

A new culture of listeners/watchers is in the process of replacing readers/writers, yet higher education operates as if it is unaware of this revolution. In this article I suggest that we are moving from a world of books or text to a world of silver discs or multimedia, and I review some of the possible implications for higher education. Higher education, if it is to survive, must find ways to convert listeners/watchers into listeners/watchers/authors by the use of multimedia. I offer a list of suggestions about how university administrators and faculty might respond to this cultural revolution.

A Cultural Revolution:

From Books to Silver Discs

“All information in multimedia format will be available in all places at all times”

In 1979 David Godfrey predicted that by the year 2000 all information will be in all places at all times. We are now five years away from 2000. It is quite possible that Godfrey's prediction may have been correct, even though in 1980 it seemed quite a risky bet, especially in such a short time. There may well be a series of information networks to which individuals can link their personal computers (or enhanced televisions or expanded game machines) and themselves. These networks could be filled with “all information.” The task of the user will be to find what he or she wants, pay for that information, and download it to some device (usually assumed to be a computer) under his or her control.

When we speak of information, individuals of my age and background think primarily of information conveyed through words and numbers. When I first encountered Godfrey's prediction, that was my reaction. There would be some great computer in the sky somewhere (or perhaps in Colorado as prophesied by Kurt Vonnegut in *Player Piano*). It would be highly indexed. You could enter any word or phrase and suddenly torrents of words and numbers and perhaps some graphics would come spewing out of your terminal.

Today, however, we must think of information as being a much richer set of data, data that includes not only words and numbers, but also still and motion graphics, still and motion pictures, and sounds. These six data types make up the components of what I call multimedia.

Thinking of data, not as words and numbers alone, but as multimedia, what do we make of Godfrey's prediction? Can we say with equal assurance that his time line is probably correct if we clarify his prediction and say: all information in multimedia format will be available in all places at all times by the year 2000? I believe the answer is yes. And should this prediction come true, and it is well

on its way to coming true, the implications for higher education are profound. This essay attempts to explore some of those implications.

A Cultural Revolution

It is my contention that we are in the middle of a profound cultural revolution of which we are only dimly aware. The revisions to my understanding of data are central to an understanding of my conception of that cultural revolution. I believe we are leaving a culture of reading and writing and entering a culture of listening and watching.

What evidence is there to support this contention? We have much anecdotal data that we hear everyday. My students do not read. Their writing is terrible. I struggle to get them to write. The words may differ, but most of us who teach have made this claim in recent years, absolutely convinced of its accuracy and universality. I also feel certain that if we were to collect data on the sources of information referred to by the last generations of the reading/writing culture and the first generation of the listening/watching one, we would find that the former cite books, articles, newspapers in support of statements they make. They talk about characters in books they have read. The members of the new culture cite instead films or videos they have seen, characters and plots of television shows they have watched, audio themes to which they have listened. I feel left out of conversations with my students (and my children). I have no knowledge of their referents. They perhaps feel the same way about their conversations with me!

Many studies indicate that by the time a student graduates from high school he or she will have spent two times as much time watching television as has been spent in a classroom. Data reported by the U.S. Office of Education indicate that 70 percent of all 13 year olds watch television an average of 3 hours a day and 23 percent of all nine year olds watch television an average of six hours per day! Other surveys reveal that only half of Americans of all ages have *ever* done all four of the following: tell a friend about a book; take a book out of a library; spend their own money on a book; read more than one book by a single author.

Surveys of my own undergraduate students at the University of South Alabama show that all reading that they do (homework, newspapers, magazines, comic books, etc.) consumes 4.4 hours a week: watching and listening to multimedia 6.2 hours a week.

The conclusion seems clear: *Reading is out (and writing as well). Watching and listening to multimedia is in. Whether we like it or not!*

The Printing Press Revolution

An earlier revolution in communication started in the mid 1400s with the invention by Gutenberg of the movable type press. I have found it helpful to look at the developments in that revolution as I consider the revolution of which I am a part.

