. It is something we create, and we march toward it blindfolded by the comforting homilies of industry chieftains at our peril.

I try to be pretty careful about predicting the future. I like to try to follow Yogi Berra's advice that "[t]here's one thing I won't predict, and that's the future." You might consider this a handicap in my job as the director of a research lab. But looking at the future is hazardous, especially when you begin to believe your own predictions. I direct my research by looking as carefully as I can at the past.

II. THE DIGITAL REFORMATION

I didn't attend Harvard. I went to this strange little place out on the West Coast called Reed College, best known as the place where Steve Jobs dropped out.[4] Like the speakers who attended Harvard, I was required to study *The Iliad* and *The Odyssey*. Unlike those gentlemen students, I stayed awake during the lectures. In fact, I even took the following course, Humanities 210, where they made me read Max Weber's *The Protestant Ethic and the Spirit of Capitalism*.[5]

While writing this speech, thinking about an apt metaphor for the change that the Internet will bring, I pulled this book down from the shelf and started rereading it. Weber's book is a polemic that links the Protestant Reformation and the Industrial Revolution, in particular, Calvinism and the rise of entrepreneurial capitalism. This may seem a stretched metaphor to the Internet, but please bear with me.

Upon rereading Weber's book, I changed the title of my talk from the time I sent the abstract to make it a little bit clearer: The Digital Reformation.

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2. *See, e.g.*, *The Changing Family*, TIME, Oct. 1, 1990, at 72 (noting that dual-income households comprise almost 29% of American families with preschool children).

3. *See, e.g.*, *Splitting up: Research on Harmful Effects of Divorce*, COMMENTARY, Sept. 1996, at 63.

4. In fairness, both James Beard, the chef, and Gary Snyder, the poet, are better known for graduating from Reed.

5. MAX WEBER, THE PROTESTANT ETHIC AND THE SPIRIT OF CAPITALISM (Talcott Parsons trans., UNWIN HUMAN BOOKS 1989)

People bandy about the word "revolution" and think that they're being brave. Revolutions change political systems and governments. They're certainly disruptive. But the Reformation changed virtually everything about Western society: religion, government, scholarship, education and business. That is what the personal computer and the Internet are inexorably doing: changing not only what we expect them to change, but everything. I can't tell you exactly how things are going to change, but I picked three words around which to organize my thoughts. They are words that are often heard in discussions of the Internet — or rather, two words that I hear a lot and one I wish I heard more. I've chosen "freedom," "risk," and "responsibility" as a way to frame my comments.

I'm showing on the screen a plate from the Book of Kells, one of the most beautiful of the illuminated manuscripts that survive from Western antiquity. Western Europe, until the late 1400's, had extremely limited access to information.[6] The image is more art than text — multimedia if you will — and it brought a sense of awe and majesty to its subject. While it is important now because of its age, it was invaluable even in its own day because of the effort that created it. The ability to publish anything was limited to governments and the Church, which was almost indistinguishable from a government in the days of the Holy Roman Empire. The ability to own books was limited to the most wealthy merchants, the Church, and royalty because of the sheer expense of creating them.[7] The Book of Kells was a life's work of stooped Irish scribes in the dark abbeys of County Cork, and this, more than its innate beauty, made it and other books rare and valuable.

In fact, there is an anecdote about the Baron of Castellane, who bequeathed to his only daughter a copy of the *Corpus Juris*, the premier legal book of the time, with the mandate that she marry a lawyer in order to receive the book. Imagine something so valuable, a piece of information so valuable, that you'd marry an attorney just to get it. These images of the Book of Kells and the *Corpus Juris* help establish the context for Gutenberg.

The Gutenberg Press has, by now, become such a hackneyed metaphor for the Internet that I'm not going to spend much time on it. Gutenberg brought us from an era of books as rare and valuable works of art to one of books as thrifty and common vehicles for information, from an era of thousands of books to that of nearly innumerable millions.[8] It is interesting to note, however, that most of what we know about Gutenberg, we know from just bankruptcy records. Gutenberg was not a stunning success as a businessman,

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6. *See* R.A. HOUSTON, LITERACY IN EARLY MODERN EUROPE: CULTURE AND EDUCATION 1500-1800, at 133 (1988); ELIZABETH L. EISENSTEIN, THE PRINTING PRESS REVOLUTION IN EARLY MODERN EUROPE 12-15 (1983).

