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THE METAMORPHOSIS OF THE WORD: LIBRARIES WITH A FUTURE

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INTRODUCTION

It gives me great pleasure to present to you the fifth annual C. Walter and Gerda B. Mortenson Distinguished Lecture, delivered on October 11, 1994, by Juan Rada, managing director of the Environmental Partnership in Geneva, Switzerland.

Dr. Rada studied economics and sociology at the Universidad Catolica de Chile, followed by postgraduate studies at the University of London, where he obtained his Ph.D. His areas of specialization are technology management and the impact of technology on management and companies.

From 1979 to 1989 he was a member of the faculty of the International Management Institute in Geneva, where he was also director general from 1986 to 1989. From 1989 to 1992 he was the founding Director General of IMD (one of Europe's leading management schools) in Lausanne, Switzerland, and professor of technology management. From 1992 to 1993, Dr. Rada was vice president of Digital Equipment Corporation International (Europe), responsible for strategic alliances and new initiatives. Since January 1994 he has been managing director of the Environmental Partnership, an organization devoted to the implementation and promotion of environmental initiatives.

In *The Metamorphosis of the Word: Libraries with a Future,* Dr. Rada presents a richly textured, thoughtful, and provocative perspective on libraries and information as we move toward the 21st century.

Marianna Tax Choldin
Director, Mortenson Center for International Library Programs and
Mortenson Distinguished Professor

The goal of the C. Walter and Gerda B. Mortenson Center for International Library Programs is to foster international tolerance and peace by strengthening ties among the world's research libraries and librarians in an effort to ensure access to knowledge throughout the world.

The Metamorphosis of the Word:

Libraries with a Future

Ladies and Gentlemen,

It is a great honor and privilege to deliver today the fifth Mortenson Distinguished lecture. It is also a great opportunity, for a person who has left academia, to reflect on the changes that are today occurring in the presentation, accumulation, and distribution of knowledge.

We belong to the world of the literate, a world that has been forged during centuries of small and big steps, a world that is rooted in the creation of the alphabet, in the developments of prose and the normalization of the word. The world of the literate is also and most importantly the world of the book. The book, much before any concept of modern libraries, had the enormous power of being a cornerstone of entire civilizations and of creating the basis for what has been called universal religions, those based on the written text of the Bible, the Torah, the Koran, the Bhagavad Gita, and the Buddhist manuscripts.

The written word permitted the transmission of messages through time and space without undue alteration of the content. It helped to produce and standardize belief, ways of thinking, approaches to reality, and opened the door to the development of logic, reasoned argument and, eventually, forms of scientific methodology and the concept of scientific proof. The power of the written word has been such that we mark the transition from pre-history to history by the development of the written word. Humans have been divided as civilized or otherwise according to whether their culture had stepped into the world of the literate or not. Christianity was divided forever on whether the written word of the Bible should be read and interpreted by all or not.

Scholars of the classics have illuminated us on the enormous consequences on our history of Greece's technological and intellectual transition

from a preliterate to a literate culture, showing the impact of the introduction of the alphabet as the written word replaced the oral in the literature of Greece and, later, Europe. This transition had consequences that scholars, as usual, still and will continue to debate, but it is safe to say that in it lies the very root of our current mindset. Professor Eric Havelock, a noted scholar in this domain, calls it the "alphabetic mind".

The alphabet converted the spoken tongue into an artefact, separating it from the speaker and making it into a "language," into an object available for inspection, reflection, and analysis. This language meant that things could be preserved without recourse to memory, and that the bits and pieces of these memories could be rearranged, cut, added, and restated. This new world was conceptual. Havelock argues, "Non-literate speech had favored discourse describing action; the post-literate altered the balance in favor of reflection."

It is hard to recount here in a brief manner the enormous impact that these historical processes have produced on our way of being and thinking. They have shaped history and the western mind, pervaded the development of religions, beliefs, ideologies, and science and, therefore, our profound cultural perception of reality. This is a perception mediated by a linear and often reductionist view that the relationship between the person and the written text can easily create.