What changes were wrought by Gutenberg's invention? What institutions were challenged? What professions were profoundly changed? Are there similarities with what is happening today?

Then, as now, the new technology led to an explosive growth in the new mode of communication. Within half a century of the first printed book, 27,000 titles were published. Within six years of the first interactive CD-Rom, over 12,000 have been published. Then, as now, the new communication mode was deplored and opposed. Bans on reading books published without the imprimatur of the Church were

disseminated through sermons and encyclicals, accompanied by dire warnings about the events taking place and their perpetrators. A monastery in Strasbourg in 1447 described printing as “a black art . . . a practice of deplorable evil.” As late as 1553, a publication of the Sorbonne called for a perpetual prohibition of printing “to save the religion.”

Television, and television watching, have produced analogous though somewhat less extreme rhetoric in our times. They have been blamed for the decline in reading, the undermining of cultural values, and even an increase in teenage homicide. Educators decry the “excessive” time spent on listening and watching, and the limited time spent on reading and writing. We blame television, television producers and script writers, the younger generation, lax or absent parents. We try to devise public policies that will control the media, cleanse it from those things people (especially children) should not see or hear. We search for ways to return to the basics of reading, writing, and arithmetic in our schools.

I agree with some of these charges and conclusions. I am especially bothered that television and early technologies that moved us beyond the printed word were passive technologies that encourage inactive listening/watching. Authoring in these media was far too expensive for the average listener/watcher, or even the average college or university. In the last five years that has changed. Everyone can now be a multimedia author. But the schools must choose to make that happen. Even if we have abandoned efforts to teach writing on paper, we can teach authoring in the new media. In fact, it is easy to get the listeners/watchers engaged in becoming authors of the new media if they have the tools. It is writing only in the world of text that the listeners/watchers resist with ferocity and determination!

Is Higher Education the 20th Century Monastery?

The most interesting area of potential analogy between the communication revolution of the 15th century and that occurring at this time is that between what happened to monasteries then and what might happen to traditional institutions of higher education at this time. Prior to the invention of the printing press, the monasteries were the primary sources of books, of copies of the written word. In the monasteries, readers read to ten or so copiers who dutifully transcribed what was being read. They, or others, then lovingly decorated their work. It was a slow process. Production runs were very small. Owners of books were few in number. The cost was very high. This process became obsolete with the invention of the printing press, when, in spite of the Church’s opposition, what we would today call irresistible market forces turned to much cheaper and much more widely available printed books. The change was a major factor in the subsequent decline of monasteries into irrelevance.

Are institutions of higher education the monasteries of the new information revolution that is taking place today? What can we do to avoid a similar downward path? Can we stop the revolution, or should we try to adapt our institutions?

I believe there is nothing we can do to stop the information revolution which we all acknowledge, and the cultural revolution in which we are moving from a reading/writing culture to a listening/watching culture. It cannot be stopped, just as printing could not be stopped. Furthermore, I am pessimistic that institutions of higher education will adjust to the new revolution. Higher education, like the monasteries, may very well go out of business. To me, this would be unfortunate. Some with whom I interact are eager for that to happen, for the ivy walls to crumble. They want to invent new institutions to take their place. In order to make clear why I think

that this could happen, I must first elaborate on how I think information will be distributed, and in what forms. If institutions of higher education become players in producing, disseminating, and making use of the new information types, perhaps they will survive. I will present a possible plan of action, in a burst of optimism. But there were probably some monks who thought reform of the monasteries was possible and that those institutions could and would adapt to the new realities of the time. They were wrong. I may be also. But first, an elaboration of how I see the world of information changing.

Information as Multimedia Data: A Critical Change

My contention that information must now be considered as multimedia information and multimedia data is critical to an understanding of the future that I predict, and to which I think institutions of higher education must respond. We are dealing not just with text (words and numbers), but also with sounds, pictures, graphics, motion pictures, and animations. It is not enough to become part of the new information world and use it for words and numbers. And yet many think that they are part of the new generation when they have mastered their computers and regularly use their word processors, their spell checkers, their modems to transmit text, letters and other writings (in text form) across continents in a twinkling of an eye. Yes, that is an important first step. But it does not address the revolution I believe has taken place. A listening/watching culture will not be satisfied by being able to acquire, create, transmit, and use data electronically if those data are only text.