7. *See* HOUSTON, *supra* note 6, at 133; EISENSTEIN, *supra* note 6, at 12-15.

8. *See, e.g.*, EISENSTEIN, supra note 6, at 13-14. These numbers are not intended literally. They illustrate the impact of the press on information publication.

but he is not entirely to blame.[9] The technology to print comparatively inexpensive copies of manuscripts was necessary but insufficient to really make information accessible in Western society. It took something else, something far more radical.

It is worth commenting on the central reason that Gutenberg's business did not have the success of today's Internet IPOs: a minority of the population of Western Europe was literate at the time.[10] Gutenberg invented a technology for which there was a very small number of buyers.[11] It took Martin Luther to do something completely heretical. He translated the Bible from Latin to the vernacular German, and he convinced people to learn to read and interpret it for themselves. I'm not making a religious point, but a social one. He promoted the radical decentralization of the canon of the time, the religious dogma of the age. He encouraged individuals to make their own interpretations of the Liturgy at a time when the model of the Roman Catholic Church was to encourage people to seek interpretation from the institution, that is, from their parish priest. That was the only interpretation that was supposed to be trusted. Luther turned this on its head and said, in essence, "Go find your own deeper moral code. Go find your own interpretation that is distinct from that of the government or the Vatican."[12]

This was an incredibly radical idea, and, in fact, Weber's thesis in *The Protestant Ethic and the Spirit of Capitalism* is that one of the Protestant Reformation sects, the Calvinists, and their dogma of predestinationism led away from an agrarian existence and towards a calling, a profession, or a craft. Protestantism encouraged the accumulation and investment of capital rather than a consumption of capital. That encouragement, based on the tension between the desire to be successful in a worldly life and the injunction against sin and conspicuous wealth, led to the first widespread institution of entrepreneurial capitalism.

The beginning of the Reformation proceeded from the late 1460's to about 1520 or so — about 50 years between the invention of the press and the Reformation or about 50 years between the invention of an enabling information technology and the radical decentralization of the political and social power in Western Europe. From that point on, it was just a series of steps that led to the Industrial Revolution and our modern industrial society.

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9. *See* THEO L. DEVINNE, THE INVENTION OF PRINTING 385, 417-18, 425, 430 (Gale Research Co. Book Tower 1969) (1876).

10. *See* WILLIAM MANCHESTER, A WORLD LIT ONLY BY FIRE: THE MEDIEVAL MIND AND THE RENAISSANCE: PORTRAIT OF AN AGE 96 (1992). "[B]y the most positive estimate over half of the Continent's male population was illiterate, and the rate among women was higher — perhaps 89 percent. . . . Exact calculations are impossible."

11. *See, e.g.*, DEVINNE, *supra* note 9, at 512; ELISABETH GECK, JOHANNES GUTENBERG: FROM LEAD LETTER TO THE COMPUTER 54 (1968).

12. *See, e.g.*, PAUL ALTHAUS, THE THEOLOGY OF MARTIN LUTHER 53-63 (Robert C. Schultz trans., Fortress Press 1966).

This year is the 50th anniversary of the first digital electronic computer, the ENIAC, at the University of Pennsylvania.[13] It's the 25th anniversary of the microprocessor.[14] The Internet is over 25 years old, depending on where you place the beginning,[15] and it's the 20th anniversary, more or less, of the personal computer.[16] This is something I have not heard so far this week: the technology we're discussing has become an "overnight success" in 25 to 50 years. It's been around for a while, and I think that having had the 25 to 50 years to gestate, we are in for changes on the order of magnitude of the Reformation. I'm going to examine each of those three words that I put in the subtitle of my talk — freedom, risk, and responsibility — and hope that they give us an idea of what may change.

