REVOLUTION IN TECHNOLOGY

Leader: CHRISTIAN J. DESROCHERS
Moderator: THOMAS M. MARRA
Speaker: GEORGE GILDER*

MR. CHRISTIAN J. DESROCHERS: I've enjoyed my term as Product Development Section chairperson, and at this point I'm going to turn it over to Tom Marra, incoming chairperson.

MR. THOMAS M. MARRA: Our speaker is George Gilder. He is a Senior Fellow at the Hudson Institute and a graduate of Harvard University. He's the author of nine books, including *Life After Television, Microcosm, The Spirit of Enterprise*, and *Wealth and Poverty* and is currently working on a new book on computers and telecommunications to be entitled *Telecosom*. Mr. Gilder was a pioneer in the formulation of supply-side economics, and he has consulted regularly with key figures in both the Reagan and Bush administrations and with leaders of America's high-technology businesses. His major work is *Microcosm* which, and I'll read this one, explains the quantum roots of the new electronic technologies and maintains that the law of the microcosm requires decentralization of both business and government. He'll explain that.

Long expected to favor large capital-intensive bureaucracies, the new technology, in fact, impels a global revival of entrepreneurship. That I understood and I like it. Mr. Gilder has given several hundred speeches around the world to major corporations and to conferences on business, technology and telecommunications issues.

MR. GEORGE GILDER: Well, this is going to be an exciting decade. You often hear that somehow our children are going to not live as well as we do, that we're going to sink in some law of debt over the next 10 years or so, that recent years have been years of rampant consumption and have failed to prepare anything for the future. I think this radically misunderstands what America has been about over the last 10 years. To give you a vision of the change I think is going to transform all industries over the next 10 years, it helps to have a vision. I'd like to offer a vision of sand and glass and air.

The sand comes in the form of a silicon sliver the size of your thumb nail, inscribed with a logical pattern as complex as a street map of America switching its traffic in trillionths of seconds. This year, the microchip contains about 20 million transistors. Within the next 10 years or less, or really within the next seven or eight years now, it's going to be possible to put a billion transistors on a single sliver of silicon. Now, a billion transistors is equivalent to the central processing unit of 16 YMP super computers. That's the top-of-the-line super computer made by Cray Corporation, and 16 of them would cost some $320 million to purchase. Within 10 years, it's going to be possible to inscribe that kind of super computer power on one chip manufacturable for less than $100.

This means that in the next 10 years, far from slowing down or maturing or exhausting itself, the power of the microchip will increase about a millionfold. The cost effectiveness of the microchip will increase about a millionfold. I submit this is the most important single fact in the world economy. Because the microchip is not a neutral force. It's a centrifuge. It flings intelligence from the centers to the fringes of all organizations and all industrial structures and all information systems. To see how fast this chip technology functions, how fast the centrifugal force operates, you can look at the computer business after 1977, when the microprocessor really began to have its impact. The microprocessor is the computer on a single chip.

Within 10 years, the number of both total computer power commanded by centralized systems with dumb terminals attached dropped from almost 100% in 1977 to less than 1% in 1987. In other words, the entire computer industry was completely transformed. The computer establishment was completely overthrown in 10 years. This effect was disguised somewhat, because when you think of the computer industry, you ordinarily combine the big machines with the little machines into one agglomerated industry. So the ascent of distributed technology was disguised by the continued sales of mainframes, but it was the fastest adopted technology in history and it did transform all industries.

Well, this technology of sand over the next decade will be joined by a technology of glass, and that is fiber optics. It comes in the form of threads, is as thin as a human hair, is as long as Long Island, is fed by lasers, is as small as a grain of salt, and is as bright as the sun. Today, these silica threads lay between Chicago and the East Coast and transmit about 2.6 gigabits a second. That's 2.6 billion bits a second. A billion bits. People talk about a billion pretty freely, but if you sat down and tried to count to a billion, I think it would take you 400 years of about 10 hours a day of counting. My daughter figured that one out. She's the actuary in the family, a 14-year-old, but I figured it's about right.