I emphasize this point because it significantly differentiates my understanding of the future from the views of those who see the critical importance of technologies but still think only (or primarily) in terms which equate information with words and numbers and not with multimedia. We are not talking about a technological revolution in how words and numbers can be created, transmitted, stored, and accessed. We are talking about a revolution in what constitutes the data which we communicate. Multimedia is in. Listening and watching are in. Whether we like it or not!

Implications of the Multimedia Revolution:

Books Are Out, Silver Discs Are In

Let us look at some of the implications of this cultural change which I have postulated. First, books are out, silver discs are in. I am not advocating this position. I am just reporting that it has happened. The dominant media will change, perhaps more quickly than I expect, but for now we can consider Laserdiscs, CDs, and CD-Roms, all silver discs, as the primary vehicles by which multimedia data will be distributed and accessed.

A critical attribute of these silver discs is that they are *interactive* (as compared to linear) information storage devices. Yes, books are interactive too. But they belong to the world of text, of reading/writing. The original media of the new listening/watching culture, television and audio tapes, are not interactive. They are linear devices that can easily and accurately be accessed only at the beginning of the data. One of the silver disks can be accessed with absolute precision and absolute immediacy at any point for which it is programmed. Interactivity as an important characteristic of the new information technologies will be referred to often in the discussion which follows.

Audio CDs

Audio CDs (usually referred to as CDs) are currently the most common silver discs. All of the readers of this article, I imagine, will know what I am talking about and will have listened to an audio CD and have used a CD player.

Laserdiscs

Laserdiscs are also silver discs. Unlike audio CDs, the video data on Laserdiscs is not stored digitally. Video data remains in analog (wave) format, but the discs are interactive. Commercial Laserdiscs (first available in 1979) are able to store 54,000 individual pictures on each side. It would take four days to individually view each of these pictures on both sides of the Laserdisc at a rate of one per second, a rather fast pace. But that is not necessary, because the interactive capability makes access to any given frame (one of the 54,000 pictures) absolutely accurate and instantaneous. Thus libraries of still frame pictures on Laserdiscs are instantly available, permanently stored, and will not fall out of a slide tray. And yet, they are seldom found in universities and colleges, even where pictures (such as in art history programs) make up a major part of the data set under study.

The pictures stored on a Laserdisc can also be shown as motion pictures at the American standard of 30 frames per second. This provides 30 minutes of video on each side of the laser disc. Any frame of that motion video is instantly accessible and already indexed by frame number. If the interactive capabilities are reduced to perhaps thirty or forty access points (called "chapters" in this format), one hour of video can be stored on each side of a Laserdisc.

In addition to video data, there are often two audio tracks on a Laserdisc, each also accessible at any point. The recorded sound on each can be different. One track can hold an explanation for beginners, the second one for advanced students. One can contain the original movie sound track, the other a detailed exposition on the movie. Or the two tracks can be in two different languages.

My explanation of Laserdiscs has been more elaborate than for audio CDs. It would be much better if I could show you a Laserdisc, and let you access it randomly. Your understanding of the technology would be improved. Your sense of the power of interactive access to thousands of pictures would be enhanced. But we are writing (and reading) in the old cultural forms that, if I am correct, are about to pass away. You are comfortable reading this essay because that is the culture to which you belong. Your children (or grandchildren) would not find this approach at all sufficient or satisfactory!

CD-Roms

The third silver disc is the CD-Rom. Most readers of this article will probably have heard of CD-Roms, but I suspect most will not have used an interactive CD-Rom. A CD-Rom, as distinguished from an audio CD, contains data in all of the multimedia formats: sounds, still and motion pictures, still and motion graphics, text (words and numbers). CD-Rom readers are attached to personal computers. The data are displayed on the computer display screen and the sounds are heard though the computer speakers or speakers attached to the computers.

