

Digital Librarians

As one of civilization's most enduring institutions, the university has been extraordinary in its capacity to change and adapt to serve society. Far from being immutable, the university has changed over time and continues to do so today. A simple glance at the remarkable diversity of institutions comprising higher education in America demonstrates this evolution of the species.

The challenges and changes facing higher education in the 1990s are comparable in significance to two other periods of great change for American higher education: the period in the late-nineteenth century, when the comprehensive public university first appeared, and the years following World War II, when the research university evolved to serve the needs of postwar America. Today, many are concerned about the rapidly increasing costs of quality education and research during a period of limited resources, the erosion of public trust and confidence in higher education, and the deterioration in the partnership between the research university and the federal government. However, our institutions will be affected even more profoundly by the powerful changes driving transformations in our society, including the increasing ethnic and cultural diversity of our people; the growing interdependence of nations; and the degree to which knowledge itself has become the key driving force in determining economic prosperity, national security, and social well-being.

We are living in the most remarkable of times. Who would have predicted a few years ago:

- the collapse of communism and the end of the Cold War
- the redefinition of the world economic order
- the direct manipulation of the human gene to cure disease
- the Internet phenomena, linking 25 million people worldwide
- digital convergence, in which communications and computer companies merge with the entertainment industry.

Yet all of these events have happened, and the pace of change continues to accelerate.

Indeed, many believe that we are going through a period of change in our civilization just as profound as that which occurred in earlier times such as the Renaissance and 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!

I used to portray the 1990s as the countdown toward a new millennium, as we found ourselves swept toward a new century by these incredible forces of change. But the events of the past several years suggest that the twenty-first century is already upon us, a decade early. We live in a time of breathtaking change, at a pace that continues to accelerate even as I speak.

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 twenty-first 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.

In Michigan we have a unique vantage point from which to view a particularly important feature of these changes. If there was one sector that most strongly determined the progress of the twentieth century, it was *transportation* and its related industries--cars, planes, trains, oil, space. Transportation determined prosperity, national security, even our culture--with the growth of the suburbs, international commerce, and so on. During this period Michigan's automobile industry had no equal, and the state rapidly became one of the most prosperous and powerful industrial regions on earth.

Today things are very different. We have entered a new era in which the engine of progress is not transportation but rather *communication*, enabled by the profound advances we are now seeing in computers, networks, satellites, fiber optics, and related technologies. We now face a world in which hundreds of millions of computers easily can plug into a global information infrastructure. Jacques Attali in his profound essay, *Millennium*,¹ suggested that the impact of information technology will be even more radical than that of the harnessing of steam and electricity in the nineteenth century. Rather it will be more akin to the

¹Jacques Attali, *Millennium* (New York: Random House, Inc., 1991).

discovery of fire by early ancestors, since it will prepare the way for a revolutionary leap into a new age that will profoundly transform human culture.

It is clear that information technology, on which our knowledge-intensive society is increasingly dependent, continues to evolve very rapidly. In the next several years we will see yet another 1,000-fold increase in the power of computers and networks. In the same time frame, massively parallel computation servers will offer tera-operations per second, while the price performance ratio of workstations will continue to improve. Within several years, widely available international networks capable of point-to-point multimedia (including video) will be available. Wide-area networks in the gigabit-per-second range will be in routine use, although still well short of the 25,000 gigabit potential of third generation fiber optic technology. Wireless communication will support remote computing and communication.

These rapidly evolving technologies are dramatically changing the way we collect, manipulate, and transmit information. Needless to say, the implications for our universities are profound.

Evolving Missions

One frequently hears the primary missions of the university referred to in terms of teaching, research, and service. But these roles can also be regarded as simply the twentieth century manifestations of the more fundamental roles of *creating, preserving, integrating, transmitting, and applying* knowledge. From this more abstract viewpoint, it is clear that while these fundamental roles of the university do not change over time, the particular realization of these roles do change--and change quite dramatically, in fact. Consider, for example, the role of "teaching," that is, transmitting knowledge. While we generally think of this role in terms of 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, we should also recognize that classroom instruction is a relatively recent form of pedagogy. Throughout the last millennium, the more common form of learning was through 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 the mass educational needs of modern society.

The classroom itself may soon be replaced by more appropriate and efficient learning experiences. Indeed, such a paradigm shift may be forced upon the faculty by the students themselves. Today's students 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, 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.

Hence, it could well be that faculty members of the twentieth-first century university will be asked to set aside their roles as teachers and instead be 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.

One can easily identify other similarly profound changes occurring in the other roles of the university. The process of creating new knowledge--of research and scholarship--is also evolving rapidly away from the solitary scholar to teams of scholars, perhaps spread over a number of disciplines. Indeed, is the concept of the disciplinary specialist really necessary--or even relevant--in a future in which the most interesting and significant problems will require "big think" rather than "small think"? Who needs such specialists when intelligent software agents will soon be available to roam far and wide through robust networks containing the knowledge of the world, instantly and effortlessly extracting whatever a person wishes to know?

So, too, there is increasing pressure to draw research topics more directly from worldly experience rather than predominantly from the curiosity of scholars. Even the nature of knowledge creation is shifting somewhat away from the *analysis of what has been* to the *creation of what has never been*--drawing more on the experience of the artist than upon analytical skills of the scientist.

The preservation of knowledge is one of the most rapidly changing functions of the university. The computer--or more precisely, the "digital convergence" of various media from print to graphics to sound to sensory experiences through virtual reality--has already moved beyond the printing press in its impact on knowledge. Throughout the centuries the intellectual focal point of the university has been its library, its collection of written works preserving the knowledge of civilization. Yet today, such knowledge exists in many forms--as text, graphics, sound, algorithms, virtual reality simulations--and it exists almost literally in the ether, distributed in digital representations over worldwide networks, accessible by anyone, and certainly not the prerogative of the privileged few in academe.