In the meantime, the persons who did not step into the world of the literate or the "alphabetic mind," the indigenous populations of, for example, the Americas, Africa, and Australia, were considered part of the uncivilized, a backward expression of humankind. Our libraries did not collect their knowledge; since it was not written, it was not valuable; since it was not in books, it was not reliable. In this manner, we have lost much of the accumulated knowledge of the majority of humanity that only in the last few decades, in the realization of the early arrogance, we have tried to reconstitute in an often vain attempt to unearth realities buried by centuries of neglect.

Many of you will wonder by now what this has to do with libraries. Libraries are the repository, the institutional expression, of the world of the literate, a monument to a civilization that valued the conceptual and the reflective, an expression of the world of scholarly achievement that is based on text, on publish or perish, hopefully on reflection. In a different world, achievement would have been measured by the capacity to build artifacts, boats, wells, the ability to hunt or the ability to tell stories, told first by unknown ancestors.

The power of the world of the literate was such that it became the measure and standard of knowledge. Knowledge itself was divided. The knowledge in written form was kept in the most noble of institutions, the library, and written knowledge remains to this day the standard. Much later, in fact only about two centuries ago, the knowledge contained in artifacts began to be collected in museums, the knowledge contained in pictographic form was collected in galleries, and natural history museums became the repositories of plants, animals, and minerals. This division has been one more expression of the fragmentation of knowledge, the body and the soul, the mind and the brain, the objective and the subjective, Caesar and God, religion and science . . . the analytical and reflective process of categorizing and organizing knowledge in a taxonomy in which the synthesis and the resolution of all the contradictions can only be done at the level of the individual.

All of this has been, however, for the better because it has underpinned the fundamental strength of this way of being and thinking. It has created a tolerance for diversity which, in some historical moments, has been strong and in others weak. The hidden strength of fragmentation has been diversity; while combining concepts of reality, science, and life have led to totalitarism in all its expression throughout history, and not just of this century.

While the alphabet created the basis for the "alphabetic" mind, printing, not just by Gutenberg, but most importantly the development of the portable book by Aldus Manutius (1450–1515) of Venice, created the personal library and revolutionized forever the control of knowledge. For the first time, the institution of the medieval library and the institutions behind it began to be undermined, most notably the Catholic Church, with its combination of creation and repository of knowledge. The medieval institution started to be replaced by a commercial product: the independently published

portable book. A new technological and intellectual transition started, which reinforced the conditions of the scientific revolution and accompanied the great period of the discoveries.

Erasmus of Rotterdam, who more than most saw the enormous potential and impact of the portable book against the views of the established universities and scholars of his time, praised Aldus Manutius for "building up a sacred and immortal thing, and serving not one province alone but all people and all generations," and went on to say that in contrast to the libraries of princes and of Ptolemy, "Aldus is building up a library which has no other limit than the world itself."

The portable book produced a subversive impact, creating the conditions for the Reformation, for the use of vernacular language, for the diversification of publishing, and for greater individual expression of authors and readers. It also created the instruments for the development of bureaucracy and large organized states. It greatly and massively expanded the community of knowledge. After Aldus, the control of knowledge became a very wide task, involving all the strength of the state and not just the control of a few scholars. But the transition went deeper—publishing became the vehicle for the transmission of ideas and debate, for proselytism and for scholarly recognition. The seeds for the Enlightenment were sown, and with it, the belief in education and, in this century, the belief in universal education and literacy.

Since the alphabet, the privileged form of presenting knowledge has remained the written word, and the portable book was emphasized and expanded beyond recognition this fact.

Our century started to produce significant changes in the picture described above. This is what I call the metamorphosis of the word.

The development of what was originally known as wireless telegraphy, today known as radio, began a subtle but important change, providing a new potential to the oral. This was later accompanied by the development of cinema, television, and a great variety of media for the transmission, storage, and delivery of words and images. In the past decade, technological developments led to a dramatic reduction of the cost of publishing, with desktop publishing, the recording of the word with tape recorders, and the recording of images with video. All of these different media are now converging with great force into multimedia, with the digitalization of sound and image.