III. FREEDOM

Freedom is a word that gets bandied about quite a lot on the Internet and in the context of new digital media. Unfortunately, I believe it is often misused. People talk about freedom in the context of the Internet when what they mean is the freedom to watch any TV channel they like. This is not my idea of a fundamental human right: the freedom to merely consume information. I am talking about a more traditional definition of freedom of speech and the arts, but more importantly, the freedom to create speech and the freedom to communicate speech. In particular, I am concerned with what we can call "personal authoring" or "personal publication." I don't like those terms, but they're as good as I've come up with so far. Both of those words are mired in a little bit of oldthink, implying overt acts of volitional publication such as the printing of a book. I have in mind a more expansive notion, but these phrases will have to do for the moment.

We had a great talk last night from Harvard President Neil Rudenstine about the educational process as a mutual creation based on the sharing of ideas. I think that the thing that we need to emphasize about the Internet is not that it's a giant digital library or that it's a vast encyclopedia — two metaphors that I've heard people use[17] — but that it is a mechanism for person to person communication, a mechanism for personal authoring.

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13. *See* NANCY B. STERN, FROM ENIAC TO UNIVAC 1 (1981).

14. *See* MARTIN CAMPBELL-KELLY & WILLIAM ASPRAY, COMPUTER: A HISTORY OF THE INFORMATION MACHINE 236 (1996).

15. *Id.* at 293.

16. *Id.* at 240.

17. *See, e.g.*, Robert E. Calem, *The Network of All Networks*, N.Y. TIMES, Dec. 6, 1992, Business, at 12; Anne Gregor, *Navigating the Kids' Lane on the Infobahn*, L.A. TIMES, Oct. 16 1994, Calendar, at 91.

We mistakenly went down a very strange road a few years ago. Al Gore popularized the term "Information Superhighway."[18] For George Gilder, it was the "Telecosm."[19] And to Nicholas Negroponte, it was "Being Digital."[20] All of these digital pundits were predicting interactive television. Interactive television: a mechanism that existed solely for delivering vast amounts of advertising and entertainment to your home and possessing only the ability to send back enough information to pay for it. This misguided prediction of the future set us back a number of years. The telephone companies and the cable companies spent years — and tens of millions of dollars[21] — saber-rattling over who was going to own the pipes that carried this digital tidal wave into your home. They all failed to realize that the Information Reformation is about personal information. The reformation is not about the same old stuff turned into bits and delivered to your doorstep in a slightly new way. It's about creating things on one's own — interpreting the digital dogma on your own and contributing back into the stream.

In 1450, "freedom of the press" accrued only to institutions that could afford to pay the equivalent of many years' wages for a single copy of a book. Then Gutenberg, followed by the attachment of the steam engine to the press, brought us the penny-dreadful, Charles Dickens, and newspapers. Personal computers, Xerox machines, desktop publishing and laser printers brought the ability to *print* to almost anyone, but the ability to *publish* — to reach a meaningful part of one's culture — still accrued to those who could afford either delivery trucks or television stations or satellites.

The Internet has become the distribution mechanism for he disenfranchised and the unpublished. This includes, of course, the bad novelist, the mediocre cartoonist, and the amateur film maker. It also includes demonstrably false "press releases" from Mexican guerilla organizations, right-wing hate speech, and conspiracy theories of all manner of nutcases. Note that the respected journalist Pierre Salinger was recently taken in by a self-published manifesto concerning the crash of TWA Flight 800.[22]

Critics commonly respond that our citizens are "couch potatoes," interested only in mindlessly consuming what it thrown at them. In argument to this, I hold up a Web page that I pulled off the Internet recently

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18. *See* Gene Koprowski, *The ASAP Interview: Vice-President Al Gore*, FORBES ASAP, Dec. 4, 1995, at 134.

19. *See, e.g.*, George F. Gilder, *Telecosm: Feasting on the Giant Peach*, FORBES ASAP, Aug. 26, 1996, at 84.

20. *See* NICHOLAS P. NEGROPONTE, BEING DIGITAL (1995).