Finally, it is also clear that societal needs will continue to dictate great changes in the applications of knowledge it expects from universities. Over the past several decades, universities have been asked to play the lead in applying knowledge across a wide array of activities, from providing health care, to protecting the environment, from rebuilding our cities to entertaining the public at large (although it is sometimes hard to understand how intercollegiate athletics represents knowledge application).

This abstract definition of the roles of the university has existed throughout the long history of the university and will certainly continue to exist as long as these remarkable social institutions survive. But the particular realizations of the fundamental roles of knowledge creation, preservation, integration, transmission, and application will continue to change in profound ways, as they have so often in the past. And hence, the challenge of change, of transformation, is, in part, a necessity simply to sustain our traditional roles in society.

The Millennium Project

This summer I will be launching a small research center in the new Media Union on the North Campus aimed at exploring the future of the American university. This center, known as **the Millennium Project**, will draw together scholars and students both from our campus and beyond to explore various possible paradigms of the American university for the 21st Century (...or, better yet, the Third Millennium...).

While the Millennium Project will explore a number of quite different visions of future universities, it will not be a simple thinktank. Rather it will be an experimental laboratory. It is our intent to use the center to develop working models or prototypes of future university paradigms. Like the famous Lockheed

Skunkworks, every so often the hangar doors of the Millennium Project will open and something really weird will be wheeled out and flown away

The Millennium Project will be launched on seed funding from the University for an initial five-year period (...to the year 2001...) But we have already had strong interest in support from both the federal government and private foundations, and the Project could eventually evolve into a major national center or institute for the study of higher education.

The Media Union

As we have noted on many occasions, the Media Union itself is designed to explore many aspects of the impact of information technology on education. To quote the initial prospectus:

“Our new Media Union merges the creative aspects of disciplines across the entire campus, ranging from art, psychology, and architecture, to engineering, philosophy and biology. Inventive scholars will come together with powerful resources, entering a free-wheeling space where extraordinary people can do exceptional things. Michigan’s portal to the rest of the world, the Media Union will reach out to the huge storehouses of information growing daily on the Web, while drawing national and international scholars and students into our campus conversations. New information technology will create a “virtual” community of thinkers, allowing face-to-face dialogue and collaboration across thousands of miles.”

Or, as put more succinctly by Dean Paul Boylan, “We are creating an environment where students and faculty can dream and then act on their dreams.”

In response to a request by the executive officers and the North Campus deans, I have agreed to serve as well as “chief scientist” ...or perhaps more appropriately “executive producer” of the Media Union. (Some have even suggested “The Wizard of MU” as a more apt title...) While others will provide the ongoing direction for the technical support and operation of the facility, it will be my role, joined by my colleagues in the Millennium Project, to provide much of the intellectual momentum for this exciting new resource.

Academic Outreach

I have also agreed to work closely with Doug Van Houweling and his colleagues on a number of projects associated with our growing efforts in academic outreach. These include the development of so-called “virtual” or cyberspace universities at the state, national, and international level; exploring new methods for the delivery of educational services such as multimedia; and designing and launching a major new academy for the education of future academic leaders. My particular role in each of these projects will vary. For example, the Governor has asked me to head up the effort to build a statewide virtual university to serve the automobile industry. The AAU universities have asked me to explore a similar concept that would allow these research universities to provide educational services on a worldwide basis. And Farris Womack has expressed an interest in working with me to develop a national academy for academic leaders, similar to the very successful executive education program conducted by our School of Business Administration.

Relationships

The interrelationship among these various roles is best illustrated by the diagram in Figure 1. This characterizes the Millennium Project as providing the intellectual content for a sequence of activities ranging from fundamental research to development to prototyping to actual production and delivery.

More specifically, the Millennium Project will explore various paradigms for the future of higher education within the extraordinary environment provided by the Media Union and sustained through strong interactions with academic units—in particular, the School of Information and the North Campus schools and colleges; the Information Technology Division; and the University Libraries. There will be extensive interaction with other ongoing efforts such as academic outreach, K-14 education, UMTV, and new initiatives such as virtual universities. Finally, it seems likely that new organizations will be formed to take successful paradigms beyond the prototyping and testing stage, such as nonprofit corporations and alliances with for-profit companies.

Concluding Remarks

There is an increasing sense among leaders of American higher education as well as among our various constituencies that the 1990s will represent a period of significant change on the part of our universities if we are to respond to the challenges, opportunities, and responsibilities before us. A key element will be efforts to provide universities with the capacity to transform themselves into

entirely new paradigms that are better able to serve a rapidly changing society and a profoundly changed world.

If American higher education is to respond to the challenges, opportunities, and responsibilities before us, universities must develop the capacity to transform themselves into entirely new paradigms that can serve a rapidly changing society and a changed world.

We must unshackle the constraints that prevent our institutions from responding to the needs of a rapidly changing society, remove unnecessary processes and administrative structures, question existing premises and arrangements, and challenge, excite, and embolden members of our university communities to embark on this great adventure. Our challenge is to provide an environment in which such change is regarded not as threatening but rather as an exhilarating opportunity to engage in learning, in all its many forms, to better serve our world.

And this is where you come in. For I believe that the information and library science communities on our campus are uniquely situated to become important change agents both to ignite and to guide the transformation process in our institutions. More specifically, universities need to be challenged, to sense the excitement and opportunity of the digital age, and to be exposed to visions of what may be possible.

That is your task. To educate. To challenge. And to excite.

Let's just do it!