In the context described above, multimedia should not be confused with one more technology, but rather considered as a new way of presenting knowledge that can potentially have an impact similar in nature to the development of the "alphabetic mind," or at least as important in global and cultural terms as the revolution of Aldus Manutius.

Multimedia, by using images, sound, text, and graphics, conveys knowledge in a highly synthetic and powerful manner, collapsing into one medium the library, the museum, the gallery, the film, the photograph, the sense of place and sound. Suddenly, learning and perceiving become much closer to the daily experience of living, and by doing so, have a much higher pedagogical and retention impact. The difference is that the process is sensorial in nature, the language is that of the subjective, the perceptive, of the senses, and thus not simply conceptual or reflective in the meaning of the world of the literate.

In fact, we have already started a transition from the reflective to the perceptive, from the objective to the subjective, from the emphasis on science to the emphasis on culture . . . this is to say, the understanding of the way we perceive reality rather than the understanding of reality itself.

Underpinning these changes is a technological and intellectual revolution that is based on many simultaneous developments. I will highlight some of the most critical ones from a technological stand point.

I mentioned earlier the digitalization of sound and image, which has also allowed significant development in three-dimensional graphics (3-D), which in turn are being used for complex simulations, first applied in the aerospace industry and currently made popular by electronic games and virtual reality. Concurrently is the development of extremely fast hardware,

advanced storage systems, the arrival of increasingly sophisticated object-oriented software, and new generations of relational databases. In addition, the word "tele," from the Greek "distance," is added to more and more activities from tele-communications to tele-presence, with new compression technologies and the use of vast and powerful networks that collapse time and space. All of this creates the conditions for the development in practice and in more and more domains of the concept of "navigating in knowledge, or knowledge navigation." This concept, originally developed in the context of advanced human-interface systems, has evolved into a fundamentally different form of presenting knowledge that takes us in a new direction, away from the one of the "alphabetic mind" and of the written text.

Let me illustrate this with a couple of examples. The student of medicine, instead of reading and studying the circulatory system, takes a realistic, virtual-reality trip through the blood vessels and, for good measure, stops in the heart to appreciate the different aspects of this complex system before continuing the trip. This can, of course, be applied to any other area. The same three-dimensional graphics simulation can be interfaced with tactile sensation and mechanical pressure to provide a sense of the physical.

For the history lesson, the experience can be similar, where the battle of Waterloo is seen, partly enacted and dynamically modeled. It can be interpreted and seen from different perspectives: that of Napoleon and that of Wellington. One historical fact, but two interpretations of history.

All of this is conceptually happening today with the development of virtual environments, telerobotics, and the advanced developments of simulations. But what does it mean? Fundamentally, it is a radical change in the way we create, store, distribute and organise knowledge. We already have a sense of this change, in a more restricted manner, with the development of the "electronic word" and the effects on communications, new human protocols, and the emergence of the cyber-culture.

The concept of navigation into knowledge will create at least four critical needs for the purpose of understanding the library of the future:

1. The first is the development of a new language, which will include icons, the development of a new type of typography (a sort of the modern equivalent of Aldus Manutius' *italics*), the understanding of machine-speak, and of synthetic messages. A new concept of literacy will emerge, encompassing a broader set of skills than the traditional reading and writing. People will be educated in the graphic arts as it becomes increasingly the privileged vehicle to convey information and knowledge, as it is the case with idiogramic languages.

   Today, most major decisions are not made on the basis of detailed written reports, but rather on brief written summaries and a set of slides, full of graphics, to convey in the shortest possible time the greatest amount of information and knowledge.

2. The second is a new classification of knowledge, with a much higher degree of complexity and abstraction, including a multi-media view of subject matters.

   The current taxonomy of knowledge and the use of indexes correspond to the sequential technology rooted in the nature of the book.