21. *See, e.g.*, John Wilen, *Phone, Cable Companies Pave New Superhighway*, PHILA. BUS. J., Aug. 9, 1996, at 9; Karen Kaplan & Amy Harmon, *The Telecom Reform Bill: Impact and Technology; Once It's Law, The Action Begins*, L.A. TIMES, Dec. 21, 1995, at D2.

22. *See* Jonathan Varkin & John Whalen, *How a Quack Became a Canard*, N.Y. TIMES, Nov. 17, 1996, § 10 (Magazine), at 56.

containing a hand-colored picture of a dinosaur, labeled "Fruitosaurus."[23] It is not the most attractive home page that I have run across, but it is interesting because it was "authored" by a kindergarten class and drawn by a boy named Ryan. I'm sure there have been a lot of people talking about children getting on the Internet, but one of the things that I think we discount, especially when we start talking about the Internet as a place simply to receive information, is the intense creativity inherent in many people and especially in children — at least before we often grind it out of them. Not every individual will develop a flashy home page, but the Internet is full of spontaneous acts of creativity, from Ryan's Fruitosaurus to your neighbor's photos of spouse and children to your colleague's collection of "bookmarks."

"Whoever controls the language, [whoever controls] the images, controls the race."[24] With that quote, Allen Ginsberg pointed out the prime roles that communication and media take in our culture. As a society, we are at a juncture where we must ensure that the Internet becomes something more than a new vehicle for all the old advertising, the old journalism, and the old politics that we have in place today. It must become a mechanism for personal expression in an analogous way to the rise of personal expression after the Reformation. Like Luther's Reformation, this one is about shifting control of the dogma and about who will control the canon and the images that define our culture.

IV. RISK

Free speech, such as I just talked about, is a precarious enterprise. Free speech is fine as long as it's your speech, yet when it's somebody else's speech that you don't like, you get kind of worried and end up with things like the Communications Decency Act.[25] Many of these risks of the Internet overall have been covered here this week, and I'm going to concentrate on just one of them.

Nicholas Negroponte coined the phrase "the digital homeless"[26] to describe those who do not have access to modern Internet media. I'm less concerned about the digital homeless than I am about what I might call "the

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23. *Dinosaurs On Parade* (visited Dec. 14, 1996) <http://www.hipark.austin.isd.tenet.edu/home/projects/kinder/dinosaurs/dinosaurs.html>.

24. NICHOLAS JOHNSON, TEST PATTERN FOR LIVING 2 (1972).

25. The Communications Decency Act is part of the Telecommunications Act of 1996, Pub. L. No. 104-104, tit. 5, 110 Stat. 56, 133-43 (1996) (to be codified in scattered sections of 47 U.S.C. and 18 U.S.C.).

26. *See Negroponte Attacks Laws Designed By the "Digital Homeless"*, WASH. TELECOM NEWS, Feb. 5, 1996, available in LEXIS, News Library, Curnws File.

digital clueless," those who have access but who lack the skills to make use of the new communication tools. They are the illiterate of the new age. The digital clueless will become nearly unemployable because they are unable or unwilling to use computers and networks. It seems that before long the only jobs for that kind of people will probably be in the U.S. Congress.

Returning to our metaphor of the Reformation, we can easily observe the intense disruption in society that occurred as a result. Wars were fought, monarchs overthrown, and the very basis for the economy began to change. The Industrial Revolution replaced an agrarian society that was, by and large, self-sufficient. One produced enough to meet one's consumption and little more. Occasionally you would gather a bunch of people together and raise a barn or something like that, but by and large, it was a distributed, largely self-managing economic and social structure. The rise of industry required the construction of hierarchical management systems to ensure communication within the organization, within the factories. As the Digital Reformation takes its course, information rather than manufacturing is becoming the center of the economy, and we're beginning to see a shift back towards decentralized management models and decentralized work models.[27]

This is not always by choice. People are working more independently of central institutions, but, in many cases, they're doing so because they have been involuntarily downsized.[28] The unemployment rolls are swelling with the ranks of middle managers from the central part of the hierarchy, and people have been cast out into this world of distributed work with very few of the tools they need. Personal computers help, and the Internet helps. But by and large, we don't yet have the right technology for effective distributed cooperative work — a form that our industry of knowledge will be taking as it moves onto the Internet.

