John H. Strange

The information revolution has raised many issues that must be addressed by university and college administrators and faculty. Many are not now equipped with the knowledge and information to decide upon appropriate responses to the information revolution. I list several possible sources of help, but caution that ultimately informed decisions can only be made if individuals experience the technologies themselves, at least to the extent that they can evaluate the expert opinions they obtain from a variety of sources.

Whom Can You Trust?

Seeking Guidance About Technology

Computers. The Internet. Laserdiscs. CD-Roms. Interactive video. High definition television. Satellite links. The list of new technologies goes on and on. We are overwhelmed by new devices and new approaches to gathering and distributing information. Everyone has a plan. No one has a plan. Our heads spin and we decide to wait until the dust settles. Especially since the bills attached are enormous and there is no pot of gold which can pay for it all, or even much of it.

We Are Uneasy About The Future

We do not know what the future will look like. We are told that information will primarily exist in digital form and will be distributed electronically everywhere at all times. But this has no real meaning for us because we are accustomed to think of information as contained in books, periodicals, and other printed materials deposited in libraries and similar places. We hear that we must provide instruction in many places at one time, but no one agrees whether we should do that with satellite or fiber optic cable transmission of instruction, or whether we should establish a branch campus with classrooms for instructors who will drive there from the main campus and teach on weekends, nights, or even on the regular schedule. And then some advocate that we should not try to provide classroom instruction at all, but that we should break the time and place barriers and make sure that students can learn wherever and whenever they want. We hear of institutions experimenting with courses delivered on CD-Roms, accompanied by books, computer network access, and limited visits to the campus for examinations. We hear that there should be a computer on every faculty member's desk. But it seems that as soon as this has been accomplished, either the computer is terribly out of date or not powerful enough to do the type of work that must be done.

The future is unclear, or there are many futures.

Our Understanding Is Muddled

We do not fully understand the new developments around us. Not only is the terminology confusing, the actual uses for, and benefits from the new technologies are not clear to us. We are promised increases in productivity, but they rarely appear to have materialized when budget time comes. We hear that teaching will be improved, but the evidence rarely follows. Information is provided to us indicating that there is an incredible explosion in the use of information networks. It seems that everyone is using the Internet, or that everyone would be if we had more ports, a larger host, or additional access facilities. It sounds wonderful that the world is driving down the Information Highway, but we have a gnawing suspicion that many may not know where they are going on this highway, and we certainly do not. Our understanding of what is happening is clouded and unclear.

We Do Not Know Whom to Turn to For Help

We read what we can, and sometimes it makes sense, but often we have no personal experiences that relate to what we read. We need help, but to whom can we turn? Whom can we trust in the hope of getting good information that will help us plan for the information age?

Computer Centers?

In many institutions of higher education, the computer center staff are viewed as the experts, the specialists who are looked to for guidance in charting the future and solving the current problems related to new technologies. But are they really the experts we want them to be?

Computer center personnel know computers and the networks that connect them. But usually their principal expertise is in large computers (mainframes or mini-computers) and the networks that connect them, but not personal computers. They are mainly interested in systems designed for many users rather than machines that have one user, and they often seek to convert a personal computer into part of a multi-user network. This is not to say that the conversion of a computer from a purely personal use to the ability to use it on a personal basis as well as in conjunction with others is a bad idea. It is not. However, it leads to very important changes in perspectives and priorities that has triggered to some interesting disputes on many campuses. Where resources are scarce, those who would link all computers into a larger network have championed spending money for the networks. Laying the fiber backbone becomes the priority. The personal users respond that they need more machines for more people first. Then build the network. The debate is often couched in plumbing terms. Must the institution first put in pipes to carry water without the water to carry or swimming pools to use the water at the ends of the pipes? Or should the institution allow everyone to buy his or her own plastic pool (or bathtub) filled with rainwater, unlinked to a central supply system? Which comes first, the pipelines or the devices that are actually used by the consumer? What if there is not enough money for both? If lots of plastic pools are built first, and then connected, will the result be as good as it would have been if the reverse procedure had been followed? If a network is laid first, will there be any money left for the users' equipment? And will the network still be the one that is needed to make the connection, or will it be too slow or too small?