   This is likely to change as we create new "indexes" for a world that does not distinguish among the vehicles that convey knowledge, whether they are books, words, motion, still images, or sound. Ultimately, we will be able to search the bookshelves of the library horizontally and diagonally. All of this will change knowledge itself.

3. Thirdly, we will measure scholarly achievement in a different manner, since text will only be one dimension of a person's knowledge and not, as in today's world, *the* dimension.

   A good course will be the one capable of combining, in a creative manner, education with entertainment and thus appealing to the many different levels and forms of learning.

The impact on institutions, not the least on universities, will be enormous, as in the case of the portable book and the medieval libraries. Commercial producers at first will partly substitute for and then fully compete with important segments of the current educational system. Telecommunications will also make aspects of education easily transportable, and the production of courses in electronic form will render the educational system subject to greater competition nationally as well as internationally. The use of graphics, images, and simulations will minimize the differences in language, as can be readily appreciated today with icon-driven software or electronic games.

The course that I described earlier, for the student of medicine, will probably cost millions to produce, and a return will only be obtained through mass production and merchandising. It is therefore more likely to be produced by a division of a publishing house or by new start-up companies, rather than by a university.

A larger split than today is therefore likely to occur between teaching and research. The first will become more commercial and the second will become the core of universities and institutions of higher learning.

4. Fourth is the issue of cultures. The more diverse the sources of knowledge, the more emphasis will be put on the cultural roots of our understanding, of scientific options, of views of the world, of cosmovisions.

   The easier it becomes to manipulate knowledge, the more compelling it will be to look at cultural alternatives in the perception of reality.

   Our student of medicine, at the touch of a button, will be able to look at a subject, say the circulatory system, from the perspective of Chinese medicine or other alternative forms of medicine out of scientific or historical interest. Understanding the diversity of approaches will become a measure of scientific rigor and an important element of scholarly achievement.

These four aspects lead me to a conclusion about the library of a future. My hypothesis is simple. The library of the future will be all that it is today plus it will take an active role in the four areas described above.

This active role will be seen as the library transforms itself into a place where people can go to prepare these complex, technically demanding navigational learning packages.

In other words, it will be a combination of a repository with a media laboratory, a digitalization center, and a place where the technical support to put it all together can be obtained. It will be a very active and essential component in the production process of knowledge, and not just in the storage and distribution of it.

To be sure, none of this will occur overnight, but also to be sure, all of this is occurring already.

It is very possible that the late 20th century and the beginning of the 21st will be remembered in the history of Western thought as the moment in which a new alphabet was developed. The consequences of this are hard to imagine, even harder to describe properly with the language of the past. What is nevertheless clear is that it will be a world where creativity will be of the essence and where knowledge itself will be redefined.

This means that libraries, as the world, will have to go again through a new metamorphosis in which the word will no longer mean the written one, but a new, different, kaleidoscopic reality.

Thank you very much.

Questions & Answers

QUESTION: I want to ask you about the statement made about teaching and how it is likely to be going in a more commercial direction. I'm thinking of a friend of mine who is teaching sociology in a multimedia classroom and using music videos, film clips, publicly owned multimedia materials, some traditional material on a regular basis for this large class. It seems to me that it's possible that we're creating some of our own material. We have desktop publishing; we have new technology to screen our own type of teaching materials. So I can see it going in both directions, one part commercial material that we would buy and use and the other part more of our own created material in the classroom.

ANSWER: Well, I think that, as I mentioned, the role of the library in the future will be to provide those services to faculty in a very complex manner, not simply this amateur thing of the professor who happened to like the Macintosh, and so forth. Why? Because at one level this is fine, but once you begin to accumulate more material and more complex systems, you begin to have a real problem of scale. Let me give you an example. You have a problem today, a technical problem, that's still not solved—it's going to be solved—which is that relational databases are based on administrative procedures. Databases only identify our data specifics. You cannot have a database that will identify sound, video, text, and so forth simultaneously; now the new generation of databases will be able to do that. But this is what your colleague would like to have, to have a relational database that is multimedia in form, and he will be able to put it in a better pedagogical manner. That pedagogical manner will have to be supported in many respects by his own instinct, but also by a lot of creativity, a lot of art, and so forth.

