ENCYCLOPAEDIA BRITANNICA

and the

INTELLECTUAL TOOLS

of the FUTURE

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PREFACE

Change is a process. It is difficult to assess the precise point at which one can say about something that "before a certain point it was X and afterwards it was Y." Without being able to pinpoint the exact date, we can say that sometime in the past year or two most publishers have accepted the fact that the future of publishing is at least partly an electronic future. This doesn't suggest a uniform understanding of what that means or that people agree such a development is a good thing. But in contrast to five years ago, publishers predict a markedly greater impact of the computer and other electronic media on their industry. This report seeks to define for Encyclopaedia Britannica what the implications might be for its future.

Now that the reality of electronic publishing has reached what might be termed "critical mass" (not so much in actuality as in recognition of potential), each publishing company finds itself having to come to terms with it. Unfortunately, most seem to have adopted a "reactive approach." Best defined by the term "playing catch-up," the reactive approach is motivated largely by the fear of being left behind (often fueled by reports of a competitor's entry into the electronic media marketplace.) The scenario goes something like this. Company A

recognizes that it has to do something in electronic publishing or it will lose its share of the market that is fast developing. Market research and brainstorming sessions propose a number of products to be developed. The hallmark of the reactive approach is that the new products invariably rework old products, repackaging old materials in zingier packages. Trendy at its core, this approach takes technology rather than content as the determining factor.

Such an approach consigns a company to the role of follower, especially unfortunate when the product in question has an important social function. Early in our investigation, we decided to avoid this reactive approach and adopt a more rigorous stance. Rather than starting with the technology, we have tried to step back and look at the world of the 1980s and beyond, trying to understand how the role of an encyclopaedia might change as society itself changes. By reviewing what is needed in the way of reference and general educational materials, we could then creatively take up the question of how the various new electronic media could best serve those goals. We felt that only this sort of approach would be suited to Encyclopaedia Britannica, which, owing to its reputation and resources, has considerable responsibility to use these new technologies in ways that will make as great a contribution to society as possible.

The Introduction sets the social/historical context for

Britannica's efforts in electronic publishing, answering the question why we need electronic media, and what can electronic media do that cannot be accomplished with a book. Any discussion of how to use electronic media needs such a framework if the result is going to have any redeeming and long-term social value.

INTRODUCTION

"Within the past 2000 years, it is possible to perceive a pattern in encyclopaedia production that closely corresponds with the changing social needs of each age."

Encyclopaedia Britannica, Article ENCYCLOPAEDIA

Mankind is not distinguished from other animals by the ability to learn, but rather by the ability to transmit learning, "outside the body," from generation to generation. As knowledge has increased in quantity and complexity, the system for transmitting that knowledge has itself been transformed. Britannica arose with the industrial revolution and has served as one of the principal knowledge "transmitters" of the past 200 years. How has the domain of knowledge changed over time and what are the implications for Encyclopaedia Britannica in the future?

One key change is clearly the size of the domain. "Information/knowledge explosion" is one of the pop phrases of the times, but underlying it is the fact that the actual quantity of information is increasing exponentially and will continue to do so for some time. Unfortunately many people making a case for the use of new technologies tend to reduce the question to one of quantity alone. They argue that what is needed is a giant, automatic file cabinet that can retrieve the

vast amounts of information currently stored on paper. This outlook ignores the even more profound transformation in the attributes of knowledge itself.

The first way in which the quality of knowledge has changed is directly related to the increase in quantity. All information and knowledge is interrelated; advances or changes in one area effect to a varying degree all other areas. As the total amount grows, so do the number of interconnections and therefore the overall complexity. A story about Michael Faraday, the nineteenth century English scientist, claims that he had read and presumably absorbed all the science books available at the time. His ability to make significant contributions across several different disciplines was in part a function of his encyclopaedic knowledge. Today, the goal of absorbing all scientific knowledge is not possible, yet there is no less need for a comprehensive overview and the ability to seek out interconnections, wherever relevant. How to deal with this contradiction is definitely one of the key questions.

The second important way in which the body of knowledge has changed is that so much of what has been added in the past 250 years concerns processes and events that are virtually unobservable and therefore harder to understand.

Two centuries ago, before the invention of the steam engine, before electricity, before much of what we know as modern technology, the technical processes of day-to-day life were

relatively transparent. Manufacture and agriculture were carried out on a much simpler level than today and for the most part close to where people lived. Even lacking formal education, the average person had a working understanding of what went on around him. It was no mystery how a horse and buggy operated, or how a printing press worked. That is not to say that a person didn't have to be taught how to operate a press, or that someone could construct a carriage just from everyday familiarity, but simply that without formal education you could understand them because you could "see" their operation.

Not so today. As modern science developed, particularly the understanding of nature's underlying principles--physics, chemistry, biology--most of the new knowledge was based on the discovery of processes and principles that cannot be seen. For example, you can't see electricity, molecular motion or DNA replication. This represents a fundamental change in the domain of knowledge. Knowledge of something that can't be observed or experienced directly represents a higher order of abstraction. As such, it is much harder to acquire than an understanding of observable phenomena.

This is true not only for physical science, but for virtually any subject other than the purely spiritual. 250 years ago the geographic boundaries that were important to the average person were a lot smaller than they are today. At that

time the concept of the town meeting worked because the citizens all had intimate knowledge of the conditions of each other's existence. While most of us realize today that events half-way around the world have a bearing on our lives, the reality of life in Egypt, for example, is largely an abstraction, the Six O'Clock News notwithstanding.

With a body of knowledge that is so much larger and so much more complex and difficult to grasp, people need to be "smarter." They are going to have to absorb larger amounts of more abstract information, over wider areas. They must be able to maneuver more efficiently and effectively in "knowledge-land." Short of science-fictional solutions like instant knowledge pills, being smarter can only be achieved by having more powerful intellectual tools and knowing better how to use them.

Traveling in "Knowledge-Land"

Given the changes in the domain of knowledge, what are the necessary attributes of such intellectual tools. First, there is ease of access. Ideally, information and knowledge should be available at the fingertips and organized so "travel" between all possible points is easy. The key word here is "organized." It won't be enough to just file papers in an electronic filing cabinet in alphabetical order. Information must be available in such a way that the interconnections between subjects are

apparent. Someone studying cell physiology must be apprised of all related topics and have a way to follow any appropriate path of inquiry.