Anyway, the 2.6 billion bits a second is a tremendous pace, particularly compared to the capacity of the connections to your homes and offices. Some offices, small businesses and homes have the four-kilohertz-capacity phone lines, and to count to 4,000 is a less onerous task. What's essentially going to happen in the next decade is these kind of connections that run between Chicago and the East Coast and under the oceans of the long-distance lines will move to homes. This will impart about a millionfold increase in communications power in general.

Even this underestimates the power of fiber optics, because the true transforming impact that this technology is going to have is not yet well understood. Even 2.6 billion bits a second is a result of what's called the electronic bottleneck. Every time you amplify light waves for transmission, you have to convert them to electronics and then convert them back to photons again. Essentially, the light has to pass through an electronic bottleneck, and transistors can't switch much more than two or three billion times a second, and probably never will switch much faster than that. So there's this obstacle to using the tremendous true band width of fiber optics, which is about 75,000 gigahertz, which is essentially unlimited bandwidth. It means that if you really could tap the full capacity of these fiber threads as thin as a human hair, you could run all the communications of the country through one thread on Mother's Day, which is the peak.

REVOLUTION IN TECHNOLOGY

It's really true that fiber will not be a replacement for copper, as is often seen. It will be a replacement for air. Indeed, a one-fiber thread can accommodate a thousand times the bandwidth of all the radio frequencies currently used in the air from AM radio to KU band satellites. One fiber can hold all that capacity. Of course, there is the electronic bottleneck, the terrible limitations afflicting these electronic microchips. Until recently, far less than 1% of this capacity has ever been tapped. Now, in the last two years, IBM, Bell Labs and NTT in Japan have invented all-optical networks. All-optical networks mean that the electronic bottleneck is eliminated.

They have erbium-built amplifiers, which means that messages can pass through the entire network on wings of light and never have any conversion. You tune into the messages like radios. You're treated as if it's air. Your terminals tune in to the signal you want rather than having to process all the signals and find your own message. You envisage a fiber sphere emerging in which you tune in to your own messages. Everyone has their own frequency, and you tune into it, as the radio does today, and this will transform communications, just as the microchip put all industry through a wringer because it made transistors essentially free. That's essentially what happened.

Today, a transistor on a memory chip costs about two or three hundred millionths of a cent. This is down from about $7 which it was 30 years ago. So essentially transistors are free; the prime rule of thrift in business is to waste transistors, and we all do it. We waste transistors on playing solitaire. We do, don't we? We are correcting our spelling. There's nothing too humble to waste transistors on these days. Essentially, businesses thrive by wasting the cheapest resource, and the cheapest resource really is mips and bits resulting from free transistors, and that's what's happened over the last decade.

It had its first impact on the computer business, and the second big impact will be on the broadcasting establishment. If you look at the structure of the broadcasting establishment, you'll see that it's top/down, master/slave hierarchy closely resembling the mainframe hierarchy with the dumb terminals attached. There were a few thousand mainframe computers and hundreds of thousands of dumb terminals. That was the general architecture of information technology. In the broadcasting industry establishment, there are 14,000 local broadcasting stations plus a few networks, and they don't even have dumb terminals attached. They have idiot boxes. So the computer's next impact will be on television.

My new book is *Life After Television*. It's essentially about this transformation from a world with just a few transmitters and lots of receivers, which is the broadcast model, to a world where potentially there are as many transmitters as there are receivers. Telecomputers will be connected to the fiber sphere and will tap into any database, library, film center, church, theater, or university classroom, in the world. You can walk through the halls of the Louvre looking at your favorite pictures, having them explained to you in your living room. It's a real transformation of entertainment and information tools that will blow away the broadcast establishment over the next decade.