We are talking here about a sort of synthesis between the university and Hollywood, sort of a strange mix that needs to emerge. One interesting case is *Jurassic Park*. In *Jurassic Park* you need very advanced technology and high engineering dexterity, and at the same time you need the artistry

of Spielberg. If Spielberg alone couldn't do it, Silicon Graphics alone couldn't do it. So if you begin to look at this new type of synthesis (going back to your colleague), I think that this will happen and faculty members will do this; they tend to be the exception rather than the rule. In the areas of knowledge where there is a degree of stability, I think they're going to be definitely commercial. The areas of knowledge where you need to combine exploration with behavioral discussions, things of that nature, I don't think it can go. But we have—I did not mention in my presentation— to account for issues related to distance learning, compression technology, and so forth that will allow people through distance, to participate in what is called telepresence type of situations.

So all of this is changing, and don't ask me to really forecast it. The only thing I believe is that what your colleague has done is change the way of presenting knowledge which is not based on texts and the alphabetic mind; it's based on a sensorial approach to learning, and this sensorial approach to learning is different. Whether you're in the classroom or outside in the university, it's a different way that has nothing to do with, if you like, the traditional Western way of learning. It's central in nature, and this is what I was trying to convey, that we're seeing the shift in the presentation of knowledge in front of our eyes, and we're not really understanding the importance that it has for the university and for educators.

QUESTION: Do you think that technology separates the world in general into the knowledge rich and the knowledge poor?

ANSWER: The short answer is yes. But I think it is more complicated than that in the sense that what is going to happen with the facility for desktop publishing and this and that is that diversity is going to grow. We have a tendency that comes from the Industrial Revolution to standardize—this mentality of the nineteenth century of which this country is a good expression. If you look at the difference—and I will make a very quick statement here—between the United States and Canada, the United States wants to be a melting pot. Canada says no, we don't want to be a melting pot. Everyone of us wants to remain different. So the library of the City of Toronto keeps records in 29 languages, and there is no attempt to make everybody the same. To learn to live in diversity is more difficult, is more complicated, but is much richer. So I think what is going to happen is that—and by the way, we're beginning to see the pains of living in diversity because during fifty years of Cold War everyone was standardized, two blocs, the good and the bad, and diversity was repressed both in the East and the West—diversity will begin to explode in both East and West. Look at Europe, look at Quebec in which the vindication of difference becomes a very important aspect.

So when I was mentioning the cultural roots of knowledge, I think I'm going to get a much more subtle distinction here between knowledge rich and knowledge poor. And we're going to say, "What type of knowledge are you referring to?" We're going to learn to respect the calentura..? medicine of the traditional delta of the Amazon as we respect our white-coated doctor in the central hospital. This respect for diversity I think will lead to a very different view of who is knowledge rich and who is knowledge poor. This is the first aspect of my answer. The second aspect—and here I come back to a point made in an earlier lecture—is that the electronic world leads to a more democratic situation as compared to the text. I have to say that in the short term it can be perceived like that. But in the long term or in the medium term, the expansion of knowledge and the demand of people who can have access to knowledge is so enormous that it has nothing to do with the text. And if you take television—how many millions upon millions of people today have access and are being exposed to events and realities that otherwise they wouldn't be. Now, are they PC-literate? Do they know how to run a CD-ROM? Not necessarily so.

I think you will have, as with the portable book, a very massive expansion in the community of knowledge, very massive. But it will be characterized by diversity. A professor will not be able to get away with the idea that he knows only the Western way of doing things or thinking about things. He will not be able to get away with knowing only what other of his colleagues have written. He will have to know what is in the museums. He will have to know what is in graphic form. We will expand the nature of scholarly achievement. We will redefine it.

QUESTION: With all this new technology, isn't there the possibility some of it will break down or become obsolete so that valuable information put into the system will be lost? Aren't we just at the beginning? Also, regarding the information highway, what advantage will that have over taking courses in the traditional classroom?