Second, in order to enable people to conceptualize hard-to-grasp, abstract scientific principles, modern intellectual tools must make extensive use of the full range of audio and visual materials ~~—photographs, motion pictures, real life and animated.~~ This is ~~the only way~~ to render physical processes which are unobservable to the unaided eye in a way that they can be understood. Many historical and non-scientific subjects also will be covered ~~much better through the~~ use of such media.

Third is the necessity of developing a modern pedagogy that can maximize the potential for learning. Effective learning is an active process which requires the individual to integrate concepts into his or her own knowledge structures. Knowledge can't be transferred in ready-made form; it must be reconstructed anew in each person's brain.

Interestingly, this concept of a so-called modern pedagogy is directly related to some of the oldest concepts in education. The apprentice system which combined seeing and doing was historically the first mode of formal education, and an extremely effective one. The tutorial method, of a teacher and one or two students, especially with a socratic teaching style, encouraged the active acquisition of concepts. These two forms

of education largely disappeared (except in the context of on-the-job training, or among the elite) with the advent of universal education, but we would do well to resurrect their essence.

Two major implications for Britannica flow from this conception of how the domain of knowledge has changed. The first concerns the technological basis of the encyclopaedia and associated products. The second has to do with the role of an encyclopaedia relative to the task of enabling people to cope with the ever larger and more complex body of knowledge.

New and Old Technologies

Until now the most versatile technology available for transmitting and disseminating knowledge has been the printed book. It's portable, it's inexpensive, and most importantly it allows total user control of both the rate and sequence in which the content is accessed. However, when considered in the context of the attributes that are needed now in our intellectual tools, the printed book has many shortcomings. As a technology, it does not facilitate rapid retrieval of information and knowledge from anywhere in the domain. The library which allows for the concentration of many books in one place has been a partial solution, but it too, needs to undergo big changes to keep up with the growth of knowledge. The

graphic capability of books is limited to still images, and of course they have no sound. Finally, while (good) books may encourage the reader to use his brain, they are not able to interact directly with the reader, in the sense that a book cannot adjust its presentation, according to the responses and needs of the reader.

The central thesis of this report is that the new video and electronic technologies, particularly the videodisc and the computer, provide the technical basis for designing and constructing exactly the sort of tools we have described. The videodisc uses the power of television to present audio and visual materials without being locked into the linear, passive broadcast mode. Like a book that has motion and sound, as well as text, the videodisc permits the user to access the content in the sequence and at the pace that suits him best. The computer is important not only for its ability to manage vast stores of information and knowledge and to access that content in ways particularly suited to the user, but also for its potential to function as a guide and tutor for the learner. (In this report the generic use of the word videodisc refers to the optical laser videodisc. For a discussion of the difference between the optical disc and others as well as a general description of the capabilities of videodiscs, computers and related technologies, the reader is referred to Appendix A.)

Because the book has been the mainstay of our intellectual life for hundreds of years, the suggestion that its role may be

superseded by alternative technologies is controversial. Two obstacles make it difficult to understand this question. The first is the incorrect assumption that questioning the utility of the book is the same as questioning the value of words and written text. The second stems from the erroneous view that television is an inherently passive medium. Let's discuss these in order.

A book can be defined as a physically distinct object consisting of bound pages of printed material. It is important not to confuse a book with its text and illustrations, which can be delivered by other media. The principal aspect of a book which has made it so valuable in the transmission of knowledge is not its portability, but that it is a user-controlled medium through which a reader regulates both the rate and sequence in which material is accessed. The computer and videodisc as media for delivering text and graphics will preserve and strengthen this key property of a book. While electronic media cannot currently match the book in terms of portability, this (temporary) drawback is more than offset by the dramatic expansion in the proportion of the entire domain of knowledge that the user will be able to access with relative ease. In time, the entire library will be at his fingertips, plus he will have the benefit of tremendously powerful search and retrieval procedures as well. Some naive people who espouse the important potential of video and computers in learning completely miss the

point by arguing that reading is on its way to becoming passé. Our view is completely opposite to this. PEOPLE WILL READ MORE IN THE COMPUTER AGE, NOT LESS.

One of the factors causing people to be cautious about applying the new technologies to learning is the healthy concern stemming from the relatively negative experience with television to date. For example, Mortimer Adler has spoken forcefully to the effect that television promotes "a habit of passive reception, sitting back and letting the bewitching images off the screen wash over one. This passive habit of mind is then transferred to the reading of books, which results in the kind of reading that does not deserve the name." (Comments at the Library of Congress/U.S. Office of Education Seminar entitled "Television, the Book, and the Classroom," 1978). We couldn't agree with this more, but the problem is not with television per se, but with the linear, passive nature of broadcast television. At the same conference, Mr. Adler went on to say that "...there is no doubt that the book demands greater intellectual effort and provides greater opportunities for understanding, that is for turning back pages, comparing what is said on one page and on another. The book requires something of the mind that television can never require." We would argue that this is true of broadcast television, but not of the complex, challenging programs that are possible with the videodisc, especially when it is linked with the power of the computer. (It's unfortunate

that the output of the videodisc and computer are displayed on the same screen as network television. Without deserving it, they have suffered guilt by association.)

In summary there is some truth in the cliché that a picture is worth a thousand words. Some ideas can be represented more simply and clearly with a picture. However, those people are espousing a fundamentally reactionary position who argue that with the arrival of television, we can forget the importance of the written word. It would be a giant step backwards to do away with words as a mode of communication and go back to pictograms, even true-to-life pictograms with motion. On the other hand, it would be just as regressive, in the long run, not to use the full power of still and motion pictures when they are appropriate. The promise of the new technologies is a dual one--they provide complete flexibility in the choice of appropriate media and they vastly expand the individual's field of operation and mobility within the entire domain of knowledge.

