

1984 -- Who Will Run the Machines

given by
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to
Central Washington University
William O. Douglas Honors College

I'm delighted to be here for two reasons: one to join the Honor College students and faculty of a sister institution in a state which has long had a strong attachment for education. I'm also particularly honored to come here as a speaker at the William O. Douglas Symposium. I had the privilege of meeting Bill Douglas on several occasions, and while I didn't always agree with his view of the world, I did respect his integrity and courage. His love of this country, and his belief that the people should live in harmony with the land and environment around them are important lessons.

In preparing my remarks I chose the title "1984 - Who will run the Machines?" I was fortunate to have had an experience last week which seemed to bring together all of what I was going to say, or at least put it in some kind of perspective. I've just returned from a week in New England and was reminded once again of how vividly that small and sometimes harsh land is a microcosm of our 400 years on this continent. We were preceded, of course, by the Native Americans who have lived here for eons, but European exploration and settlement of this continent began there. I was struck again by the tantalizing acquaintanceship I've had with a 17th Century ancestor. I don't pretend to be an Alexander Haley or to have searched for all of my roots, but fortunately the Evans family for years lived in and settled throughout New England. Acquaintanceship with that 17th Century ancestor was through a detailed probate of his modest estate which is now in the Connecticut State Library. In a wispy, Spencerian script, each kitchen utensil and article of clothing was carefully chronicled, labeled and valued.

An interesting measure of value of that time was the relative measure of a pair of cotton gloves, or a pair of wool pants, bedsheets, pots and pans. The items of real value, however, were neither those which were for the person, nor even the household. They were the farm implements and the farm animals, even more important than the value of the land they tilled. For those were the elements of survival and progress in what was primarily an agricultural society. Each succeeding generation settled within 20 miles of their ancestors. For more than 200 years they grew with New England and then in one outstanding leap moved 3,000 miles to the Pacific Northwest. Those colonial ancestors and their neighbors cut the sea of forest in New England, to plant crops for sustenance and each year plowed up new stones. No matter how often he plowed and how often he planted, each succeeding years new stones seemed to appear. They were carefully stacked in miniature Great Walls which stretched over hills and valleys separating each new homestead from the preceeding one.

Eighty percent of that population was needed to farm, to till the soil to produce the food for one hundred percent of that population. But industry quickly built to follow the European industrial revolution which had taken place not too many years earlier. Political revolution, came quickly in both Europe and America, followed by a new merchant class which rose and in turn built a new middle class. We were then at a cusp of change between two societies — one agricultural, one industrial. Soon textile factories and foundries dotted the New England landscape, followed by flour mills and whiskey stills, both attributes of the then modern society. Now in a visit to New England, you can still see those stone walls tracing the ancient boundaries of farms, passing, however, not between pastures but through new forests that reclaimed old farms and pastures as people had moved on to the cities and to other parts of this nation.

More land is forested in New England today than 200 years ago. Mills are closed and shuttered. Old dams have been breached and slowly but surely, Atlantic salmon are reclaiming their ancient spawning beds. But in gleaming contrast just a few miles away, Route 128, traces the center point of a new society. Low modern buildings pulse with the vitality of that new age. Bits, and bytes, and chips — a host of new words, even a new language, fill the conversation of those aging geniuses of thirty trying to stay ahead of their teenage competitors.

Daniel Bell in The Post Industrial Society and Alvin Toffler in the Third Wave and others have described and predicted this new society ahead. At The Evergreen State College, the most popular freshman offering by far is a full-time, year long, interdisciplinary program, titled "Society and the Computer". The fundamental theme of this year long program is a theme question to which students respond. The question posed is whether the current change in society caused by communications and the computer is equivalent to the change evolving from the Industrial Revolution.

Students in Fall quarter study the history and sociology of 18th Century Europe and compare those events during Winter quarter with today's sociological changes occurring through the dramatic development of communications and computers. As Spring arrives, the program culminates with a final term essay in which students analyze whether we now are at another time of change equivalent to that of the Industrial Revolution.

But it is easily as difficult to define a turning point in history, while living through it as it would have been for James Watt to clearly know the revolution he helped to create several hundred years ago. Only with the passage of time, and the understanding that comes with history, will we truly know whether this indeed, is such an era. Some things are apparent. We now feed ourselves and export surplus food to much of the rest of the world with less than four percent of our people engaged in agriculture rather than 80 percent a few hundred years ago. We now produce more basic industrial goods, of

greater complexity and greater volume with fewer workmen than ever before.

Many are troubled about future job security in a society which can feed itself and produce its basic goods with a shrinking percentage of a growing population. But in a knowledge and communication society which is dependent on brains and service, opportunities of a different nature will arise. Some are already beginning to evolve. New jobs and new professions will be born, mature and die in a person's working lifetime.