Computer center staff also are often heavily influenced by the needs of their best customers. And they reflect those views when asked for advice for the future,

or how to invest in technologies in the present. For example, when future investments are considered, the needs of the administrative data processing operations is usually given high priority. But what of the needs for instruction, or personal use? Are they as central to the thinking of the computer center staff? There is a tendency, as well, for computer center staff to give preference to the needs of certain campus users, such as some scientists, for big machines. Does this advice shortchange the general, overall needs for technology throughout all aspects of campus life, especially in instruction? That is a question which must be asked!

Finally, we have the needs of the campus network. The larger the network and the more services provided over the network, the more important is the investment in the equipment to support the network, at times to the detriment of the needs of individual users.

The issue to which I wish to draw your attention is not who is "right" and who is "wrong" in this debate. The point is that computer centers are centralized units. Their main interest is big and powerful multi-user machines. They want networks to convert personal users into users of a multi-station system. They have biases and blinders, like the rest of the world. We should be skeptical of seeking guidance only here.

Personal Users of Computers?

Perhaps we should turn to the users themselves, or at least to the users of the personal technologies, those who advocate a computer on every desk first, then link them together.

Our primary difficulty is in identifying these people. Personal computers are now found all over our campuses. Who knows where they all are? How can one reach them? User groups might be a way. But which user group? There seem to be many competing user groups: the Mac users, the DOS users, the Windows users, the Unix users, the Graphic Arts Users Group, the Student Users Group and on and on. Often these groups appear to be fighting with each other. And even if a list could be compiled, who would speak for the group? They all have very personal views on how their computers should and can be used. They seem to be unconcerned about a global picture. How can we get a larger view from a diverse set of individualistic users?

Media Experts?

Of course it is not only computers that make up the technological world driving the information revolution. The media experts, the video and audio specialists have much to contribute to our understanding and planning efforts. But are there experts available in media centers on our campuses? Many colleges and universities are primarily consumers of media. They produce little of their own. In these cases, the expertise we seek does not exist.

Where expertise does exist, it is often located in a television production staff responsible for developing broadcast quality or institutional quality material for wide distribution, using the medium of linear analog video. These experts, valuable as they are, are not as familiar with the interactive digital technologies that I describe in my other article in this issue. Nor can they furnish much advice with regard to the quick and inexpensive video that is not of broadcast quality but is effective for student use. It is not surprising that the experimentation existing on some campuses in the field of digital video is often being done outside the typical television or video production facilities. Where else can we turn?

Salespersons and Technology Providers?

Many times we do not have to turn at all. The salespeople who market all of these new and wonderful developments are constantly trying to contact us. And we can often get free trips to seminars, executive briefings, or other meetings if our boards of ethics, consciences, or calendars will allow. But are those with the primary interest in selling us equipment, services, software, or even "advice" the answer to our dilemma?

Before we reject these sources out of hand because they are trying to sell us something, we should remind ourselves that the other "experts" to whom we have thought about turning for advice are also trying to sell us something: a perspective, a point of view, at times an ideology. Often, we can get much more current information from salespeople than from our own faculty and staff. They are selling current technologies. And we can sometimes get to learn about the future, about unreleased products which are in the pipeline. Some of these products may never come to fruition, others will be changed, but they can help inform us of trends in the field, and perhaps the specifics as well. That kind of information is usually not available locally.