The Role of Britannica

In many ways encyclopaedias are resources of "first resort." When faced with the need to learn something, whether a simple fact or an overview of a whole field, people often turn first to an encyclopaedia. In order to function as an effective entranceway or window into the domain of knowledge, as it exists today and as it continues to change, the modern encyclopaedia will have to make full use of the powerful new electronic

technologies. The creation of an "intelligent" encyclopaedia drawing on the tandem capabilities of videodisc and computer is one of the most important intellectual tools crying out to be developed.

Earlier when we talked about people needing to be "smarter," it was suggested that besides the construction of more powerful tools, people would have to know how to use them better. Given that learning is more and more becoming a life-time endeavor, childhood becomes especially important as a time for learning how to learn. The power of the new technologies should be used to create an encyclopaedia specifically for children, which while carrying out its reference functions, does so in a context which places its main emphasis on teaching the child how to think and how to acquire knowledge.

By virtue of its experience, its reputation, and its resources, Britannica is one of very few organizations capable of marshalling the forces to undertake the development of these modern encyclopaedias and other related products. We believe that only by utilizing the potential of electronic media can Britannica scale new heights as a principal disseminator of knowledge. Britannica is in a position not only to fulfill an important responsibility to society as a whole, but also through the development of new markets and financially attractive new patterns of distribution, strengthen the company's position for a very long time to come.

"Encyclopaedia Britannica Presents..."

This chapter outlines a number of individual videodisc programs which will set the stage for the long-term development of two different electronic encyclopaedias to be discussed in Chapters 2 and 3. All our recommendations for EB in the area of video and electronic media are based on an overall strategy which assumes that while the consumer/education market will take several years to mature, the existing market is sufficient to support initial efforts, which in turn will provide important experience for future projects and have a significant influence on the development of the market itself. Further, since printed materials will continue to be the foundation of Britannica's business in the near future, early efforts in electronic publishing should strongly support the sale and distribution of the printed materials.

The series of individual programs described below are designed to:

- a) Put Britannica decisively into the marketplace at a relatively low cost. This will protect Britannica's position in the consumer/educational market as that market moves increasingly into electronic media. As the Britannica name comes to be associated with top quality video (and electronic) materials, people will begin to look to it as the leader in that field as they currently do in the field of print. Since at

least one, and possibly as many as two or three, products billing themselves as electronic encyclopaedias will come to market before Britannica does, this early reputation for quality video products will influence many people to "wait" for Britannica, thus protecting its market share.

- b) Provide valuable experience in the development of electronic materials.

- c) Support current print materials. If marketed properly, these programs should garner considerable name recognition for Britannica. Not only will the Britannica video programs attract considerable media attention, but the Britannica name will appear prominently in the consumer electronic media marketplace, where it has never been before. The electronic materials also can be cross referenced to the print materials, referring the reader to Encyclopaedia Britannica itself or to other EB publications. These materials might even be offered as premiums to new encyclopaedia buyers.

Following are descriptions of several programs for the videodisc dealing with subject matter that is both of broad interest and appropriate to the Britannica. The dollar amounts given with each program are reasonable estimates for the cost of development and production up to the point of actual manufacture of the discs. Costs associated with manufacturing will be discussed in Chapter 5.

A note on multiple formats and delivery systems.

In many cases, if EB plans from the beginning, it can produce several programs from the same basic material. For example, the program on space exploration (described below) could be designed for an interactive videodisc, using the system's full range of capabilities. But additional footage could be used to produce a linear program suitable for videotape, the existing RCA videodisc system (SelectaVision), or cable television. A program on archaeology could be developed in the same way, with the possible added advantage of producing a complete "telecourse" on the subject, using additional footage that was shot when the original program was produced. Getting the maximum mileage out of the materials in this way will help recoup costs as early as possible, and allow practical exploration of various delivery systems. Where it is relevant suggestions will be offered for producing alternate versions of the programs in other formats.

Great Moments in History: A Motion Picture Archive

Invention of the motion picture camera at the turn of the century made it possible to preserve a dynamic visual record of historic events. The Wright Brothers taking off at Kitty Hawk, Nazi guards marching prisoners at Auschwitz to the ovens, the atom blast at Hiroshima, the McCarthy HUAC Hearings, the

Hindenburg disaster, James Meredith enrolling at the University of Mississippi, the Beatles appearing on the Ed Sullivan Show, mankind's first steps on the moon, and the eruption of Mt. Saint Helens--all are preserved on motion picture film. An untapped resource, this film is mainly unused and unseen, largely because it is inaccessible. The videodisc provides a way to make historic footage available in the home.

As a complement to the existing Britannica materials, EB could have no more appropriate debut in electronic publishing than a videodisc film archive of significant events. Using the dual audio track capability of the disc, a narrative putting the events in perspective can be added, even when the original film includes important sound. Still frames can be inserted after each sequence directing the viewer to relevant sections and pages of various EB publications, increasing the archive's usefulness and promoting EB's products at the same time.

An outstanding feature of the archive as part of an initial electronic publishing program is its complete suitability as a linear presentation for videotape or the RCA (CED) videodisc format. It will also make a good premium for EB sales efforts. (In fact, it might even be a valuable sales aid for the Encyclopaedia Britannica salesman to use when he makes home visits.)

Many of the films that would comprise this disc are available from the National Archives. Their films, for the most

part, are in the national domain and there is no question of payment for "rights," only for the cost of the print itself. Other films would be obtainable from private sources. This disc program should cost approximately $125,000 to produce, unless a large number of copyrighted films were used, with rights fees inflating the cost.

This first archive disc could easily become one of an extended series. Subsequent archival film collections could focus on specific topics like "science," or be arranged chronologically with each disc covering in depth a particular span of time (as Time-Life has done in print with its "Decades" series).

"Please Explain" with Isaac Asimov

Isaac Asimov is one of the best known and most successful popularizers of complex scientific ideas. In the early 1970s he wrote a book called Please Explain, in which he posed 100 common questions related to modern science and answered each in a concise, clear style. He addressed the origin of air, the existence of a solar wind, the operation of an electron microscope, the greenhouse effect in the atmosphere, the meaning of relativity, and the phenomenon of polarized light among other interesting subjects. EB could work with Asimov to adapt this question/answer format for the videodisc. The combination of Asimov's trenchant style of explanation with the multi-media capabilities of the disc could result in a trailblazing

departure in the field of popular science literature.