CD-Roms came into existence in the middle 1980s. At first they were used to store huge quantities of text (words and numbers). Very efficient indexes were provided so that all instances of any word could be located quickly. Reference materials and technical journals were the first types of publications published on

CD-Roms. Then came the complete works of a particular author, first in text-only versions, and then in editions that also contained graphics, sounds, motion pictures, and other multimedia features. A recent CD-Rom edition of the works of Sherlock Holmes adventures includes interactively accessible clues, reprints of contemporaneous issues of the Times of London, pertinent videoclips. If you are surprised that it sold better than an earlier text-only version, I have not yet convinced you that text is out and multimedia is in. Even though a text document (a book) is published using the new medium, it is still primarily text. It is the movement from text to multimedia that constitutes the most dramatic change, not the change in the medium of publication! I keep emphasizing this point because when I am limited to words to make my point about different data, my readers do not grasp as quickly the information and arguments I am trying to convey!

Interactive multimedia CD-Roms first became available in 1989. In the first four years (by January 1993), trade journals reported that 880 interactive, multimedia CD-Rom titles had been published. One year later, some 3,000 multimedia CD-Rom titles had been published, and by January 1995, the total had increased to over 12,000. Estimates are that the number of titles produced by 1997 will total 70,000. In 1993 the total sales of of interactive CD-Rom titles were reported to have been \$325 million; in 1996 it is estimated that the market for interactive multimedia CD-Roms will exceed \$1.1 billion. The number of CD-Rom players is rapidly increasing as well. By 1992, 2.5 million CD-Rom drives were shipped worldwide. In 1993, shipments had risen to 6.3 million, and to 11.0 million in 1994. In 1995, industry experts expect sales of 14.6 million, increasing to 18.5 million by 1997.

CD-Roms: Primary Data Sources for Next 20 Years

I believe the CD-Rom will be the primary vehicle for the distribution of most data, at least for the next twenty years. There are several reasons that have led me to this conclusion. First, the CD-Rom is interactive, and it contains audio, still and motion graphics and pictures, as well as text. That is the format that the listening/watching culture expects, will soon demand, and then require. I would like, at this point, to show you representative examples of some of the more interesting CD-Roms that have been published. Again, I cannot for this essay is in text format. Let me describe two examples instead.

Pedro Meyer, a well known and respected photographer, has created a moving, haunting, and beautiful CD-Rom entitled *I Photograph To Remember / Fotografio Para Recordar* published by the Voyager Company in 1991. The title gives the first clue to one of the distinctive features of the CD-Rom. It is a both a Spanish and an English language CD. All narration, as well as all text, is available in both languages. One click of a button, at any time, allows a switch from English to Spanish, or the reverse. The CD-Rom begins with a set of photographs formed into a collage that occupies one screen. Each photograph represents a section of the CD-Rom. A click on any picture will take you to that section. The photographs are all narrated, in Spanish (or English), but you can look at the pictures without the narration, or you can hear the narration for any given picture but not for others if you so desire. If you wish to go to places other than the beginning of a section, you may do so. You can move in any order, in any direction, through the CD-Rom. The text, pictures, narration, and music that make up the CD are haunting in their beauty and impact, telling the story of Meyer's parents' lives from a very personal, moving perspective. I wish that you could, at this very instant, share with me the excitement of this work of art.

A second CD-Rom which I would now like for you to experience is *Macbeth*, the first in a series of Shakespeare's works that will be published by the Voyager Company. The CD-Rom contains the complete text of *Macbeth*. The text is in a hypertext format which means that hot text appears throughout the play, and when selected, additional materials are instantly shown. These include audio explanations or pronunciations, graphics depicting staging, scenery, or costume; motion pictures of the performance of that passage by the Royal Shakespeare Company. In a large number of instances, particular passages can be seen not only as performed by the Royal Shakespeare Company, but also in performances directed and produced by Orson Welles, Roman Polanski, and Akira Kurosawa. Audio narrations, which are available with the various performances, point out differences in interpretation and staging. A complete index of every character's role is instantly available, as are a concordance, textual analyses, essays on the language of the play, commentaries on Jacobean theater. A note taking feature is included as well. If you were reading a CD-Rom instead of this printed journal, you could now click a button and see the three witches as conceived and presented by Polanski. Then you could watch Welles approach, or the Royal Shakespeare Company's, or Kurosawa's. That is impossible, however, because you are reading only text. You cannot hear, or see, what I can hear and see when I read *Macbeth*! And the listening/watching generation will not read *Macbeth* in text-only editions either!