Essentially, every telecomputer in a living room will be as powerful as a broadcast station is today, just as the impact of the computer itself, the work station, gave

every actuary or engineer the previously creative powers commanded in the industrial age by factory owners and tycoons. In other words, there's tremendous distribution of intelligence and creative power at the heart of this system. The effect of the fiber optics is to render communications power essentially free. So all of a sudden, you prevail by exploiting communications power. Bandwidth becomes free. When bandwidth is virtually unlimited, you don't need switches anymore because you can tune in. You don't have to switch. Phone companies that regard their crucial expertise or core competence as switching, as they all do, will discover they face a technology that doesn't use switches, but that uses passive optical systems, which are incomparably cheaper. Already today the cheapest bandwidth on the face of the earth is a prototype all-optical network at IBM. It connects all the various laboratories of IBM around Westchester County. It's a 9.6-gigabit network and it costs $16,000 per terminal to build and this is crafted out of prototype equipment. It's just going to blow away all the existing kind of network systems over the next decade.

So there is the technology of sand and the technology of glass. It's going to be joined by a technology of air. The fiber sphere will be surrounded by the atmosphere. We're in Washington, and in Washington people imagine that we're running out of air. If you go around the precincts of the FCC, you will see 10,000 lawyers surrounding the FCC, and they're all arguing that the spectrum is a scarce, wasting resource. It's a precious, natural endowment that has to be parceled out to the world carefully by politicians sensitive to all special needs of all their constituents. The fact is that air is virtually infinite and that spectrum is not scarce at all.

To get a picture of it slightly, what you're really doing with fiber optics is using the infrared portion of the spectrum, which is 10^{14} and you're channeling infrared light down these wave guides. But infrared light can also be used for wireless local area networks today. An old pioneer of the fiber optics business was Will Hicks, who invented single mode fiber. He also invented the first infrared wireless local area network. It was recently bought by the BICC, the British cable, for $6 million. If you can use infrared for local area networks, and Motorola can use 18 gigahertz for local area networks, it really shows that the spectrum is much more capacious than anybody imagines.

Virtually all telephones are essentially going to be portable, digital cellular devices, over the next decade. The most common personal computer is going to be a digital cellular phone that you carry around with you. It will recognize speech. It will collect your voice mail and electronic mail. It will navigate streets. You will plug it into your car. It will be your agent and notebook and it will be the most common computer.

The air is not scarce either. We have to face a world where the key resources are the cheapest resources, which, in part, are always the best products. They're essentially centrifugal in their architecture, because all these technologies are technologies of wires and switches. In the computer industry, the wires and switches are laid out across the silicon substrate of microchips. In the telecommunications industry, the wires and switches are laid out across the mostly silicon substrates of continents and sea beds, but they all are one essential technology and it's a centrifugal technology.

It's also, of course, an information technology. The heart of your business, of course, is information, and yours is an information business. So these tools are going to be

central to all your activities in the next decade. The insurance business has been kind of a last bastion of the mainframe computer and the big centralized computer system with the dumb terminals attached. It's changing, of course, but it has been peculiarly resistant to the kind of centrifugal effects of the technologies to date. I think that's because these technologies still have remained expensive. Memory and storage technologies have been particularly expensive. It's been harder to distribute large quantities of information than in the past, but memory technology is on just a fabulous learning curve today.

Today, people are figuring out how to have movie central, how to have a centralized movie data base from which you can tap into 15,000 movies from anywhere in the country. It will blow away Blockbuster, which gets half its profits, incidentally, from late charges. That's true. That's how the business works. It tries to trick you into not returning your movies. For a movie central, probably the cheapest thing to do is to have 15,000 two-gigabyte hard drives that cost a couple thousand bucks or less. The big centralized DASD systems are no longer going to be cost-effective. RAID drives and all these other systems will essentially function with work stations.

I think this is going to affect all industries, but I think it's going to have a special impact on insurance. The big insurance companies are really now suffering a kind of socialization by regulation – regulatory socialization – because the government has increasingly gone into the insurance business. As far as I can tell, when the government goes into the insurance business, it doesn't appear to consult actuaries. It seems to me the government defies the principles of actuarial soundness in any insurance venture it launches, including moral hazard.