Of course, we hear different futures from competing salespeople. Predictions about use, response, and usefulness of particular competing devices or approaches are often 180° apart. And at best we can learn from these sources what will happen in the long term only in vague terms. First, salespersons are focused on selling particular products, not analyzing broad trends. Second, they often are not told secrets about developments that will make what they are selling obsolete in the next weeks, months, or years. And finally, these salespeople often have a very limited understanding of the context in which their products will be used in our institutions. They have a use for their product which they assume is universal. But we have other needs. Adaptations must be made. Retraining must occur. Someone must "see" the opportunities for growth and development in their areas of expertise that will result from the new products being offered.

It seems that salespeople can be helpful, but they too are not the solution to our dilemma. Where else can we turn?

The Printed Word?

We are used to searching for answers in print. We have been trained to read and write. We are of a generation, perhaps the last of that generation, in which information has been primarily disseminated through printed media. Can the printed word provide us help in preparing for the technological world accompanying the information age? If so, where is it to be found?

Perhaps academic journals will help. Which ones? Where is there a broad view of the policy issues facing colleges and universities as they seek to enter the information age? We can certainly find lots of research on what technologies are effective under what circumstances, but it is rarely of a breadth that would provide us with useful policy guidelines as we seek to prepare for a very different world.

In the futurist literature we can read about worlds that are not yet, but are sure to come. But can we be as certain? How have the predictions made in previous writings matched with actual developments. We do not know. And we need answers now.

What about the trade publications? There are numerous magazines and weekly newsletters and journals devoted to computers, video, electronic media, interactive technologies, networking, the Internet, CD-Roms, multimedia, digital in-

formation, broadcasting, audio recording, scientific instrumentation, and on and on and on. When we read on scan these publications, we find highly technical information which is difficult to understand with our limited vocabularies; press releases that are disguised as news stories and read much like the mailings that cross our desks; debates over the merits of specific software most appropriate for certain kinds of product development. We learn a lot. We can see that the world is filled with change. But we do not get the specific help we need. It is not analyzed in a way that is useful to us. There is no overall sense being made of the changes described so completely in these many publications.

And then there are books. I have my list of favorite books, which follows. They give, I think, a good overview of what is happening in the world, at least from a perspective which is in agreement with mine. But they contain little direct advice contained therein. You can get a global overview from these books, but no specific help in addressing the planning problems facing you on your campus. Nevertheless, believing that some books may help, I provide at the end of this article my priority list of recommended reading with my comments to guide you.

Help From Other Sources

Elsewhere in this issue I argue that we are leaving a world in which communication was dominated by the print media and in which the educated were proficient in reading and writing. I argue that we are entering a world in which multimedia on silver discs dominate the communication process and in which the culture will be of listeners and watchers who can also become multimedia authors. I may be right, or I may be wrong — but there is no way in which you can form your own judgement without some first hand experience with the new media. Only by reading them can you truly understand what will soon be commonplace. And only by reading them can you test the understanding of the future of those to whom you normally turn for assistance, the assistance of whom has been questioned in this essay. I therefore urge you to "read" some of the new interactive publications that are currently on the market. I think you will be surprised by their power and complexity, and see their importance to higher education. A brief list of suggested "readings" of interactive multimedia is also appended.

It Is Up To You!

Assistance has been questioned from all sources. Is there no help anywhere? Many administrators, faculty, and trustees decide that the world of new technologies is too confusing right now, that change is too fast. Faced with this rapidity of change, one temptation is to wait until the picture clears, or even to view all of this technology as just a fad that will soon be gone. These are inappropriate responses for a university administrator to make. I would argue that action must be taken, even if we are unsure of the future. Advice must be sought from all quarters. Experts must be challenged in their biases and assumptions. Competing views must be placed on the table. Information must be gathered from all sources.

Ultimately, you can trust no one with these important decisions except yourself. In making decisions about the new technologies, do not be lulled into thinking it is just computers that we are talking about. It is not. Nor can you afford to relinquish decisions to one of the elements of the community with differing needs and differing opinions. Nor can you act without being informed yourself. You must get all of the contending parties involved, as those that are not contending. You must insist on a complete discussion where opinions differ, even if the parties reach no

agreement. You must become informed. You must become involved. You must use the new technologies. You must imagine a future. Ultimately it is up to you!