Recent surveys by Pacific Northwest Regional Power Council have been fascinating in this respect. We have been asked to predict the electric power needs of the Pacific Northwest for the next twenty years and to devise a plan for meeting those needs from a series of priorities in electric power production. One of the most fundamental elements, of course, to determine need is to measure the future population of the Northwest and perhaps more importantly, the jobs the people will hold. Interestingly enough, one of our most basic job producers, the timber industry, is viewed as being in significant difficulty today, not just because of current economic travail, but because the industry is undergoing a structural change. Timber will be grown more quickly in the American Southeast, in forests which will be closer to national markets. This movement, together with competition from other nations, portend a slow growth, or perhaps a decline in this important industry.

Yet as we move from that traditional industry to electronics, quite a different picture appears. One high technology company which is already located in the Pacific Northwest, has a current payroll of 5,000 employees in five plants in the four Northwest states. That firm predicts employment in the Pacific Northwest of 50,000 by the year 2000. This 21st century industry more than compensates for an entire natural resource base on which we've depended for so many years.

For those who are unduly worried about the decline in agricultural and industrial production, there is a potential bright future. A future which can be even better in terms of jobs and opportunities here in the Northwest than anything we've seen to date.

What are the demographics of this fascinating age? Unfortunately, not many public or private decision-makers know or understand well enough the immense impact of demographic change.

What happened in the 1970s? They were years of a rapidly expanding workforce. The war babies of the 1950s matured. Women went to work full-time in increasing percentages. A higher percentage of our people were in the workforce in the 1970s than in any other decade in the nation's history. The explosive expansion of work opportunities allowed absorption of this army of workers and perhaps the greatest miracle is that the current unemployment rate is as low as it is. More Americans are working than at any time in the past.

The coming decade, however, will be one of shifting tides, of shortage and restoration. Shortage of new workers will occur as the number of those maturing shrinks radically. Those reaching eighteen in 1990 will be 22% fewer than the number of eighteen year olds in 1980 in spite of a growing national population. That is ominous to those of us engaged in higher education, and those whose livelihood depends on the young. By decade end, however, restoration will begin as the resurgence in births which started in 1975 expands our student population and once again fills the schools of the nation.

We can make some pretty fair estimates of our employment challenges in the year 2000, for essentially all of the workforce of that year has already been born. We know, for instance, that it will be more black, more Chicano, more minority oriented, more sophisticated, more experienced, with mores and goals not yet known. The environment in which these twenty-first century citizens will live is also partly predictable, at least here in the Pacific Northwest. William Douglas' love of the land was not an unique love, it was love that was shared by a vast majority of Northwest citizens.

In 1975 the State of Washington initiated a broadly based citizen's effort to attempt to measure alternatives for Washington and to allow citizens to choose what they thought to be the most reasonable alternatives for the future. After intense discussion and effort, by a large and diverse citizens task force, an array of eleven discrete alternatives were chosen which could be described succinctly. They ranged from a high technology future to a foreign trade oriented future to one which emphasized industrial growth. Another emphasized protection of the land and the environment, while one built on the agricultural potential of this area. Interesting, two of the eleven rather disparate futures were overwhelmingly the favorite of Washingtonians. It made no difference whether the voters were from the rural areas or from the city. They chose an agricultural Washington and an environmental Washington. In 1975 that might have been an easy choice. Compared with today it was a time of relative stability, at least jobs were more plentiful. We were embarking on a three to four year period of strong economic growth. Why not then opt for a state which is desirable but perhaps not as productive in terms of jobs as some of the other future scenarios. More recent measures, however, have revealed essentially the same result. In poll after poll, test after test, people consistently have opted for strong environmental protection. It was fundamental to our forebearers and to each succeeding generation and it is unlikely to change very much. In 1980, in the face of property tax revolt across the nation, the voters of King County by more than 60% majority, passed a special property tax levy on themselves to purchase and preserve the agricultural lands of that urban community. Recently, local business leaders were asked if they supported environmental protection even if it caused some adverse economic impact. Over half of those business leaders said "yes". Washingtonians repetitively have supported a high quality natural environment and the investment necessary for its preservation.

If the future of our natural environment is predictable, human relationships are not. The future nature of families and communities are much more difficult to measure here as well as elsewhere. Will the decade long decline in public confidence in our fundamental institutions continue or be reversed? Will voters continue to ignore polling places in increasing numbers or will their public participation regenerate? Forty years have passed since World War II, and we have yet to elect a post World War II president. When a new generation president is elected, will support be kindled by a renaissance of the student activism and the social progress so typified by the youth of the 1960's? We're now poised at this potentially fundamental turning point, uncertain, fearful, worried even more about today's job than tomorrow's potential.