ANSWER: Well, the only answer I can give to you is the record produced at the debate at the time of Erasmus of Rotterdam. At the time of Erasmus, imagine the revolution. Good and bad, we'll use this interesting stuff, and here an Italian gentleman from Venice invents the italic letter, graphics, typography, which allows you to collapse and reduce the big book into four pieces, which is where the quarto and the A-4 measure come from. And suddenly the book is this big and concentrates a whole text. To tell you how imperfect this whole thing was, books didn't have numbers until the nineteenth century, the index didn't exist, the titles were very long because they were a form of advertising the content. The debate between the scholars of the time and Erasmus was that Erasmus said this portable book is permanent. People were saying, no: people can lose it, they can destroy it, it can be burned. Here in the library, you know, it is permanent. Not only is it permanent, but it is defended by the institution. In the same type of debate, Venice created a special council to look at the publications of Aldus in order to preserve the quality of the translation of the classics because the fear was that, with this trivialization of the book, suddenly quality would go down. Of course it did and it didn't—those things happen.

So what I'm saying is that when you look at this virtual type of situation, it can give you the sense of nonpermanency, like all technologies give you the sense of nonpermanency when they're in the early stages of development. Nobody suspected that the car was going to change *completely* our way of living and doing until the thirties. But for forty to fifty years in the development of the automative industry, people thought that this was a replacement of the coach, which we were used to for centuries, and then we realized that we can go farther and faster, and change the whole movement system. So I think you're right: "at the beginning" would be the way to describe it, and steadily it will shift. I don't think, by the way, that this type of change occurs overnight. I think it will be used to complement the text and be used later to substitute some text; it will be used later to substitute additional amounts of information. In terms of the information highway, there's no reason why people wouldn't be taking classes across the country with a good professor, as opposed to being stuck in one particular class or with one particular teacher. So when you begin to look at what dynamics this might create—this is the message I want to convey—I don't know exactly how all of it will pan out, but at least the dynamics are there.

QUESTION: Would you comment further on the change from the objective to the subjective and the many realities of this multimedia world? How can the multimedia resolve the many ways of presenting knowledge so that it is both objective and subjective?

ANSWER: This is the fundamental dilemma of the Western mind. As the Greeks discovered some time ago, I think our civilization in particular had some problem with this issue. Why? Because we come from the Judeo-Christian tradition in which there's one truth and one belief, and therefore we have culturally a great difficulty in dealing with the ambiguity of the world. I think that the issue is not going to be: Is there an objective, is there a subjective? Both will be legitimate. Today one is legitimate, and the other one isn't. Both will be legitimate: intuition will be legitimate, as reason will be legitimate, and probably people will work in those very different levels themselves. I don't know any individual who doesn't work at all the levels: the rational and the emotional, the intuitive, and the logical. We all work at all these levels.

What happened is that we went through a cultural process that started much earlier but was sort of frozen at the end of the seventeenth century, that we're beginning to recuperate from now, and that process led to a view of the world that has been questioned since the beginning of this century and is being questioned in more and more domains. This

is hard on educators because you don't know what you're saying. Education has this terrible dilemma that it has to sit in between codifying knowledge of the past for people who are going to work in the future, and therefore it is always an elusive situation.

What I mean by the subjective and intuitive is that we are beginning to understand in many respects—and it is clearer today in the natural sciences than it is in the social sciences—that the way you structure experimental work, the way you understand your perception, provides you the outcome of your perception; in other words, your hypothesis becomes your thesis by the way you structure the problem. And this is becoming increasingly true in physics, this is becoming increasingly evident in chemistry. So we are beginning to enter a period which I find fascinating because of the creativity of it. In other words, I prefer to live in a world that is full of ambiguity and where there's great complexity where the answers are not given, rather than in a world where basically everything is tied up.