CD-Roms Have Already Taken Over

Another reason that CDs will take over is that they already have. In 1993, for the first time, more encyclopedias were sold in CD-Rom format than in printed book form. In 1994 the sale of CD-Rom based encyclopedias exploded and print based forms of encyclopedias almost disappeared. Why? CD-Rom encyclopedias pronounce words, include motion picture examples and demonstrations, contain extensive full color pictures that are exceedingly well indexed, are filled with graphics and animations demonstrating how things work. In addition, the text is so highly indexed that locating any topic, or any references to that topic is practically instantaneous. The CD-Rom product is a far superior product! And the retail price is less than 25 percent of the cost of a printed version. Traditional text is out. Multimedia is in! Whether we like it or not!

Game Machines Will Soon Be CD Based

An explosive growth in the number of CD-Rom players in American homes will take place late in 1995 and grow exponentially after that. The reason may be surprising to you. New versions of game machines (such as Nintendo, and more specifically Pippin, a new competitor for Nintendo) will contain CD-Rom drives and computers, even though the purchasers will probably not know they are buying a very powerful computer without a traditional monitor and hard drive. Television monitors can be used to display images initially, and the speakers in the TV will disseminate the sounds. Game machines have always been computers in disguise. These new machines, however, anticipate that the user will later add a monitor and a hard drive. Then the user will have an extremely powerful computer as well as a game machine. When shipped, Pippin will cost about \$500. It will play every CD-Rom that has been produced to date for Macintosh computers. The wide distribution of game machines that are really CD-Rom players guarantees an expansion of the CD-Rom market that will be explosive. These new game machines will be heavily

marketed during the Christmas 1995 buying season.

Audio CDs Are Becoming Interactive Multimedia CD-Roms

Another reason for anticipating a central role for CD-Roms is that audio CDs are now being sold which contain interactive multimedia sections containing more audio as well as motion pictures and graphics in addition to the standard set of audio tracks. To play the CD as if it were a traditional CD, you use your audio CD player. To enjoy the new multimedia elements, you put that same CD into your CD-Rom player attached to your computer (or into the CD player that will soon be in your game machine). The first of these new hybrid CDs (called CD+MM) reached the market in April, 1995 as this essay was undergoing final editing. By the time you read this, these new hybrid CDs will be quite numerous. This development will rapidly expand the CD-Rom market at an explosive rate!

We Can Now Write Our Own CD-Roms

A further reason is that we are now able to write our own CD-Roms. Authoring tools are now available that allow the digitizing of existing video and the development of digital movies that can be run from CD-Roms. These authoring tools enable users to acquire and manipulate still frame pictures, audio, and graphics. They also make it easy for users to create animations, and to combine these elements into an interactive multimedia product. I teach students how to use these tools. My students, for example, learn everything necessary to create the multimedia segments that are on the new CD+MM hybrid discs. They author similar products.

My best multimedia students are in grammar and high schools. Even some second graders have demonstrated considerable talent in developing multimedia products, and there are now multimedia development tools available that have been especially designed for use by eight and ten year olds. My grandchildren love them. They are publishing their own multimedia products and distributing them in their schools! The older the student, the longer it takes for the student to become comfortable and proficient in using the tools. I suspect we are seeing the effects of the cultural change of which I write. Members of the new culture are familiar with, have references to, and enjoy working with the multimedia that is central to their communication. Those of us who have no commitment to and little experience with the multimedia culture find it very difficult to become authors of multimedia, or even interested in becoming authors. We have no referents or examples in our heads; we think that it is harder than it is; we are scared to begin to learn to write all over again. Nevertheless I have successfully taught older faculty to use these tools, and excited a number of them into at least coexisting with the new listening/watching culture.