How then should we prepare this precious generation who will come to leadership at the dawn of the twenty-first century? A generation which will be asked to provide the wealth, the work, the investment, the support for a burgeoning number of retired citizens and an increasing number of youngsters coming immediately behind. Shortly after the turn of the century we will arrive at a time when a minimum of our population will be of work force years and a maximum will be either too young or too old to work. If we can pass through that difficult time we then begin to regenerate ourselves with a younger work force and those of us who potentially will live happily through retirement will be able to shuffle off to greener pastures.

Appropriate education for tomorrow's leaders must start with an understanding of today's society. Without being too brutal, success is too often measured by "what's good for me now?" In education, the measure of success in industry is probably the Harvard MBA. But the Harvard MBA over the years has brought to American industry and into the American idiom the term "what's the bottom line?" That's an unfortunate question, because that has been translated into, "what's the bottom line today, this year, this quarter?" If you can't make a profit now, if you can't produce, if you don't have instant success, then you have failed in your leadership responsibility. The fundamental question isn't even one of a longer term view, but of critical importance, "how did you get to the bottom line?" It's too easy now for people to use that term as an alternative for "the end justifies the means". We want instant gratification whether its from "how to do it" sex or religion as we search for unusual cults and new ways to be instantly rewarded. Even television news gives us what we think we have to know in sixty second bursts of intense sight and sound and precious little thought. Now the ultimate in instant gratification has arrived on the scene in the State of Washington. The lottery, designed so you don't even have to wait for the week's drawing but instead scrape away the plastic covering and find out whether you are five thousand dollars richer or, far more likely, a buck poorer. Temporary alliances proliferate. Friends are for a few fleeting instances, and then, they and you move on. Jobs and even marriages are temporary. This current television generation acts like a speeded up movie with actions hasty, jerky and unreal.

The current wisdom, especially during this period of economic difficulty is that we must restore the economic vitality of this nation, and to do so we must focus educationally on the "machine". There is an eerie sense of "deja vu" as we embark on Sputnik revisited. We have not had the dramatic nature of that event to build momentum, but nonetheless legislators and congressional leaders seek to rebuild our engineering schools. The demand explodes for business graduates, electronics technicians and software wizards. The emphasis is on the communications device, television, computers, and printers which eventually will bring newspapers and other wisdom into our homes. Satellite links and cable television will dramatically expand choice for viewers and learners. I had an opportunity within the last two months to visit the Advanced Research Laboratory at Hewlett-Packard and hear of fiber optic transmission which can send the equivalent in computer information of the New Testament every second. Biological analysis by computer frequently results in a better job of medical diagnosis by machines than by a doctor. Satellites crisscross the sky, unifying planetary communication. The emphasis on training engineers and technicians demands restoration of math, science, physics, chemistry, and biology courses.

No one seems to ask the critical question. "Who then runs the machines?" Who will decide what goes into those marvelous devices? What depth of analysis precedes entry, or are we going to be subject forever to the technician's jargon, the famous GIGO, "garbage in, garbage out"? Why should we be satisfied with garbage in? Humans must do the synthesis, and make logical decisions as to what is important to put into our machines? How are we going to communicate our understanding of need, and what we require from those mechanical memories? Who will have a deep enough sense of history to understand why we make the decisions we do?

Even more important than what goes into computers is how we will use the exceedingly large amount of knowledge we can produce. I visualize a decision maker literally drowning in computer output. Who will have a sensitive enough grasp of history to know how to use, and for what purposes, the results of this analysis? Who will understand how people will be affected by this new age and its sociological implications? Who is going to understand the logic necessary to use information and perhaps most importantly, who will stand up for the appropriate morality in the use of information?

If we are to prepare well for this troubling but exciting twenty-first century then education's role is exceptionally important. It's time, I believe, to abandon the "jump through the hoop" curriculum in both high school and college or university. Students continuously drive themselves into educational anorexia, seeking all "A's" on whatever courses will produce them, in order to move on to the next level of education. While technical training is critical in a technological society we must not ignore liberal arts education. But how do we recreate the renaissance man? How do we reconstruct a Thomas Jefferson who was not only a great writer and statesman, but an architect, author, politician, farmer, musician, craftsman, and

linguist. A man who avidly sought knowledge until the day of his death. But Thomas Jefferson was born just a decade after Newton died. He was just two generations behind Descartes, Pascal and many of the other discoverers of modern scientific methods. A liberal education in colonial days could be comprehensive with the knowledge then existing and a common curriculum could produce a person well educated in an exceedingly broad sense.