Now for our civilization, the cultural aspect of this country is a very good example. We have massive problems, ethical and moral problems vis-á-vis life sciences and everything having to do with life because of our Judeo-Christian tradition. If you go to Asia, this is a non-issue. In their tradition, this is a non-issue. Their ethics, if you like, from their own standpoint are completely different. So you will begin to see that the cultural aspects begin to condition scientific research, scientific activities, begin to condition the way we were led to think in a more evident manner, in a way that has been repressed by ideology in the past fifty years, but it now suffers in a much stronger manner than ever before. So we will begin to see this and we will have to learn to live with a tremendous degree of tolerance for diversity, which is the subject of this endowment. And we're very bad at it.

We're bad at it in the family, we're bad at it in the tribe, we're bad at it in the country, let alone in the world.

QUESTION: Will you please tell me how the oral tradition relates to creativity today?

ANSWER: One element that was critical in oral tradition was poetry. I think that the more technological the system becomes, the easier things become to manipulate and to manage. The more important elements related to subjective creativity will become the liberal arts. I was mentioning that in the case of France in the new educational reform, there has been much more emphasis going to the classics than the arts. The reason for that is that when you look at 200 television channels and everything you get is a variation of a theme, then you realize that your problem is not television channels; your problem is that there is not enough creativity in the system. That creativity comes from learning the difference—you know, contrast, experiences—and comes from what I would call a preliterate form of knowledge or tradition: the question of poetry, the question of songs, the question of that type of knowledge.

Havelock and others have done tremendous amounts of scholarly work in the past few years in trying to understand much better the transition in Greece from poetry to prose, from the preliterate to the literate, trying precisely to illuminate somehow the requirements of today. When you look at this work, you begin to realize that the fact that we have—not suppressed—but deemphasized the aspect of preliterate tradition has produced a cost, and that cost means that creativity suffers. I remember many years ago—don't quote me—Carnegie-Mellon ran a creativity test in the different faculties, people entering Carnegie-Mellon and graduating and looked at what happened to the level of creativity. Creativity went down in everybody, all faculties; the only exception was architecture. Now what is interesting about architecture is that architecture combines, in a very interesting manner, manual work—because you have to do things, create models—and you have to have some aesthetic sense, but you also have to have some exactness and some precision and increasingly some degree of understanding of engineering procedures. So suddenly you begin to have a synthesis that is quite interesting, and this study of Carnegie-Mellon bears out the

fact that maybe we need much more architecture-type of learning in which we will combine many different things as opposed to the traditional route.

QUESTION: You seemed to be saying that there is no distinction between information and knowledge, but aren't they really somewhat different?

ANSWER: I think they're different, but you know, we have had this debate about data information and knowledge, and I always find it hard to swallow. In other words, I find it very difficult to tell you where information ends and knowledge begins. People define knowledge as a form of theory in which information can be organized in a particular manner, and therefore knowledge is provided by hypothesis or thesis or concepts, and so forth. Yes, I think I will agree with that, but if you look at the same information in a very different manner, you create a completely different knowledge. And this is exactly what scholarly work is all about: two professors look at the same information and come up with completely different knowledge bases. So you ask yourself, well, wherein lies and what is the nature of the process? I think we don't understand it in its entirety so far, and therefore I prefer simply to talk about knowledge because information is subsumed there. I also believe that the development of technology, navigational tools, search tools, interface systems, icons, and so forth will help us to synthesize far more information in a much quicker manner, and that in itself will alter knowledge.

Today, for example, in physics, astronomy, and so forth, the amount of information generated is so massive that you have to create all sorts of filters and in fact professions, people whose job is to collapse it and put it together for the scientist to interpret. I'll give you a case. I was visiting the map library today—just a piece of data—by 1997 there will be the equivalent of 1.5 million floppy disks of information coming out of remote sensing satellites to the earth everyday. Now, the problem there is the representation of information. How do you take that amount of data and represent it so a scientist can look at a cloud formation and do something with it?

So, I find it difficult to make this distinction. This is why I prefer to look at knowledge and say to a library that their business is knowledge, their business is not information. Let Time Warner be in the information business, let Reuters be in the information business, let CNN be in the information business. Libraries are in the knowledge business.