We have seen, in small instances, quite effective cooperative work on the Internet. The Internet itself is an example of cooperative work in many cases. But we do not yet have the technology for peer to peer communication. Technologically we're stuck in the mode of client/server where many independent PCs depend on a central resource for the mediation of communication. Our networks still model a hierarchical organization. I think that we need to pay a lot of attention to understanding the technology that enables distributed cooperative work and, on the social side, to understand what it means when we decentralize our organizations. I've addressed work here, but we need to understand the process of decentralizing government and a number

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27. *See, e.g.*, Price Colman, *Bottom Line Fuels Growth of Teleworkers*, ROCKY MTN. NEWS, Jan. 12, 1996, at 51A; Carol Kleiman, *Telecommuting Makes 'Virtual Office' a Reality*, CHI. TRIB., Oct. 29, 1995, at C1.

28. *See, e.g.*, Jennifer J. Laabs, *Downshifters: Workers Are Scaling Back. Are You Ready?*, PERSONNEL J., Mar. 1996, at 62; Stephen Franklin, *Layoff Lesson: Here to Stay*, CHI. TRIB., Jan. 2, 1996, Business, at 1.

of other institutions on which we have come to rely. This will be disruptive in the extreme but, I believe, is inevitable.

It is important to note that the PC and the Internet — now, and increasingly, as we get new technologies for distributed work — are truly useful only if users can find other people, band together, and cooperate. The creative ability for an individual in this distributed, cooperative environment, while greatly expanded over previous institutional structures, is currently limited by the technology for distributed communication and poor ease of use of that technology. We must build new technology that allows for interpersonal cooperation on the Internet. In the cooperation of individuals, we get a great deal of strength.

V. Responsibility

I don't know how T.S. Eliot knew about the Internet. But when he wrote "Where is the wisdom that we've lost in knowledge? Where is the knowledge that we've lost in information?," he identified one of its main problems: a surfeit of information and a paucity of knowledge. (I won't even touch the issue of wisdom.) Context turns information into knowledge. Context distinguishes a random piece of data from a fact that fits into a larger whole and makes a point, makes a difference.

Context is provided by society, but being on the Internet today is a lot like wandering around a shopping mall that's been neutron-bombed. There are beautiful store windows and all this beautiful merchandise enclosed behind glass. You can wander around in this place, but there are no other people there. It's a very spooky, very lonely feeling to be in a place where you see lots of rich information but have no idea whether people are crowded around it (unless the server is really slow) or whether no one is there. There is no context provided by the Web.

Is it any wonder that people are so interested in chat groups? They at least provide a little bit of social context. Unfortunately, it's not a lasting social context. Chat groups lack permanence, and therefore, the context they provide is fleeting and insubstantial. We have very, very few mechanisms on the Internet to provide a lasting social context.

Much of the talk, in fact, of government regulation of the 'Net is aimed at providing some kind of social context on the extraordinarily wide range of information available there. As I was pulling this presentation together, I thought about the motivation for that regulation, the need for context, and about what I can call "small 'g'" government.

It occurred to me that, at its best, government is community. At its worst, government is tyranny. (At the moment, in light of things like the Communications Decency Act, digital intellectual property litigation, telecommunications deregulation, and so forth, much of government seems

simply to be lunacy.) But at its best, the government or our community provides the social mores, the context in which we can interpret the information around us in the communication. At its best, government is neighborhood. The Network does need some control, but I am deeply uncertain as to whether that control can come from any of our existing national governments.

We need to create the means and the mechanisms to build community on the Network. In the absence of it, I think that we're doomed to see the Internet continue as a technological trinket and not as a fundamental social force. But in building these communities, we have to realize the 'Net is not a monoculture anymore. It was a monoculture back in the 70's and early 80's when guys like me—well-educated, white men with propeller beanies—were the only people online. But, at this point, we need to turn parts of the 'Net into neighborhoods—turn places on the 'Net into the analog of our neighborhood streets or our corner cafe or whatever things that help define our particular culture.