Moral hazard. I like the example of the building, after the chemical changes that occur in buildings when the insurance pay-off rises above the value of the structure. Spontaneous combustion often results. Almost all government insurance programs have defied the principles of moral hazards.

For example, we have disability insurance programs that essentially promote disability, encouraging people to cultivate their disabilities into completely crippling conditions. The program Aid for Families with Dependent Children is another example. It was designed as insurance against orphans, against the death of the spouse, or some other catastrophe. Now people in inner cities, which I used to spend most of my life writing about, often orient their whole lives around this so-called insurance system.

Deposit insurance has the same kind of moral hazard problem. If you insure deposits, you effectively insure the loans and the assets as well, and so you defy the principle of moral hazard again.

What's now happening is that the government, it just seems to me on the surface, and I'm not a great student of your industry, is increasingly imposing on you the same kind of principles that govern its own business at the government level. This is reducing the flexibility and resourcefulness of the big insurance companies and is exploiting their opportunities according to true actuarial principles. As in the banking business, where now real banks only have about 40% of the market share in banking, there will be all sorts of new kinds of entrepreneurial insurance schemes

using the new technologies that are emerging. All businesses will be transformed over the next decade.

I think there's going to be a new environment of decentralization in insurance. Companies that transform themselves from hierarchies into heteroarchies -- that is, from master/slave organizations into peer networks of largely autonomous entities -- will prevail in the next decade. I think all companies do have to ultimately adapt to this structure of the basic technologies that govern the evolution of business. I think that's going to happen very rapidly over the next decade, and it's going to be a thrilling and exciting time to be alive and in your business.

FROM THE FLOOR: Were the economic growing years a result of the PC or was the PC a contributing factor?

MR. GILDER: In 1982 or 1983, Carl Louis Schultz, who is head of Brookings and was previously head of Carter's Council of Economic Advisors, debated me on MacNeil-Lehrer, I think. He said that all my stress on computers was a mistake, that computers constituted well under one percent of GNP and they couldn't have any basic impact on the future development of the economy. Five years later, we learned that fully 60% of all the productivity gains in the U.S. economy in manufacturing during the mid-1980s -- and this was the period of fastest productivity gains in manufacturing of the entire post-war era -- came from the computer industry alone. That's computer manufacturing alone. So computers have been absolutely central to the evolution of the economy and are the driving force.

It was a great commitment that the United States made. It's why the 1980s were not lost. During the 1980s, every year compounded, there were 28% more software engineers than the year before, and 43% more computer scientists than the year before. The U.S. ended the 1980s with three times the computer power per capita that the Japanese or Europeans commanded. That's mips per capita, number of millions of instructions per second in capita.

We chose digital electronics rather than consumer electronics as the prime target of our economy, and it was generally a market-chosen target. In the next decade, digital computers are going to take over consumer electronics. So really computers were central to what happened during the 1980s.

FROM THE FLOOR: Another area of technology that seems to be rapidly advancing, and that certainly seems like it might be relevant to life insurance, is the area of schematics. Have you done any thinking about the advances in that area and also about their interaction with the advances in the computer area?

MR. GILDER: The advances in the computer area were crucial to the advances in the genetic area, but it's obviously an area of fundamental importance to all health care, bioscience and the future and your extension of life, for example, although there are limits in that area. I think it is of vital importance. I think it's a different kind of importance, though, than electronics and communications. Electronics and communications have a more pervasive systemic effect, while bioengineering will have a tremendous impact on certain key areas. Maybe it will be even greater and more

important in the long run, but it doesn't have the same sort of systemic structural effect that computer technology does.

FROM THE FLOOR: It seems clear that the computer revolution has had a great impact on the work force.

MR. GILDER: During the 1980s, the U.S. adopted computers far more rapidly than any other society. During the 1980s, the U.S. also created far more jobs than any other society, in proportion to the work force at the beginning of the 1980s. I don't think it's a coincidence. I think any technology that generates new wealth, generates the capital that endows new jobs per worker ratios of all businesses, and thus increases the productivity of workers and thus facilitates the creation of new employment.

