

Preparing for a Future of Change

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Some Personal Experiences

I graduated from college 30 years ago. That was still a time of optimism in America. The glow of Camelot of the Kennedy administration still lingered with us. There were great causes to take up such as world peace, the conquest of space, the civil rights movement. Indeed, Martin Luther King, Jr., himself was the commencement speaker at my graduation.

My Class of 1964 graduated with a feeling of boundless confidence in ourselves and in our country. We each had mighty visions of changing the world. In fact, I chose to go into the exotic field of nuclear engineering because I felt that we could "make the deserts bloom" by creating a limitless source of energy for mankind. My first job after college was out in the deserts of New Mexico at Los Alamos. We were developing nuclear rocket engines that we soon expected to power the first manned mission to Mars and beyond and that would be used to colonize the solar system.

Like many generations of Americans before us, the Class of 1964 took for granted our nation's leadership, our motives for good, the virtues of science and technology. We believed that we would live better than our parents and that our children would have lives even better than ours, that old fashioned virtues and hard work would guarantee our own personal futures and our nation's future.

But there were already clouds gathering on the horizon. Even during my senior year it was suggested that things would not be quite so simple—that dramatic changes were coming. John F. Kennedy was assassinated during that fall. The Cold War had begun to heat up with the Cuban Missile Crisis. A few people were talking about a distant war in a place called Viet Nam. Civil rights protests were challenging racism. The free speech movement at Berkeley was revealing a new spirit of student anger and activism on the campuses.

Even with these warning signs, we were not prepared for the dramatic crises and confrontations, the great changes Americans and their institutions would face in the years immediately following our graduation: the war in Viet Nam that so profoundly affected all of our lives, both those who served and those who protested; the eruption of assassination and terrorism, which robbed us of our heroes; the racial turmoil that tore apart our cities; the social turbulence and seeming disintegration of national consensus and confidence; the emergence of the drug culture, as more people turned on and tuned out; Watergate and the crisis in confidence in our leaders.

Americans experienced a sense of shock as our nation began to encounter limits for the first time, as the environmental movement exposed the downside of technological progress, as foreign competition challenged our enterprise, and as our economic and political preeminence was challenged by new centers of power in Asia, Europe, and the Middle East.

In a sense, during the decade following my graduation, America lost its innocence. It lost its sense of optimism. In many ways, my class may have

represented the last generation of Americans to be truly optimistic about the future, to welcome its challenges and to feel equal to them. I can't say whether or not my own choice of a career would have been different if I could have foreseen the future. But perhaps it is useful this afternoon to engage in some futuring, to speculate a bit about the world you will be entering.

A Time of Challenge and Change

The French poet, Paul Valery, once said, "The trouble with our times is that the future is not what it used to be." If my experience is any guide, your future will be a time of greater change and transformation than any experienced before in our nation's history. You are graduating at a truly extraordinary time. Think about it for a moment. You were born and educated in the 20th Century. Indeed, most of you are children of the '60s generation—my generation, and that's a frightening thought! Yet, you will be spending the majority of your life in the next century, in the 21st Century.

We are living in the most remarkable of times. Just consider, for a moment, some of the changes which have occurred in our world just within the past few years:

- The Cold War has ended, and Communism has been rejected around the world, swept away by the winds of freedom and democracy.
- The Soviet Union has collapsed into chaos, torn apart by the forces of freedom, nationalism, and ethnic tensions.
- Many of America's largest and most powerful corporations have been reeling from the rapid changes occurring in the world marketplace.
- Asia is emerging as an powerful economic force, with Japan and China now ranked as the second and third largest economies in the world.
- We are now manipulating the human gene directly to cure disease—and may soon be doing it to create new life forms and influence the evolution of the human species.
- Computing power—speed, memory, communication rates—has increased by a factor of 100 over the past five years, with world-wide networks connecting hundreds of millions of people, enabling them to communicate with one another with ease and sophistication.
- The computer and television are merging in a so-called "digital convergence," triggering a similar merger of the telecommunications companies and the entertainment industry to create a new multimedia communications medium. Indeed, sales volume of computer games now exceeds those of the motion picture industry.

Many believe that we are going through a period of change in our civilization just as momentous as that which occurred in earlier times such as the

Renaissance or the Industrial Revolution—except that while these earlier transformations took centuries to occur, the transformations characterizing our times will occur in a decade or less! Many portray the 1990s as the countdown toward a new millennium, as we find ourselves swept toward a new century by these incredible forces of change. The events of the past several years suggest that the 21st Century is already upon us—a decade early!