The topics taken up in this particular program should cover the full range of scientific interest, at a level appropriate to 10-14 year olds but interesting to adults and the highly motivated child. Dr. Asimov has said that he would be happy to receive a proposal for such a project from EB. We suggest that Dr. Asimov be asked to formulate the questions, write the narration, and work with the filmmaker to decide the best way to visualized the answers.

A suitable version of this program could be produced for videotape and the RCA videodisc. Although not as versatile a format, the user could review sequences as often as necessary. The cost of the program should be approximately $200,000.

The following three programs are proposed for collaboration with the Smithsonian Institution.

Space Exploration, Past, Present and Future
Invention & Discovery: The History of Technology
Everyday Life in the American Past

The Smithsonian Institution is an invaluable national resource. Its dazzling complex of museums, art galleries, and research facilities embraces the National Air and Space Museum, The National Museum of History and Technology, and the National

Gallery of Art. Its collections span the entire breadth of human inquiry. Taken as a whole, the Smithsonian's collections are a physical analogue or embodiment of much of the Britannica's intellectual content. The Smithsonian is actively considering ways it can use the new video technologies to make its collections available much more widely. We think Britannica and the Smithsonian would make excellent partners. Specifically, we are suggesting that EB produce a number of videodisc programs with the Smithsonian, using the Smithsonian's collection as the basis of the visual presentation. We have discussed this with a responsible representative of the Smithsonian and believe a proposal from EB would be most welcome.

Space Exploration - Past, Present and Future

The enthusiastic response to the Space Shuttle and the Voyager mission reflect a deep and abiding interest in space and space exploration. An introduction to the subject that is both scientific and popular would surely meet enthusiastic response. The extensive collection and powerful exhibits of the National Air and Space Museum, plus the wealth of photos and film footage available from NASA, could form the basis of an excellent videodisc presentation.

Invention and Discovery - The History of Technology

The Smithsonian's collections are an unparalleled repository of mankind's wondrous inventions, spanning the whole range of human toolmaking, from the earliest stone tools to the modern computer; from Newtonian glass prisms to glass fiber optics, from steam engines to atom smashers. Although oriented toward American contributions, the collection includes artifacts from around the world, providing a sweeping panorama of the entire human effort to change the physical circumstances of existence. This perfect basis for a program on the history of technological development matches the videodisc's great potential. There have been countless treatments of this subject in the past. Well-illustrated books have often given a good overview of the topic, but since the reader can't see the machines in operation, too much is left to the imagination. Films on the development of technology, while in some respects excellent, have sacrificed both breadth and depth because of the exigencies of linear presentation and the prohibitive cost of film has precluded wide distribution of those which exist. A videodisc program on this subject can combine the best attributes of books and films. The machines will spring to life, yet the viewer will be able to pause and ponder at his own pace, permitting a rich and thoughtful explication.

Everyday Life in the American Past

Our history schoolbooks are usually filled with names,

dates, descriptions of battles and significant events and commentary on so-called historical trends. Rarely are we treated to any insight into how Americans have actually lived over the past 300 years. For the most part we owe to Hollywood whatever we can picture about the reality of life in 1700, and very often such views are stylized and of questionable historical truth. The importance of knowledge of this sort is often underestimated. A visually exciting, empathetically portrayed "history" could transform any student's interest in and understanding of the significant events and trends of the past. The Smithsonian collection through thousands of artifacts and many faithful reconstructions of real-life settings portrays the substance of ordinary daily life over the past 300 years. Using the Smithsonian collection plus visits to some of the best recreated historical sites around the country, EB could produce a videodisc which documented the day-to-day life of Americans from the time of the Iroquois until perhaps WWII.

These three programs could be produced for a budget of about $200,000 each. The content and subject matter of each program is suitable for creating a linear version as well.

Clearly, with the breadth and depth of the Smithsonian's collections and work, these three programs barely scratch the surface of what could come from an EB-Smithsonian partnership.

A continuing series of discs on a number of other topics could result. The Smithsonian also includes a major museum of natural history, several important art galleries, and a sizable zoo. In fact, given the Smithsonian's charter "for the increase and diffusion of knowledge among men," we think that EB should consider the Smithsonian as a likely partner in the development of the Compton's Videodisc Encyclopaedia to be discussed below.

Origins - Milestones in Archaeological Discovery

A curious parallel to the explosive growth of modern technology has been a growing interest in the origins of mankind itself. It is almost as if, poised on the threshold of exploring the universe, men and women want to be sure they understand where they've come from and where they've been. The concurrent rise of Cosmos and The Clan of the Cave Bear (an anthropological novel set in prehistoric times) on the best-seller lists testifies to this phenomenon. It would be appropriate for Britannica to produce a videodisc that addressed this burgeoning interest in humanity's ancient past from the vantage point of archaeological discovery.

Five major archaeological sites--Olduvai Gorge, the tomb of Tutankhamen, Pompeii and Herculaneum, the recent Shang dynasty finds in China, and Teotihuacan (Mexico), each intrinsically interesting, together trace human society's advance from the earliest hominids up through ancient civilization.

Each segment should convey the drama and beauty of the original find as well as illuminate each site's contribution to the history of human society. An individual segment might describe or portray the discovery itself, tour the site, analyze key artifacts, and recreate important aspects of "daily life." The videodisc format opens the door to dramatizations that can be a great advance over the "archaeological discovery picture book."

A well-known archaeologist or anthropologist could advise on overall content and serve as on or off-screen narrator.

This program's budget could run as high as $750,000 to $1 million, and therefore must generate significant revenues outside the videodisc market. A linear version, while certainly viable, would not return sufficient revenues to make up the difference. One possibility is to shoot additional footage during production of the one-hour videodisc which could be used to expand into a college-level telecourse unit consisting of 15 one-hour programs on archaeology. The proliferation of cable-TV has generated a corresponding increase in the offering of college courses via television. Orange County, California, hosts one of the more advanced projects in this area, with more than 160,000 students enrolled in courses delivered via television to students of the Coast Community College System. EB should consider telecourses a valid and appropriate adjunct to its

early video publishing ventures. Significantly, the Annenberg Foundation has given the Corporation for Public Broadcasting (CPB) over $125 million to develop college-level telecourses. If EB were to involve one of the major CPB telecourse groups in this project, it is quite likely that Annenberg funds could be secured to defray a large part of the costs.