I hope these suggestions will get you started.

Suggested Reading
Books
Christopher Evans, *The Micromillenium*, New York: Viking Press, 1980.

Written in 1978, the thesis of this book is that the silicon revolution will result in as much societal change in forty years (by 2020) as was the result of the industrial revolution in the two hundred plus years since its inception. Evans makes specific predictions about how these changes will affect education, security, health, etc. When I last took a close look at his predictions about five years ago, we were ahead of his schedule! This is the book that got me interested in technology, its impact on society, its impact on education. I still think it is a good place to start.

Seymour Papert, *Mindstorms: Children, Computers and Powerful Ideas*, New York: Basic Books, 1980.

This book is about LOGO, a computer language which Papert helped invent at MIT, and the ways in which children use LOGO to control computers. Papert focuses most of his attention on computers rather than on other technologies. He rails at those who would control learning through computers. But he is a vigorous proponent of using computers as tools in the learning process — as long as the learner is in control. He provides many specific examples of learning through doing, and suggests that schools as we know them will disappear, not too bad an idea he adds. This book first attracted me because I see it as being primarily about experiential learning, a subject close to my heart. It is certainly a "must" book as far as I am concerned in understanding the power of the personal use of the computer as a tool. Personal learning tools and discovery learning are keys to Papert's work.

Richard Saul Wurman, *Information Anxiety: What To Do When Information Doesn't Tell You What You Need To Know*, New York: Bantam Books, 1990.

Wurman was trained as an architect. He has made a living inventing new ways to classify information. Here, Wurman attempts to create an interactive book that can be read from any place in any direction for any length. He is primarily concerned with the growth in the amount of information produced in the world, how we categorize and digest it. But he also provides us with an excellent discussion of how the educational world should be affected by the growth of information. In my opinion, this book is one of the most important books about education that has been written recently, although education is neither the direct nor indirect subject of the book. A must for a general understanding of the information revolution as far as I am concerned.

Parkhill, Madden, and Ouimet, *Gutenberg Two: The New Electronics and Social Change*, Toronto: Press Porcépic, 1979.

This prophetic collection of essays, written by a group of Canadian scholars in 1978 in an attempt to help chart Canada's response to the information age, is well worth reading if you can find a copy. One essay predicted the advent of all information in all places at all times by the year 2000. The implications for institutions of higher education that make it their business to provide access to information to their "customers" is profound.

Seymour Papert, *The Children's Machine*, New York: Basic Books, 1993.

Some eight years after the writing of *Mindstorms*, Papert takes a fresh look at technology and education. He is less strident about the failures of institutional schools, more hopeful about teachers, still concerned that computers will be misused to control learners and as passionate as ever in advocating the power of personal computers used as tools in the discovery learning process. Papert's focus on K-12 is transferable to higher education, and we can learn much from his critiques of our institutions and world.

CD-Roms

Mercer Mayer, *Just Grandma and Me*, or Mercer Mayer, *Arthur's Teacher Trouble*, Living Books (Random House/Bröderbund), Novato, CA, 1994.

A translation of Mercer Meyer's children's books into multimedia format. Many new technologies begin by converting products of previous technologies into the new. The differences in the editions clearly demonstrate some of the new and powerful features of the new technologies. Try these two for starters. Ask yourself how many three and four year olds will prefer the printed format.

Greg Roach, *The Madness of Roland*, HyperBole Studios, Bellevue, WA, 1992.

An interactive novel, or narrative, or play with interactive graphics. Our normal descriptors fail us in talking about interactive products. Roach was a playwright before becoming a multimedia author. He wanted the audience watching his play to be able to switch the perspective from one character to another as the play progressed. This is the product of that desire. The story is told from the point of view of four main characters. Viewers/readers can switch among those perspectives at will. This is an interesting effort to use the media to break traditional print boundaries.