Not only are the tools available to author interactive multimedia; not only can they be learned easily and quickly, especially by young people; not only are multimedia products being developed on the desktop; they can now also be published in CD-Rom format, at home, and comparatively inexpensively. Over 28,000 recordable CD-Rom drives had been shipped in the United States by the end of 1994, and that number is expected to rise to over 450,000 by the end of 1997. The availability of these recordable CD-Roms, at a quite reasonable price, makes it possible for anyone to be a publisher of CD-Roms. Small quantities can be produced at home, in school, or on campus. Large quantities can be reprinted overnight by CD manufacturing companies. In quantities of two hundred or more, the reproduction costs of CD-Roms is between \$1.25 and \$2.50 per disc. Printing cannot come close

to that figure. In addition, CD-Roms can be mailed by first class mail for 55¢. A book containing only the printed text of *Macbeth* would cost at least double that to mail.

Why Being An Author Is Critical

By teaching the creation of multimedia products, I feel I may be helping to broaden the listening/watching culture to one that authors or creates, or in the old terminology writes. The listening/watching culture need not just listen and watch passively. They can produce products as well, be writers in the old culture's terminology. I consider the ability to be a creator of interactive multimedia and not only a consumer to be an extremely important development with profound implications for educators and educational institutions at all levels. In the new culture as much as in the old, what matters is whether schools are teaching people to think and create. Teachers can choose, if they wish, to use the technologies only to entertain, much as they use lectures now to force feed students in preparation for burp back tests. Or schools can control the learners through technology by using integrated instructional packages much like electronic workbooks. But schools can, instead, use the new technologies to create true multimedia authors who know how to think, to communicate, to gather and use data from all sources. The technologies exist. The costs are within our capabilities. There is no longer any reason to let the listeners/watchers remain only listeners/watchers. We can now excite them into becoming authors as well. We can engage them in the thinking, creative process using media with which they are familiar and which they enjoy, as part of the thinking, creative process. Because the new media are appealing to the new culture, and because they are familiar with the media and some of the associated tools, I have found they are eager to be authors, thinkers, writers. This is what excites me about the new technologies.

A Look At the Objections

When I make this prediction of text is out, multimedia is in, I encounter almost certain dispute from members of the reading/writing culture, and usually one of four basic objections.

It Will Not Happen

One common response is to argue with me about my prediction. They can't imagine crawling under the covers of their bed with a portable computer equipped with a CD-Rom player — although such devices are already being sold. Books yes; CD-Roms, no. My response is twofold. First, they may never succumb. In fact, their description of their personal future may be absolutely correct. Second, I suggest that we gather data on how many television sets, with remote controls, are already in bedrooms and being used on a regular basis. Every hotel and motel in the United States, and now many in Europe, are so equipped. In addition, the average number of television sets per American home is considerably greater than one per home. I would hazard a guess that many are in bedrooms. If we had the data, I could probably prove already that more time is spent watching and listening in bed than reading (and writing).

It Should Not Happen

Another typical response of reader/writers is that it should not happen, and that it can be prevented if we just try harder, return to the basics, invest more effort

and time in teaching reading, improve family life, etc. Beliefs about what is right or what is wrong will have very little impact in this area. I am a reader/writer myself. I am a very infrequent consumer of television, movies, and other multimedia data currently available on a mass basis. I much prefer reading a book than watching television. But what I want, or think should happen, will not affect the cultural revolution that has already happened and which we are just beginning to recognize for what it is. It is too late to stop the process, and I doubt whether it would ever have been possible to stop it!

It Has Already Happened

Some critics of my position argue that I am not making a new argument, that the revolution of which I speak has already happened. They point to the ubiquitous television, the mass use of VCRs, the proliferation of Walkmen as proof that a communications revolution delivering multimedia data has already happened. They add their opinion that the consequences are not nearly as significant as I suggest, nor do these developments challenge institutions of higher education in any significant way.