Computers: The Mystery Unraveled

Despite the media attention given to computers, sources a person can turn to for a basic understanding are surprisingly few. Most introductory level books are designed mainly to teach "BASIC," a popular computer language, not computers. To the extent that they take up the inner workings of the machine, such books usually toss it off in a few pages and leave the reader pretty much in the dark. There could probably be better treatments in book form, but the most promising answer is likely to come from the self-paced, multi-media presentation possible with a videodisc. Most of what happens inside a computer of any importance is invisible to the eye and occurs at speeds close to that of light. The average person needs a visual and dynamic presentation to achieve an understanding of the relevant processes. Even with the enhanced power of motion pictures, the difficult subject matter calls for the self-pacing capability of the videodisc.

Britannica could produce a videodisc on computers drawing

heavily on animation and creative visual analogies. The program should cover how the idea of the computer has evolved, what a computer is and how it works, and finally the range of tasks it can assume, both at present and in the future. The program would be directed at the vast numbers of non-technical people who are beginning to recognize the necessity of learning about computers. It wouldn't be a how-to program; that can only be covered with hands-on experience. However, it would answer people's questions about computers and prepare them theoretically for practical "hands-on" experience, upgrading their "computer literacy."

The cost of such a program would be approximately $200,000. It would definitely be possible to design a suitable linear version of this program for videotape or film.

A Cultural History of the United States

The Library of Congress describes itself as a "multi-media encyclopaedia." Indeed, its collection encompasses virtually every medium used by mankind to transmit ideas and knowledge--books, photographs, slides, prints, movies, audio recordings, and now, videotapes and computer programs. A sampling of its holdings includes:

- Recorded interviews of ex-slaves done in the 1930s (including photos).

- A collection of rare children's books from the 18th century.
- Audio recordings of Robert Frost, E.E. Cummings, and other poets and authors reading from their work.
- An extensive collection of early American and European motion pictures from the 1890s on.
- A fascinating and varied collection of musical instruments.

A couple of years ago Abrams published a book which surveyed the Library's collections. As beautiful as it is, the book is limited in its ability to portray anything from the film and audio sections in a living way. Also, the high cost of four-color printing and the space limitations of a book prevented them from showing more than an infinitesimal number of the Library's vast collection of photos, prints, cartoons, etc. The videodisc is the ideal medium for presenting a genuine sampler of the Library's holdings.

Rather than just a loosely organized pot-pourri, however, we suggest that EB consider using the Library's materials to present a cultural history of the United States. This program would be a valuable adjunct to Britannica's publications. We met with representatives from the Library of Congress who voiced considerable interest at working with EB on such a videodisc project. Given the suitability of the videodisc for presenting the Library of Congress' materials, we would expect that over

the years a large number of programs will be based on its collections. That doing a program with the Library now could put EB in a good position for future projects should be taken into account.

An interesting linear version could definitely be made of the program, albeit without the extensive use of still photos permitted by the disc. A budget in the range of $150,000 is projected.

The Britannica Goes to London

The videodisc's ability to put motion pictures under the user's control make it uniquely suited for a form of "vicarious travel" which takes the viewer to far away and inaccessible places, and gives him considerable freedom to tailor the tour to his own interests, pausing where he wishes, for as long as he likes. When you add to this the ability to include both still photos and animation, you have the makings of a program that is not only highly entertaining but an educational tool of the first order.

Knightsbridge, Mayfair, Bloomsbury, Fleet Street, Covent Garden, Westminster Abbey, Speakers' Corner in Hyde Park and Parliament. For most, they are names in books or perhaps fleeting glimpses from movies and television. This videodisc would enable the viewer to ~~tour~~ See London with a guide as knowledgeable as the Encyclopaedia Britannica. Segments would

not only visit the sights but place them in the proper historical context.

In addition to the straight-forward visits to important points of interest, the videodisc permits some very interesting ways to present related material. For example, it is possible to compress a visual sequence so that it takes up a minimal amount of room on the disc, and yet play it back in slow motion so that it looks normal. A trip down the Thames could be included in this way, as could a record of many of the ceremonies London is so famous for, like the "Changing of the Guard" at Buckingham Palace. Using the still frame capacity, it would be interesting to include historical photos and drawings which indicate how the cityscape has changed over time.

It is estimated that this program could be produced for approximately $250,000. The motion footage could be worked into a suitable linear program. Clearly this same treatment could be applied to many other notable cities, making this possibly the first of a continuing series.

The Grand Canyon: A Work in Progress

"The canyon is at least two things besides spectacle. It is a biological unit and the most revealing single page of earth's history anywhere open on the face of the globe."

Joseph Wood Krutch

In another application of the "vicarious travel" concept, the Grand Canyon videodisc would take the viewer on a tour that focuses on the canyon as a living geological and biological laboratory. In contrast to the classic photographs of the canyon which portray it as an incomparably beautiful rock formation, frozen in time, the canyon is in fact vibrantly alive. Not only are the prodigious forces that carved the canyon still very much at work, but also, within the canyon is an ecological system comprising a dazzlingly varied array of animal and plant life occuring over a broad range of climactic and geographic conditions.

A visit to Granite Gorge, a mile into the earth's crust, with rock walls over 2 billion years old, has much to teach about the history of the earth itself. A "walk" down from the rim reveals significant changes in flora and fauna as the climate shifts, as a difference in altitude of only a couple of feet can prevent a living thing from migrating from one zone to another.

Some of the special features of videodisc technology would be used. A) The random access capability would be employed to provide an "active glossary" using animation and line graphics to define geological terms. B) Using time-lapse photography and the ability of the disc to play back in slow motion, a short segment would capture the dramatic effect of changes in light on

the appearance of the canyon. C) Still frames would contain textual information on a variety of topics, supporting the content of the main program. For example, charts might indicate the species of animals living in various climactic zones of the canyon.