We have not solved the problems that people ascribe to the 'Net: alienation and a sense of separation from society when we're working, especially as we are forced to work in these distributive environments. So let's work on the neighborhood aspect of the Network.

VI. SUMMARY

The freedom we're talking about on the Internet is not the freedom to be the recipient of mass-produced information. It's the freedom to create that information, the freedom to communicate it, and the freedom to interact with other people on the Network, not just with other information. The means and the mechanisms to do this are through giving individuals creative abilities.

Of course, many people will say, "Well, you know, Joe Sixpack isn't going to sit down and create something on the Internet." I fundamentally and vehemently disagree with that conjecture. It is perhaps true that very few people write novels, but lots of people make phone calls. It is perhaps true that very few people paint artistically, but lots of people decorate their homes. It's true that very few people design clothing, but lots of people wear fashion in a way that's self-expressive. We need to think about casual, non-volitional creations—the acts that we do to live our everyday lives—as acts of personal authoring, as ways of being creative and expressive on the Internet.

This is the reason I was unhappy with the word "authoring" earlier. It connotes a formalism that I'm not trying to express here. We need to create the mechanisms to allow people to casually—as they use digital technology

in their everyday lives — create information that persists and represents who they are in a digital world.

We run a great deal of risk. The institutions that we have are going to be decentralized. They're going to be destabilized by the Network. You have heard and will continue to hear much talk about what the 'Net does to national borders, what the 'Net does to things like taxation, what the 'Net does to intellectual property. (Incidentally, intellectual property is a notion, however dear we may hold it, that didn't really exist before the Reformation.) Radical decentralization of the social and government structures is going to take place.

Specifically, I think we're going to see ever-more decentralization of work and we need to mitigate the harmful social effects by ensuing that we have the tools that allow us to work in a distributed manner, tools and applications that allow us to achieve greater results. It is ironic that the PC industry sold about 60 million personal computers last year[29] and those computers largely sit on desks, unused and turned off. The total amount of computer power memory and disk space available on those computers vastly exceeds all of the mainframe computers ever sold or that most likely ever will be sold.[30] Yet much of this vast computer power goes unused because of the bottlenecks imposed by the old, hierarchical style of communication.

We need to be able to effectively use those tools that are in place (or rapidly being put in place) in a cooperative way to give individuals greater power to work together. That establishment of community is what will really knit the elements of this vision together. We have an absolute moral obligation to bring our community to the Network. If we don't do that, the 'Net will continue to be nothing but a technological marvel, and we'll continue to hold conferences on it until its hype bubble bursts and we go on to the Next Big Thing.

I said at the beginning of this talk that I wasn't going to try to predict the future, that it's too dangerous an enterprise. But what I meant was best said by Alan Kay: "The best way to predict the future is to invent it." Some of us are in the business of inventing technology that will make this vision of the future possible. All of us are responsible for inventing the culture and the community that will create the Network of the future, and all of us are

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29. *See Storage: 90 Million Drives, 61 Million PC's Sold in 1995, According to Trendfocus' Storage Demand Analysis System (SDAS); 1996 Outlook is Bright*, EDGE: COMPUTING REP., Apr. 1, 1996, *available in* LEXIS, News Library, Curnws File.

30. It is impossible to measure precisely the amount of memory on computers that have been or will be sold. For a discussion of personal computers and mainframes, see Paul Taylor, *The Struggle for Computing Supremacy*, FIN. TIMES IT REV. OF INFO. TECH., July 5, 1995, at I, *available in* LEXIS, News Library, Curnws File; Evan Schuman, *Mainframes Live On, Study Says*, COMM. WK., Jan. 15, 1996, at 19; Jerrold M. Grochow, *The Reincarnation of the Mainframe*, PC WK., Apr. 8, 1996, at E12.

responsible for carrying forward this digital reformation and ensuring that it turns out the way that we want.