But today mathematics and science courses proceed from entirely different fundamental concepts. I serve on the National Science Foundation's Commission on precollege math, science and technology education. One of the nation's leading mathematics educators pointed out to the commission that we have expanded our knowledge of mathematics tenfold in the last forty years. He said the mathematics being taught in grade and high schools today is inadequate. We no longer need to struggle interminably through awful mathematical exercises, because we have access to cheap, accurate computers. We should instead, in grade school, be studying algorithms, probabilities and numbers to a different base than ten. New fundamentals should lead to the mathematics of a computer age. My education in high school was a pre-atomic science education, and in physics we only knew of four sub-atomic particles. Now there are over 150, and new ones are being identified regularly. Biochemistry and biophysics are the roadsigns of new and complex science disciplines. It's been estimated that over 80% of all knowledge in the world has been discovered in the past twenty years.

What then, should be an educational agenda for the twenty-first century? How can we respond to this focus on the machine? First I believe we should recognize the difference between training and education. Let the corporations and the technical schools and the community colleges to a degree, do the training. Let the colleges and universities rediscover the real mission for higher education which has uniquely been ours since John Harvard formed the first college on this continent almost 400 years ago. We need to make collectively a significant reinvestment in education if we care about our own future. Not just in science and not just in mathematics, although both may be important, but a broad reinvestment in education to regain the necessary civility which is an integral element of civilization.

Second, we must learn again how to teach our teachers. We must restore the importance of teachers and teaching and in doing so, restore the dignity and the respect necessary to attract inspired educators. If we cannot do that we have little hope at higher levels of education to enhance our potential. But that responsibility of teaching the teachers is ours.

Third, we must clearly understand that the years of formal education are merely the beginnings of a lifelong agenda of learning. A lifelong process that will require us to change jobs if not professions several times during a working career. One which will require us to respond to new concepts and new ideas that are as yet unknown and to find ways of educating ourselves sufficiently to

respond to those new ideas. For a formal education to be successful, it cannot depend on a common agenda or core curriculum as was so successful in the 18th century. I believe, however, that there are some common elements which are important to a formal education. We should start with history. We must establish where we are and who we are in the long stream of time, the continuum in which we live. We must recognize the need for cultural literacy in an increasingly multi-cultural world. There is no right society, there is no exclusive background, and we cannot expect to be fully educated studying only our European heritage. Our Spanish speaking populations will soon require a bilingual response. A new wave of immigrants floods America in a repeat of the 19th Century. The United States by the turn of the century will clearly be a multi-cultural society, much more so than it has ever been. Daniel Yankelovich in a recent article on colleges and universities, Too Many Missions, stated it well. He said "a single conception of knowledge one links with scientific methods and technology now dominates our culture. Other visions of truth, understanding, judgment, insight and need are assigned secondary roles. The loss to the nation is uncountable."

None of these elements relate directly to subject or discipline as much as concepts or fundamental missions of our unique educational system. The connecting thread must be communication. Linkages which are direct, concise, accurate, and potentially beautiful. The language not only of words but of numbers, symbols, music, thought and gesture. Communications to translate the knowledge of one generation to the next.

Shortly, we'll have machines not only to store and retrieve knowledge, but machines to synthesize, to sort, to analyze, to think about and to make decisions based on the tidal wave of information surrounding them. Machines will run other machines. But the fundamental question still, 1984 or 2004, "who will really run the machines?" Systems can grow so complex that breakdown could prove catastrophic. Last night some of you may have heard Felix Rohatyn, an expert on finance who helped preserve New York City's financial health. He was on "Face the Nation" and he predicted a window of financial vulnerability for the world within the next two years. Development of electronic transfer of artificial Euro-dollars, the International Monetary Fund, and international banking made possible by machines, has created a complex interlocking financial world. However, if these systems fail, it is likely to be from human error. Not human error in programming the machine itself, but in fundamental decision making.

Ultimately however, it's not the machines, it's you, or we, who will run the machines which will determine the course of the twenty-first century. How wisely, how logically, how morally, depends largely on our understanding. Understanding, not of the science and technology of the machines themselves, not physics, electricity, chemistry, or even science at all, but our understanding of history, philosophy, logic, morality and compassion. Art, music, and literature still represent unique elements which distinguish human

civilization. The alternative is a "1984" perhaps delayed in time but more intense than any envisioned by George Orwell. But just as we have reaped the rewards in years past of an agricultural age, and then an industrial age, we now have the opportunity to reap the equal reward of a new knowledge society. We can do so through the absolutely essential investment in a complete renaissance of our higher education system.