Technology has an antidote to its job-displacing effect and its capital generation impact. It creates new employment as it destroys old employment. Our experience so far has been it's created more new employment than it's displaced old employment.

FROM THE FLOOR: Do you see a possible change that the administration is having on some of these forces?

MR. GILDER: Well, it can move them to other countries. It happened so rapidly and effectively in the United States because we had a deregulatory climate and lowering marginal tax rates. We've already basically reversed that policy. We've had tax increases in 37 states at the federal level, and we've had reregulation proceeding at a tremendous pace. The result has been this kind of sluggishness, in part, and thus a couple of the candidates want to drastically increase taxes again. It's a well-tested formula, it works everywhere every time, to slow down economic growth and creativity. I think that's why we want the low-tax candidates rather than the high-tax candidates.

Government now takes 40% of GNP at all levels and people sometimes divert themselves by saying that certain foreign countries have even higher levels of government spending. But if you examine it closely, you see that the countries that have higher levels of government spending all have nationalized health care. In other words, health care is all included as government spending. In the United States, we spend more on health care than anywhere else, and we have heavily government-regulated and restricted and subsidized health care. But if you exclude health care from all these numbers, you find that the U.S. already has levels of government spending comparable to any of the major competitors in the world.

We are not laggards in government spending, if you include all levels of spending, of course. There is one way you can increase government spending heavily without any damage to the economy. There is this one way. If you find any candidate who's figured it out, it will work. That is, you increase government spending at the same pace, but you call it investment and that will solve the problem. I don't know if anybody has figured that one out though.

FROM THE FLOOR: You've been a student of the inner cities. You've been a student of technology for the last 10 years. Have you, in your mind, joined those two bodies of knowledge and come up with any hope for the third-world countries?

MR. GILDER: I think that what essentially the inner city needs is emancipation from this socialist regime that exists within our own borders. Essentially, the inner city is a last bastion of socialism. Everybody gets their check from the government. They get their education from government schools. Their housing is mostly either government run or rent controlled, regulated and coded. So there is essentially a socialist regime in the middle of a capitalist country. We have other socialist regimes on Indian reservations. Socialism doesn't work any better in the United States, maybe worse, than it did in Eastern Europe. What you really need to do is find ways to emancipate the inner city from this kind of regime. Enterprise zones are an effort in this direction. I think the telecomputer is going to be very important. I spent time in the inner city and wrote about it. One of the first things that strikes you is the television. There are television sets everywhere. They all have television sets and they're always on, just all the time. They virtually live in this TV world. It's the cheapest form of entertainment in history, but it also is a form of cultural transmission that is very destructive. All the messages it sends argue for immediate gratification, immediate goals, and it's hostile to the kind of deferred gratification in long-term goals that are necessary to succeed.

I think that telecomputers will be cheap and powerful and will allow people in the inner cities to educate themselves. It will improve their opportunities more than anybody else. In the suburbs, you already have access to libraries, to all sorts of other information sources, and to special instruction and training programs. An array of information tools is available. It will be a truly new development to be able to have cheap access to the Louvre, or to Cal Tech, or to the best math teachers in the world, from your living room. That will truly transform the opportunities in the inner cities. It won't solve all the problems. You do have to have families. I mean, that is a rule of human life. The nuclear family is not an optional kind of system, so you have to reconstruct the welfare system and other things. I can talk about this later, but there is a positive impact of computer technology on even this problem.

FROM THE FLOOR: As information has exploded from the center out to the fringes, are there going to be any problems with the anarchy of information that will have to be resolved in the future?