It is certainly true that the existence of televisions, audio CDs, and the ability to record and play back video at a moment's notice has not yet closed any doors of higher educational institutions. But the revolution has just begun. In the first place, the users of the new technologies are about to gain the majority at which time the methods through which we have protected the old order, the reading/writing world, will no longer prevail. We are about to be outnumbered, or converted, or both. When that happens, the cultural changes of which I speak will increase in speed exponentially.

Also, the linear multimedia of old (television, movies, audio records and CDs, radio) are being joined and modified by technologies that are not only multimedia but also interactive. In addition, the new technologies allow everyone to be a multimedia author — not just specialists with large bankrolls. We are now able, if we so desire, to take actions to assure that listeners/watchers become listeners/watchers/authors. By using tools, such as the Voyager Company's Extended ToolBook, text-based documents can be easily and quickly linked to video clips, videodisc, and audio CD segments, graphics, sounds, other text. Educational institutions at all levels can help make the listening/watching culture which I contend is already in place into a listening/watching/authoring culture. That can happen if schools and colleges understand how the world is changing and if they desire to respond by emphasizing the use of the new technologies.

Networks, Not CD-Roms Will Distribute Information

Another objection offered to my prediction involves a contention about the way information will be distributed. Not CD-Roms, my critics suggest, but networks such as Internet will be the primary vehicles for the distribution of information. Indeed, in the interview carried elsewhere in this issue, Robert Kennedy makes this point forcefully. Networks will certainly play a very important role in making all information available in all places at all times. That is happening already. Internet, America On Line, CompuServe, Prodigy and other network services are growing exponentially. But I am not convinced that networks will be the primary vehicles for the distribution of multimedia data, certainly in the short term. There are three reasons for this belief:

• ***Debate Over Content Will Delay Networks and Encourage CD-Roms:*** Distribution of multimedia data by CD-Roms instead of networks allows access to materials that some find offensive without making such data available to all people at all times. Constant, unrestricted access to all information at all places and at all times will inevitably raise issues of censorship and free speech. As the use of multimedia expands, and not only still pictures are available but also motion pictures, motion graphics, and sounds, the debate over how to control the nature of and access to data on networks will intensify.

• ***Networks Are Still Text Based:*** The current networks are still primarily text-based networks. It is possible but very time consuming to send audio and still and motion graphics and pictures over networks, and requires enormous storage areas for the multimedia data that come across the network. Providers levy charges for time and storage that currently make the transmission of large quantities of multimedia data on a regular basis very difficult if not impossible. My university, and many others, restricts access to multimedia data in two ways. Multimedia data are immediately accessible only by direct link to the university's main frame computer, not by modem. This means no home access through a graphic interface. Downloading multimedia data to a storage place on the mainframe, and then retransmitting it to a modem connected site is limited because only very little storage space is allowed and retransmission to the modem connected site is extremely slow. Even more restrictive storage problems are normally encountered should multimedia data be transmitted to the home. Hence for now, at least, networks are not effective for transferring multimedia data in the volume I believe is demanded by the listening/watching culture. Improvements will be made, most assuredly. At present, CD-Roms are a much more effective, and less expensive method for distributing large quantities of multimedia data.

• ***Why Not Both?*** My final response to the argument that networks are more important than CD-Roms as data transfer agents is to predict a combination of the two. Experiments have already been undertaken, with considerable success, linking specific sites to a host computer containing large quantities of multimedia data through extremely high speed networks (which for some time will not be available in the home). Users can go to this site, select what data they want, have it transmitted from the great computer in the sky and pressed onto a CD-Rom (or audio CD), and take that data with them, all in less than ten minutes. CD audio sales sites may become the first such hybrid information centers. These stores would have no inventory for pilferage. The equipment that a audio CD store of this type would have to have would cost less than the inventory that such a store would normally carry. And yet, a total inventory would be available since every audio CD ever made would be instantly available for compilation into one's own CD (assuming, of course, that the owners of the copyrighted materials can ever be satisfied that they will receive their appropriate remuneration!)