The cost of production should be approximately ~~in the range of $200~~ 250,000. Although it would obviously not be as versatile or useful to the viewer, a linear program on the Grand Canyon using much of the footage from the videodisc presentation could be designed.

A specific proposal regarding the production of a number of these programs will be made in Chapter 7.

THE COMPTON'S VIDEODISC ENCYCLOPAEDIA

In this chapter and the next we will discuss the creation of two different encyclopaedias, one for children, on the order of Compton's, and the other, a wholly electronic edition of Encyclopaedia Britannica. These projects are futuristic only in the sense that it will be at least five to ten and ten to fifteen years respectively before either could be ready in completed form. Our conception of these projects is consistent with technology available today (or that will become available as the encyclopaedias are prepared), and incorporates the concept that the value of the new technologies lies in enabling us to present material in new ways that significantly enhance the user's ability to learn.*

(Footnote: For those who may have seen the Arete/Academic American prototype videodisc, we must point out that this sort of "repackaging" of existing materials is not what we are recommending. Produced to demonstrate the exciting applications of videodisc technology, the disc is in fact a rather trivial exercise which merely combines the existing text and graphics from the Academic American Encyclopedia with some audio and stock film footage. For example, the segment on Beethoven begins with a brief spoken introduction, with a picture of Beethoven as a visual backdrop. The user can then choose to listen to a one-minute snippet from either The Fifth Symphony or a violin sonata. The same four pictures (two showing representative manuscript pages from the two works plus two additional pictures of Beethoven) are displayed while the music plays. Following this are eleven pages of unattractive, blocky-looking text, comprising the original encyclopaedia article. Since all the pictures are also from the original article, the only addition is the brief musical excerpts, which by themselves do nothing to enrich the user's understanding.

The music is used like a pleasant picture, as filler without content. Among other things, what is missing is an explanation of how the particular excerpts illustrate the structure and recurrent themes in Beethoven's music, or perhaps how Beethoven's style evolved from those that came before him and influenced those that came after.

The other four segments on "Dinosaurs," "The Gettysburg Address," "Martin Luther King," and "Hydrofoils" are no better. It's a nice "touch," perhaps, hearing Carl Sandburg recite Lincoln's address with a picture of Lincoln's statue in the background, but it adds little to the user's knowledge of Lincoln and his place in history.

By misusing the technology in this way Arete has actually "junked up" the print presentation, with the overall effect being considerably less than the sum of its parts. One can only hope that this cheaply produced program with the boring look and feel of 1950s instructional TV will not cause others to assume that there is no future to the encyclopaedic applications of the videodisc.)

As we envision it, the Compton's Videodisc Encyclopaedia (CVE) would consist of approximately 30 videodisc "volumes." Its key features are as follows:

Emphasis on How to Learn

Although the encyclopaedia would include full discussion of all topics and would be useful for ordinary fact reference as well, it would emphasize teaching a child how to learn in the broadest sense. Not only how to find facts and information, but how to apply the scientific method to problems, how to put together pieces of an intellectual puzzle--in other words, how to think.

For example, let's take the elementary physics principles of the lever, the pulley, an inclined plane, etc. The interactive videodisc can encourage the user to discover the

meaning of these principles for himself. A motion sequence might show a humorous "Rube Goldberg" type machine, which goes through 20 steps to drop a ball in a basket. The program tells the child that at various points in the course of its operation the machine demonstrated the principle of the lever, an inclined plane etc. The child is then encouraged to replay the sequence in slow motion to discover where each of the principles was operating. A follow-up segment validates the child's conclusions and helps to raise his perception to a higher level.

And, since the videodisc can compress motion sequences, a simulated field trip could allow the child, with appropriate guidance, to study the behavior of any number of animals in their natural habitat. In the course of this exercise, the user would not only learn something about animal behavior, but more importantly, something about the skills connected with observation and the scientific method.

As much as possible the pedagogy of the encyclopaedia should strive to implement a style of learning through discovery, as well as learning in the course of "play."

Full Use of Multi-Media Capabilities of the Videodisc

The videodisc's flexibility would enable the CVE to utilize the most appropriate medium or mix of media for each subject. Sound motion sequences, either real life or animation, photographic stills, line graphics, and text could construct the

richest introduction to the world of knowledge that has ever existed for young people. Several examples follow:

- The discussion of the orchestra would utilize a real orchestra, with full stereo to illustrate how the various instruments sound individually and in combination, and also, how different musical and thematic techniques are employed.

- Sculpture can be presented in the round, enabling the user to actually "walk around" Rodin's THE THINKER, inspecting the piece in all its glory. A short segment would show how several basic tools are used and how the sculptor visualizes the statue within a block of wood or stone.

- A student interested in China would tour Peking, visit a commune, and "walk" on the Great Wall.

- The section on automobiles would include a compressed motion sequence tracing a car's manufacture from the smelting of the ore through the last coat of paint.

- The entry on architecture would encompass not only a comprehensive catalog of examples illustrating different trends and styles, but a compressed motion sequence showing workmen constructing a house from the ground up.

- In the section on the law, a visit to a courtroom would show the prosecutor and defense attorney debating their case before the judge and jury in a dynamic illustration of how the legal system works.

- The past would spring to life in the visualization of

history as never before possible in an encyclopaedia. This could strengthen children's empathy with the experience of the past, thereby vastly enriching the range and scope of the historical lessons. The ancient Greeks would take on "faces" and become far more relevant than they do through the pages of most books. The same can be said about even recent historical events such as the Vietnam War. The ability to include pictures doesn't lessen the hard work of deciding how to present the subject matter, but it puts a fuller pallette in the editor's hands.

- The discussion of plant physiology would be amplified by an animated explanation of photosynthesis.

- The richness of North American Indian culture can be illustrated with, for example, a visit to the Taos pueblo and a motion sequence showing the intricacies of Navajo rug weaving.

- Descriptions of various occupations will incorporate "on the job" visits.

- Relevant science subjects would re-enact various experiments suitable for home laboratories utilizing everyday materials. Where such experiments are not possible (dangerous chemicals, impossible costs, etc.), appropriate events could illustrate/simulate the principles.