This last point is very important, for today we are seeing a dramatic shift in the fundamental structure, nature, and perspective of our society. We are evolving rapidly into a society in which the key strategic resource necessary for prosperity and social well-being has become knowledge itself. In this world knowledge will play the same role that in the past was played by natural resources or geographic location or labor pools. Put another way, while forces such as land, guns, and money drove the past, ideas will be the driving force of the 21st Century.

The "age of knowledge" in which we now find ourselves is accompanied by a fundamental transformation that is reshaping every product, every service, and every job throughout our nation and the world.

Further, new ideas and concepts are exploding forth at ever-increasing rates. We are surrounded increasingly by radical critiques of fundamental premises and scholarship. In many fields, the knowledge base is doubling every few years. Indeed, in some fields the knowledge taught undergraduates becomes obsolete even before they graduate! The typical college graduate of today will be likely to change careers several times during a lifetime. A college education will serve only as a stepping stone to a process of lifelong education. The ability to adapt—indeed, to manage—change will become the most valuable skill of all.

The Plug and Play Generation

Today's students—you folks—are members of the "digital generation." They have spent their early lives surrounded by robust, visual, electronic media—Sesame Street, MTV, home computers, video games, cyberspace networks, MUDs, MOOs, and virtual reality. They approach learning as a "plug-and-play" experience, unaccustomed and unwilling to learn sequentially—to read the manual—and, rather, inclined to plunge in and learn through participation and experimentation. While this type of learning is far different from the sequential, pyramid approach of the traditional university curriculum, it may be far more effective for this generation, particularly when provided through a media-rich environment.

Just watch how young people surf through the Net for information. They launch search engines, scour Gopher and FTP sites, interact through MOOs and Usenet groups, both following existing links and launching new ones. In a very real sense, they are on a serious journey of learning, building elaborate information networks. It is a highly interactive and collaborative process. This is the way they learn.

Indeed, there is even research that suggests that there may be a physiological difference between the brains of the “digital generation” and those of us from 20th Century generations. More specially, it has been known that early exposure of infants and young children to various stimulation can actually affect their neurological development—the evolution of their neural networks. Children raised in a media-rich, interactive environment tend to think and learn differently because they are physiologically different from us. Our styles of learning are not theirs.

Furthermore, you are now alone! By the turn of the century, there will be over two billion teenagers—50 times the number in the United States during the peak of the baby boom. All of these future teenagers are already born, and most live in Asia and Latin America. Just as the 40 million teenagers born in America during the post-war decade determined our culture, driving our consumption patterns during the 1950s, dominating our politics during the 1960s, and contributing our president in the 1990s, so too, the global teenager will have a profound impact on world culture.

Add to this youth-dominated world the capacity for cheap, global communication, and you can just imagine the scenario. Within a decade, hundreds of millions—if not billions—of young people will be linked together by the ubiquitous information technology rapidly appearing throughout the world. A glance at early forms of the popular culture arising from such “wired communities” of young people—MTV or *Wired* magazine—provides ample evidence that their future is certainly *not* our present. While these networked teenagers will not homogenize world culture, they will certainly incorporate and mix cultures from around the world to spawn new societies. The most advanced 20th Century societies have still not learned how to deal with cultural diversity. Imagine how they will be challenged by the global teenager. On the plus side, the old boundaries between races and ethnic groups may well disappear—to the global teenager, we are all interrelated. On the negative side, our current societies, which are based to a large degree on difference—race, age, gender, socioeconomic status, and just about every other human characteristic—must change rapidly or risk irrelevance.

The Changing Nature of a College Education

The changing nature of our students, their need for an education that prepares them for a future of continual change, will drive major changes in higher education.

One generally thinks of a college education in terms of the classroom paradigm. The teaching function occurs through a professor teaching a class of students, who in turn respond by reading assigned texts, writing papers, solving problems or performing experiments, and taking examinations. To be sure, the student might also take advantage of faculty office hours for a more intimate relationship, but this is rather rare in most universities.

The classroom paradigm is a rather recent form of pedagogy in the millennium-long history of the university. A more common form of learning through the centuries was via a one-on-one relationship—an apprenticeship. Both the neophyte scholar and craftsman learned by working as apprentices to a master. While this type of one-on-one learning still occurs today in skilled professions such as medicine and in advanced education programs such as the Ph.D. dissertation, it is simply too labor-intensive for most undergraduate education.