MR. GILDER: Yes. I think there will be a lot of work for people who structure information and who package it, and who make it available in dependable forms, and who reconcile conflicts. The editorial function will not disappear. Newspapers won't disappear, contrary to what people think. I think newspapers will gain power in this era. The fact that they're resisting campaigns of the phone companies to deliver information is incredibly short-sighted, because newspapers are great collectors of information. In many ways, they probably are the best collectors of information. The reason they have trouble competing with television today is because of timeliness. The newspapers have to await the pleasure of the Teamsters Union and the Printers Union and the 12-year-old boy on a bike to deliver their product.

Through telecomputers, you could call up your newspaper database at any time and get as many stories as you want, at the time you want them, including archives and other stories written in previous periods, and you could really blow away video and pictures and everything else. This would completely blow away CNN which, as a rule, can't devote more than two minutes to any story; not because people want only two minutes of the story that they actually see, but because people will zap if there are more than two minutes of any story they don't want to see. So it's an entirely negative formula. If you do a positive formula where you can read or see as much as you want of the stories that actually interest you, you're going to have a much more effective system.

I think there will be multiple entities. A unique American asset are these coax lines that we have to 60% of the nation's homes. They are effectively one-gigahertz line. That means they can transmit billions of bits per second in the digital domain potentially, and it's a broad-band connection to 60% of America's homes. No other country has this. Cable is very undeveloped in virtually all other countries, except Canada. So we have this unique asset, which means that we can move the digital revolution to the homes in America faster than any other country, provided the cable company connects its coax to fiber or collaborates with the phone companies in tapping into phone company fiber. Cable has a great role to play in this emerging technology.

Power companies can lie fiber down the ground lines of the power companies. Fiber is not affected by electrical current. The fourth biggest fiber network is owned by Williams Natural Gas Company of Tulsa. Williams was created when the oil and gas industry collapsed in Tulsa early in the 1980s. Everybody was mystified when Williams was buying up obsolete natural gas pipelines that were the wrong gauge and that seemed worthless to everybody. It bought them up for virtually nothing and now has the fourth largest fiber network running through natural gas pipes.

FROM THE FLOOR: Can you discuss what you might think would be inappropriate uses of the new technology? For example, I read a story once about somebody who was talking about the ability to put 14 or 15 books on a CD and then spending $300 or $400 for a CD reader to read the book, which he thought was kind of dumb when you can buy a pocketbook for $4.95. Are there any inappropriate uses you see that might fall by the wayside?

MR. GILDER: Well, that example doesn't cut it. You can put 600 big books on one CD, and probably more, as compression technology advances. Also, the new generation of CDs will be about two gigabytes of a CD, which will equal 2,000 books. A very efficient way to publish books is CDs. It's not inefficient. It's cheaper than pocketbooks. Now, I don't say that we aren't going to have pocketbooks for quite a long time, but it really is true that the publishing industry has to address the ways of using this technology to deliver information.

One of the keys to it is encryption. A company called Cryptologics is about to burst forth on the world and really transform modes of distributing information of many different kinds by encrypting and metering information. So that rather than buying a CD with 2,000 books on it, essentially 2,000 books worth of information that would cost tremendous amounts of money, or buying some tremendous huge insurance

database, or whatever, which would cost millions of dollars to purchase, you buy it encrypted on a CD and then pay only for each time you decrypt something. There's a meter attached to the computer.

This is technology that already exists in sideband FM. It goes to your cryptologics center and the center then bills you. You get billed or you get debited for your use of the information. You can get a huge database on a CD ROM or on a group of CD ROMs. The ROM can be right on your desk and you only pay when you access it. You pay far less than you pay for on-line databases over the phone lines, which are cumbersome and uneconomical. All these databases are tremendously inefficient. As soon as you get this kind of encryption scheme, tremendous amounts of information could be put within the reach of each agent, or each actuary, or each person in an organization and you wouldn't have to pay for it all every time. You don't have to pay for the reservoir each time you want a glass of water.

FROM THE FLOOR: I was curious because you had mentioned the transformation in computer technology away from the top/down, master/slave hierarchy. What effect do you think that will have on the hierarchy of business organizations?