First Person: Marvin Minsky: The Society of Mind, The Voyager Company, New York, 1994.

First Person: Stephen Jay Gould: On Evolution, The Voyager Company, New York, 1994.

First Person: Donald A. Norman: Defending Human Attributes in the Age of the Machine, The Voyager Company, New York, 1994.

Try any of these three interactive CDs, all of which follow a similar format. The authors emerge (in video clips) from the pages of the complete text of *The Society of Mind* in the case of Minsky and three books each written by the other two authors. They talk about their approach, their theories, what they are saying in the text. Other key concepts also are illustrated with motion pictures. The text is hypertext allowing quick linkage to related materials. Additional materials are included, including, for example, a visit in Minsky's living room where we can click on items and Minsky appears to explain them, and their relevance in his work. These CDs provide all of the printed materials plus a lot more. In addition, the printed materials include a very powerful, interactive indexing system. Are your faculty authoring such works? If they did, would it count toward tenure if first published in an interactive, multimedia format?

Robert Winter, *Antonín Dvorák: Symphony Number 9 "FromThe New World,"* The Voyager Company, New York, 1994.

Winter has authored a half dozen or more interactive CDs for the Voyager Company. They all follow a similar format. An overview of the musical work under

consideration is available on one "card" or page. Users of the CD can jump immediately to any passage (accurate to 1/75 of a second). A second section provides a detailed history of the composer with hypertext linkages to appropriate examples from the music, additional information in graphic form on the disc, examples of music not part of the work as a whole, or other audio and/or video materials such as Scott Joplin at the Chicago World's Fair which was part of Dvořák's view of the New World. A third part explains the instruments used in the orchestras, with examples of the sounds these individual instruments produce when used in the final production of the work. A fourth section takes the reader through the work note by note as it is being played. Additional information is available at a click of a button, including historic references, comparisons with previous works, commentary of specific approaches used by the composer in various passages of the work. The final section of the CD-Rom of all of Winter's CDs is an interactive game testing knowledge and understanding of the written and audio materials presented in the CD.

Murphy Stein, *A World Alive*, The Voyager Company, New York, 1994.
    This interactive CD was authored by a fourteen year old in a little over six months. It contains detailed information on more than 100 species of animals, including their habitats. All species are illustrated, and there is a lengthy narrated movie of all of them. The movie itself is indexed, and a click of a button takes you instantly to that part of the movie covering the species you have selected. If fourteen year olds are now authoring existing multimedia products, how can we stimulate our faculty to do the same?

Interactive MultiMedia Unit, Faculty of Education of the University of Wollogong, Australia, *Investigating Lake Iluka*, Interactive Multimedia Party, Wollogong, Australia, 1993.
    This interactive CD was developed as an instructional CD for high school students studying ecology and biological sciences. Four ecosystems are available for investigation. Measurements can be taken throughout the lake by using the eighteen instruments found in the physical and chemical tool kits on the CD. Plants and animals can be clicked, providing additional information in text, audio, video, and graphic formats. Materials are available in a library. These materials include printed materials, video tapes, audio tapes, and other reference materials. The CD allows the user to take notes and construct essays. The CD is, in fact, a simulated field trip in full color and full motion delivered in a totally interactive format. This CD startled me into realizing that the future of learning will be far different from that of today! You owe it to yourself to "read" this CD if you are truly interested in getting help in shaping the future.

Laserdiscs
    Although I think the future (at least the short term future of the next ten years) belongs to the CD, interactive Laserdiscs cannot be neglected. There are many which will demonstrate the power of this medium to instruct and deliver information in ways currently alien to most of higher education. I would call your special attention to those published by ABC News such as *Health: AIDS* or *Martin Luther King*. The Voyager Company has also made significant contributions to the Laserdisc literature. See, for example, Titus Leber, *The Spirit of a City: Vienna*, The Voyager Company, New York, 1990.