What Does This All Mean?

I have made four major assertions:

1. I believe we are in the middle of a profound cultural change in which reading and writing is being replaced by watching and listening and which cannot be turned back. I acknowledge the passive nature of the new culture, but hold out some

hope that listeners/watchers can be turned into into listeners/watchers/authors if educational institutions capture their attention by turning from text to interactive multimedia.

2. I suggest that we must expand our understanding of data to include the full range of interactive multimedia, and not limit it to text.

3. I argue that for the foreseeable future, the primary method for distributing these multimedia data will be CD-Roms. Networks will primarily be used for text and still frame picture and graphics transmissions, not for interactive video and audio.

4. I suggest that it may not be too far fetched to consider the schools and especially the colleges of today as cultural institutions which may suffer the same fate as the monasteries of old which failed to survive the introduction of the movable type printing press. We are no longer serving a reading/writing culture. We are dealing with a culture of listeners/watchers. Will we understand that in time? Even more importantly, will we seek to convert those listeners/watchers into authors and transform multimedia into a more powerful tool for the creation of knowledge and the solution of problems in an information based world economy? We have the tools. Do we have the understanding and the desire?

What Can or Should You Do?

1. Get out of your monastery to find out what is going on. Read CD-Roms. Read Laserdiscs. Whatever your reaction to my argument, I do not think you can fully understand what I am talking about from my words alone. You must experience the new world of interactive multimedia. Interview kids. Visit with the industry officials who are investing millions of dollars in new ways of publishing and distributing information.

2. Stop dealing in traditional text in all aspects of university and college life, and as soon as possible. Every decision about the future should be made understanding that a text only, or a text primarily, world will not continue. All communications should anticipate, and be moving toward, a multimedia format, a multimedia world in which the listeners/watchers are in control. Lectures, examinations, theses, acceptable publications for tenure should no longer be text. They should be in an interactive multimedia format. If you are really going to avoid the revolution, you must be way out in front!

3. Convert all efforts to teach reading and writing into efforts to teach people how to author multimedia products. Seek ways to convert passive users of non-interactive multimedia processes into engaged authors of interactive multimedia products. This is critical. Leaving the listeners/watchers as listeners/watchers without making them authors is to neglect our central calling as educators. Don't let the technology control the learner. Instead, give learners the tools to create and author multimedia products. Help them disseminate and publish those products.

4. Don't become wedded to network information solutions alone. Anticipate that future customers will require that you enable them to learn at times and in places that are most convenient and effective for them.

5. Stop building libraries. Stop buying books. Buy CD-Roms and Laserdiscs. Publish your own CD-Roms and Laserdiscs. Invest in publishing ventures (with other universities and colleges) producing interactive multimedia products. We will never get new instructional materials in the hands of the listeners/watchers until we put our best efforts to addressing those needs. Someone will do it. Shouldn't the university play a key role in that process?

6. Put a CD-Rom player in the hands of every member of your college or university community. Do this immediately. Text (word processors) is not enough. Technology that does not allow for full implementation of, and authoring in, multimedia is inadequate, insufficient, and should be avoided.

7. Retrain faculty to write in an interactive multimedia format. Provide the necessary technical assistance to change the way the faculty think and produce. End rewards for text based products. Establish incentives for interactive multimedia development.

8. Do not create, or allow the creation of, rules that will artificially extend the life of the reading/writing culture. Such rules will not stop the listening/watching culture. They will only make sure that you have few followers among the new culture.

9. Seek advice from the listeners/watchers. Obtain from the users the information you need to understand and survive the revolution.

10. Create courses that are CD-Rom based. Powerful teaching and learning tools are possible when users have interactive multimedia at their disposal. Invent those tools. Make them available.

11. Trade in your academic gowns for a faster CD-Rom drive, a better mouse, a larger display screen with more colors, and a pair of earphones. Some frightened professors tell me they intend to speed up their retirement date. That's not necessary at all. Get out of the monastery and join the revolution!