MR. GILDER: Well, it's already happening. It means that middle management has to be redeployed out of hierarchical structures into more autonomous peer structures. A real transformation of business structure is underway at this moment. You see it all around you. Where it hasn't happened yet, where the industry hasn't adapted to the meeting of the microchip, this centrifugal mandate, those industries are in trouble, whether it's General Motors, IBM or the educational system. During the last 10 years, the education system is a 6% increase in students and a 108% increase in administrators. That's in a little over 10 years and that's the trouble with education.

John Chubb and Terry Moe showed that the more administrators per pupil, the worse the performance of the school, in general. This is a Brookings Institution study and this is the key to the problem of schooling. Too much money is spent on administration and middle management in an era when streamlined systems function much better adapted to the technology of the microchip.

FROM THE FLOOR: What effect are the communication networks going to have on the ability to develop the bandwidths and so forth? Do you see any effects on the way products are distributed and things are sold?

MR. GILDER: I think so. I think increasingly you could be much more intimate with your customers. Insurance is already sold in considerable intimacy with customers and that is good, and that effect will increase and apply to more and more products. You'll be able to adjust the product to the unique conditions of individual consumers and to a much greater extent than ever before. This change is occurring in all sorts. There's a book that has just come out by David Allen Malone, and I think it's called *The Virtual Corporation*. The essential point of it is that manufacturing decreasingly exists. Increasingly you'll have products tailored to each individual customer which, in turn, transforms what was previously a product produced at some central point and distributed to a product that is created in collaboration with the customer. It's a kind of virtual product, as they say, and that certainly you can expect in the future.

Increasingly, products will be tailored to each individual customer. If it's really tailored to the customer precisely enough, the customer will pay much more. There's a much larger margin available if you really answer the precise needs of a customer. I'm constantly faced with people from the broadcasters who say, "Well, what about our precious heritage of universal free TV?" That is just the worst conceivable advertising medium. You get everybody at once and you pay for the reservoir and get a glass of water, and the glass of water may be zapped.

Because targeted advertising is so much more effective than broadcast advertising, a smaller amount of advertising can support a larger amount of programming. Indeed, much of the advertising will become programming. You see the infomercials and all. Advertising that people actually seek out and want to consult is much more effective. When you buy a computer magazine, you don't resent the ads. The ads are part of the package and you want them there. If they weren't there, you probably wouldn't like the magazine. That's the way video will be. Targeted products, in general, work better and yield larger margins and are more profitable than mass-produced products. That's the real change that this technology imparts.

FROM THE FLOOR: If you could give the next president one piece of advice, what would that be?

MR. GILDER: Cut capital gains taxes. Really, the thing people don't understand is what it's doing. It may be beneficial, to some extent, to insurance companies -- I hate to tell you -- in some trivial short-term way, because it really does drive capital out of the hands of individuals who have an intimate knowledge of a particular enterprise or project or opportunity into mutual funds and insurance firms and pension funds and all these big entities that can aggregate out risk. The individual's ability to write off losses is very limited, which essentially means that you have to eat your losses and the government takes a third of your gains, plus inflation.

Virtually, in capitalism that kind of risk reward doesn't work. You can't really function that way. If you're a doctor in Silicon Valley who understands well a company down the street, you can't really invest it. You can't concentrate in that company. Instead, you have to send your money to Fidelity or somewhere and they invest in a whole array of known companies. So money is taken away from entrepreneurs who have specific understanding of the economy, and it's centralized and blinded essentially, because a centralized investment function just can't really respond sensitively to the huge array of opportunities in an entrepreneurial economy.

They hardly tax capital gains at all in Japan or Germany or most countries. In Southeast Asia, there are virtually no taxes on capital gains. We're almost the only ones who do it, and we've really had declining business starts for four years in the United States since we did increase it. It's really destructive, so that's the first recommendation.