Furthermore, the learning associated with a university education occurs through many activities, some of which are formal such as classroom instruction, and some of which are informal such as student interactions and extracurricular activities. Two datapoints provided by recent surveys are of interest in this regard. In longitudinal studies of their graduates, several universities asked alumni to rank the value of their various experiences while undergraduates. Inevitably the alumni tended to rank as most valuable their interactions with faculty and other students—the community theme again. Lowest in value was the actual content learned through formal courses.

This view is reinforced by surveys of CEOs of major American corporations, who when asked what they most sought in today's college graduates, tended to rank: the ability to communicate, the willingness to continue to learn, the capacity to value and manage diversity, and the desire to drive change. Again, particular curricular content was not high on the list.

There is a certain irony here. The contemporary university provides one of the most remarkable learning environments in our society—an extraordinary array of diverse people with diverse ideas supported by an exceptionally rich array of intellectual and cultural resources. Yet we tend to focus most of our efforts to improve undergraduate education on traditional academic programs, on the classroom and the curriculum. In the process, we may have overlooked the most important learning experiences in the university.

Think about it from another perspective. When asked to identify the missions of the university, we generally respond with the time-tested triad: teaching, research, and service. Yet undergraduate education is usually thought of only from the perspective of the first of these missions, teaching. Clearly, we should broaden our concept of the undergraduate experience to include student involvement in other aspects of university life.

For example, at a research university, every undergraduate should have the opportunity—or perhaps even be required—to conduct original research or creative work under the direct supervision of an experienced faculty member. While the few students who have been fortunate enough to benefit from such a research experience usually point to it as one of the most important aspects of their undergraduate education, most see their education only through the more standard curriculum. Interestingly enough, many faculty members who have supervised undergraduate research projects also find it to be an exhilarating role, since undergraduate students are frequently more questioning and enthusiastic than graduate students!

So too, there is ample evidence to suggest that students' learning benefits significantly from community or professional service experiences. Such activities provide students with experience in working with others and applying knowledge learned in formal academic programs to community needs. Since many students arrive on campus with little experience in relating to broader community objectives, the experience of doing something for others can be invaluable.

There seems little doubt that the undergraduate experience needs to be reconsidered from a far broader perspective. Better alignment with the multiple missions of the university, providing undergraduates with education through teaching, research, and service, would seem an appropriate goal for most universities. All too frequently each of the missions of the university is associated with a different component—a liberal education and teaching with the undergraduate program, research with the graduate school, and practical service with professional schools. However, in reality, all components of the university should be involved in all of its missions—particularly undergraduate education.

Hence, it could well be that faculty members of the 21st Century university will find it necessary to set aside their roles as teachers and instead become designers of learning experiences, processes, and environments. Further, tomorrow's faculty may have to discard the present style of solitary learning experiences, in which students tend to learn primarily on their own through reading, writing, and problem solving. Instead, they may be asked to develop collective learning experiences in which students work together and learn together, with the faculty member becoming more of a consultant or a coach than a teacher.

A Future of Hope

The future is indeed not what it used to be—or at least as it has been traditionally portrayed: as a time of gradual, predictable change, rigidly moored to the past. Rather, my crystal ball suggests a future characterized by rapid, unpredictable, and frequently dramatic change in the nature of our people—in our bonds to other societies—in what we do. It will be a future of great challenge and responsibility.

Indeed, as you stand today on the threshold of a new century, it seems clear that your generation will face problems and challenges of a magnitude that would have been incomprehensible in earlier times. Further, your years following graduation will be a time of less security, less stability, and more unpredictability than mine. But you will also face a future of extraordinary opportunity and excitement. As the philosopher Whitehead has noted, "The great ages have been unstable ages!"

Emerson once noted that the wisest counsel of all to the young was to "always do what you are afraid to do." The truth is that adapting to change and challenge is what keeps our species evolving. We should relish change, welcome it, seek it out—not for its own sake, but for the challenge it brings and the possibility for

progress. We should approach life as a true adventure of opportunity and risk. We are made for risk. We thrive on it.

I guess I tend to be an incurable optimist. I believe that we can be masters of our fate, that we can seize control of the forces around us--most of all ourselves—and bring progress to the world. In fact, I even think that each individual has the possibility to change the world.

There is an old saying that "the best way to predict the future is to invent it!" That is the real challenge before you: to go out into that exciting world full of challenge and opportunity and to invent the future! Indeed, it is your challenge to make certain that the future will not be what it used to be!