Topical Organization

Organized topically, each volume or group of volumes would

cover a particular branch of knowledge, with material alphabetized within each branch. For example, the disc on animal biology would cover aardvarks, frogs, and squirrels in alphabetical order. The usual objection to a topical organization is that it is too hard to hone in on a particular subject. With a videodisc this problem can be overcome by reserving sufficient frames on each disc to include an index of the entire encyclopaedia, making it relatively easy to find any particular subject at any time. In order to preserve the "look it up" feature of the encyclopaedia one disc would be an alphabetically organized, expanded index, including summary articles and key facts on all subjects.

Topical organization facilitates the ability of the user to study subjects related to the original topic of interest. Since the user can scan forward and backward with ease, the videodisc is a wonderful browser's medium. This makes a topical organization especially desirable as it enables someone to browse an entire branch of knowledge at one time. Further, a well-designed topical encyclopaedia, which embedded much of the content of the Propaedia in its organization and provided guideposts linking different subject areas, would be particularly important in teaching children about the basic structure of knowledge.

Space Limitations and the Economy of Style

Thirty videodiscs today, played linearly, equal 30 to 60 hours of playing time depending on format and playing mode. Even assuming the 60-hour figure will be readily available when the encyclopaedia is ready, that still limits space available for motion sequences. At first the amount seems much too confined. Assuming you have 1000 topics that deserve some motion sequences to present the subject most clearly, and if you allow the equivalent of a 20-30 minute educational film on each topic in the encyclopaedia, that would amount to 500 hours or 250 discs. While this is obviously an impossible number to deal with, there are several technical and stylistic considerations to take into account that mitigate the problem.*

*~~(Footnote:~~ The following will explain how this problem can be dealt with--not how it can be made to go away. "Real estate" or space on the disc will always be limited, requiring you to make difficult although not impossible choices. In fact, the high cost of motion picture production would force you to make similar choices even if there were no "real estate" shortage. ~~Having said that, please consider the following:)~~

- The key factor in the 500-hour figure was the 20-30 minute educational film for each topic. ~~The visual style of materials designed for the videodisc must be very different from that of educational films.~~ Can Because an educational film is designed to be played straight through for a broad audience of varying intellectual abilities, material is paced so as not to lose the slower viewers. This constraint is discarded with the videodisc. Because the user accesses the material much like a

book (you can go back over a "passage" as many times as necessary until you understand it), the videodisc maker does not have to worry about the pace of the material except from an aesthetic point of view.

- Closely related to this is the question of the density of visual images. Much of an educational film's potential value is lost because one cannot "stop" to examine the visual content. Complex, rich pictures are wasted because you never get the opportunity to pause--to get the most out of them. This has meant in practice that the key content is usually delivered in narration, with visuals reduced to mere illustration. Even when the filmmaker tries to use his medium to the fullest, making every frame count, much of this effort is wasted because of the viewer's inability to pause. With the videodisc, the filmmaker may compress far more information into a smaller space, knowing that the user can take the time to get as much out of the presentation as was put in it.

- Another problem with a traditional educational film is that you can't say very much about a particular image. Even one picture may illustrate a wealth of information, ~~if there were only time to point out the significant features.~~ The economics and aesthetics of motion pictures makes it impossible to hold a still frame on screen while discussing it for 10 minutes. Although often seen as the poor man's medium, the filmstrip is based on this very valuable capability. By the time the CVE is

ready, it will be possible to combine a still frame with running narration, without sacrificing any of the visual real estate. If you wanted to elaborate on a particular object (painting, machine, map, archaeological artifact, etc.), you could pause on it for as long as you liked. Each side of a videodisc could contain an estimated 75 hours of audio in addition to the visual content. While the videodisc encyclopaedia should not become a mere collection of "talking still pictures," this feature, when used appropriately, enormously compresses the presentation of complex subject matter.

- The ability of the videodisc to play back materials at different speeds permits you to film certain events using fewer frames per second. Played in real time, the action looks super-speeded up, but played in slow motion, it looks quite normal.

What About Text?

Even with the unprecedented use of motion pictures, animation, audio, and full-color photographic images, text will still figure importantly in the encyclopaedia. We believe text should be stored on the disc rather than published in a separate book issued along with the disc. Why? First, we think children will master the encyclopaedia easier if everything is on the disc. Having to flip back and forth between a book and a disc will be confusing. Also, we think a serious problem might

develop if the text portion were isolated in a book which would be necessarily rather dry and uninteresting when contrasted to the bright, dynamic appearance of the videodisc material. The relatively poor resolution of today's television receivers prompts producers rarely to display more than 350 characters on screen at any one time. While even this low figure might be employed successfully, significant recent developments in this area promise to correct this shortcoming. For example, researchers at MIT have designed a very readable, serifed, book-type font for video which greatly increases the amount of text that can appear the screen. In the future, a widespread move to monitor/receivers in the home and/or development of a higher resolution consumer television would also significantly increase readability of text on the screen.

The Question of Computer Programs

Some subjects, while they will benefit from the visual capabilities of the videodisc, could be enhanced even more by the added capabilities of a home computer. The videodisc alone will enable you to explain the principles of geometry much more clearly than a book, just by adding animated explanations of geometric principles. But a computer program providing experience for the user in the actual application of those principles would induce the most effective learning--learning by doing. The treatment of chemistry, using a computer program to

simulate the mixing of various compounds, would let the child learn chemistry by "doing" chemistry. Well within the realm of possibility right now, such programs will increasingly gain sophistication in the next few years. How they might be included in what is essentially a videodisc encyclopaedia involves both technical and marketing considerations, with the latter being the principal factor.

Computer programs may be such an important feature of an encyclopaedia that appropriate software should be provided at least as an option for those families and institutions that can take advantage of it. That it should be an option at this time, rather than a standard feature, is largely a marketing question to be discussed below.

Computer programs could be included three ways. As it becomes possible to store significant amounts of digital information on a videodisc, the programs may be stored on the disc itself. In this manner the user could access the computer program on algebra at the same time and from the same source as the main material. (The computer programs would be stored in unused portions of the audio track and would not affect the rest of the material.) It is even possible that programs for various computers, e.g., Apple, Atari, and TRS-80, could be stored in different locations, making it practical to make one disc which would work for all three systems. Secondly, programs on floppy discs (like those used now as a program source for

microcomputers) could also be bought along with the videodisc component. Lastly, programs could be delivered over telephone or cable-TV lines.