It doesn't help to just cut the capital gains tax for long-term holdings, which is what people are constantly proposing. That's worthless. You have a long-term holding. When you sell it, you don't care if the person who buys it is going to sell it the next day. You just want a liquid market and a thriving market in which to sell your long-term holding. So having some special capital gains tax cut for long-term holdings will

1431

not increase the incentives to hold stocks a long time. As a matter of fact, the current system is supremely effective in inducing people to hold stocks for a long time. Right now, you can't sell them. To sell a stock -- that is, unless it's in your Keogh or something -- you have to expect it to drop a third. If you bought the stock, you didn't expect it to fall a third. In general, you don't sell. That's why returns from the capital gains tax have plummeted since the tax was cut.

FROM THE FLOOR: How do you think that the change in communications, from being basically a one-way direction to where you can put on your TV set and nobody knows what you're watching, to a two-way communication with target audiences and all that stuff, will relate psychologically with respect to people and privacy, or the desire for privacy and not having people know what you're watching, or what you're doing, or what they want, or what they like?

MR. GILDER: People constantly raise this question. I don't care, but I want people out there working to satisfy my needs. I really do. I think it's great to have all these corporations all around the country who know enough about me so they can supply me precisely the products I want at low cost. I don't think this is a negative. I think it's a positive. Now, in those few instances where you really want to be private, there is encryption and there is this market for private products of various sorts. I think those private needs can be satisfied. It's fundamentally impossible to use the technology in ways that are less personal. I suppose some of that will continue to be broadcast. As it is today, anybody is embarrassed by the idea that they're watching television shows. So, broadcast television is getting more and more embarrassing to watch and so it would escape that problem. So maybe there is a future for broadcast television after all.

FROM THE FLOOR: A follow-up question. There are other people making decisions about what you like based on what you do. What if they're wrong?

MR. GILDER: You don't buy their product.

FROM THE FLOOR: Yes, but you've been exposed to an alternative.

MR. GILDER: The whole nature of this technology is it vastly increases the alternative in choices to which you're exposed. It really destroys the whole nature of channels. If you have millions of potential channels, then you have choice. You're in control. The whole idea that this somehow moves control away from you is exactly contrary to the fact. This is a moment like the transition from trains to automobiles earlier this century. You get in a train. You have to go to the station on the schedule prescribed by the train management. You have to ride to a few destinations that are specified by the train system. It's all controlled from above and you adapt to the railroad system. Well, the automobile changed all that. It empowered individuals to get in a car and go where they want to go with the persons they want to go with.

That's essentially the change from the top/down broadcast system to the computer. Television is a tool for tyrants. You can really tell whether a country is democratic or totalitarian by the number of televisions it has in one-way communications devices compared to how many telephones and computers it has. In totalitarian countries, there are six times as many televisions as telephones, and the telephones don't work.

REVOLUTION IN TECHNOLOGY

In democratic countries, there are as many telephones as there are televisions. Essentially it's a liberating technology, not a technology that increases the control by malevolent, centralized powers. It's the opposite effect that you're describing, I think.

FROM THE FLOOR: You mentioned earlier the extremes that run through society. We've seen that recently in England. We've also seen it somewhat in our elections. Is there any way to bring society along faster so they are willing to adapt?

MR. GILDER: This is something that many people don't understand when they talk about this technology. Most of these new transistors are being devoted to the human interface problem, many of them are, and speech recognition will soon be pervasive. It's already pervasive at doctor's emergency centers and radiological centers where insurance premiums are reduced if you adopt speech recognition to replace the doctor's handwriting on these forms. It's true. Speech recognition will make this technology increasingly accessible in the next decade.

I spend all my time with computers, consulting and writing about computers and their technology, but my kids are better and more truly comfortable with computers than I am. They've been brought up with them. They live with them. When I need it fixed, I ask my seven-year-old to fix it. In 1989, 46% of the kids aged between three and 17, according to the census study, used computers regularly at home or at school. I don't know why they started at three, but that's what the census numbers were. This thing is really happening and it's a comfortable technology and will become increasingly available to rich and poor and to everybody as the decade proceeds.