Market Considerations and Cost of Development

Later we will discuss the possibility of a fully electronic "on-line" edition of the Encyclopaedia Britannica which delivers text and computer programs over telephone and cable-TV lines (or even satellite) while visual and audio information is accessed at home on a videodisc. Although we think in the future this will be the dominant form of encyclopaedia, the market for a stand-alone videodisc encyclopaedia definitely exists today and will continue for some time.

Although the videodisc player and a microcomputer are a natural combination, we can't expect their acceptance in the marketplace to follow the same pattern or necessarily occur at the same pace. The relatively high price of microcomputer equipment alone will mean that for many years, many consumers will own videodisc players but not computers. Additionally, while videodisc players represent a relatively "familiar technology," universal adoption of the computer will be slowed until technological advances make them much easier to use. If EB were to skip directly to the stage of a computer-driven encyclopaedia, we think it would miss a substantial interim market for a videodisc-based product.

On the other hand, within five years, at least hundreds of thousands, perhaps as many as a few million, homes and educational institutions will be using both videodisc players and microcomputers. Offering the option of computer capability to this market will be feasible, and advisable.

The cost of developing the Compton Videodisc Encyclopaedia is estimated at ~~$20~~ 25 million.

THE INTELLIGENT ENCYCLOPAEDIA

As we began to grasp how the domain of knowledge has changed and the need for corresponding changes in our intellectual tools, we started to see the development of an electronic encyclopaedia, not as an interesting potentiality, but as an absolute necessity. We made a chart for ourselves listing all the reasons why Encyclopaedia Britannica should decide not to produce an electronic encyclopaedia and conversely why it should go ahead.

The reasons against were varied, but they fell into the following categories: problems relating to technology, problems relating to design, the high cost of development, and EB's relative inexperience in the area of electronic information and knowledge retrieval and dissemination. As we discussed the matter, we realized that the problems relating to technology and design were challenges that could and would be surmounted during the course of development (both through EB's efforts and through advances made in the field as a whole). We began to see that while the front end cost of an electronic encyclopaedia is quite high, the returns are likely to be substantial enough not only to offset those costs but also to put EB on a much stronger long-term financial foundation. On the question of EB's lack of experience with electronic media, we decided that to raise this as an objection is in effect to say that the technology is more

important than the content. Again, this problem can be resolved.

On the positive side of the ledger, 1) there is a clear social need for such a tool, 2) the technology has progressed to the point that developing such a product is feasible, and 3) EB is one of very few companies that has the requisite experience and stature to carry out a task of this magnitude.

The discussion of an electronic Britannica will proceed as follows: a brief definition of the capabilities that one would want in an electronic encyclopaedia; a suggestion about a hardware configuration which could accomplish these goals and which will likely be "in place" in homes, schools, libraries and offices; and the relationship of an electronic encyclopaedia to traditional markets and patterns of distribution.

An Encyclopaedia for Reference and Education

In his introduction to the Fifteenth Edition, Robert Hutchins stated that there are two aspects to the Britannica's role: it must be both a "reference work and an educational instrument." In making this point, he reiterated the important and profound distinction between facts and education (or knowledge). "Although information is often confused with education," he wrote, "a moment's reflection will convince the reader that they are not the same. Facts are indispensable to education, but the possession of any quantity of facts does not

guarantee that understanding which alone deserves to go by the name of education."

The principal problem addressed by the novel structure of the Fifteenth Edition was how to provide a ready resource for simple fact reference, yet also to perform the crucial role of enabling the user to derive a higher order understanding, or knowledge of a field of subject matter.

With this concept as our starting point, we ask, what power should an intelligent encyclopaedia put at our disposal? It must permit people to enter the domain of knowledge on at least four levels and from many different directions. First, it has to be a reliable, comprehensive, and efficient source for fact reference. Second, it must provide an overview of all subjects, laying out briefly the historical origins of a topic, its importance in various contexts, and its interconnections with related concepts. Third, we want an in-depth presentation for the person who desires to go deeply into the theory and background of a subject. Fourth, our ideal encyclopaedia should actually teach us the rudiments of a subject. This is the difference between learning "about" chemistry and learning chemistry. Thus, where an elementary knowledge of chemistry, say, is necessary to understand other subjects, the encyclopaedia should be able to provide the user with the ability to learn basic chemistry well enough to be able to use that knowledge in related areas. One might think that this is

taking the educational function of an encyclopaedia too far. After all, education is the role of the schools and of textbooks. But if the modern encyclopaedia is to be an effective window or entry point into the world of knowledge, it can't just make knowledge available, it must also "teach" content in such a way that the user grasps the basics and understands them on the level of functional, usable knowledge that has been integrated into his own cognitive structures.

The intelligent encyclopaedia should also function as a dynamic research partner. Indexing and search procedures should make travel throughout the whole domain easy and efficient. Specific questions "asked" of the encyclopaedia should trigger responses tailored to the breadth and depth of the request. In fact, the encyclopaedia should help the reader decide the directions in which he wants to go. It should allow the user to "browse" through the entire domain. The importance of this should not be underestimated. Given the multiverse of interconnections between topics, people need to be able to follow ideas down unexpected paths. Making this easier would contribute to the actual formation of new knowledge. Since knowledge is the fitting together of a pattern of bits and pieces of information, facts and ideas, the ability to go back and forth with ease would enable the reader to be more creative in his study and research.

Finally, the intelligent encyclopaedia should be able to

draw on the full range of available media, so that each topic utilizes the most appropriate combination of media.

On-Line Computer Power + Videodiscs

At present the delivery system that would best accomplish what we've described is a combination of an "on-line" computer and interactive videodiscs. The text of the encyclopaedia plus the computer-driven learning modules would be on-line, accessed via two-way cable or telephone wires, through a terminal in the home (or school, business, etc.). A set of videodiscs issued to the user, to be played on his machine, would comprise the audio and video components of the encyclopaedia. The on-line portion of the encyclopaedia would send instructions to the user's videodisc machine, in order to coordinate the videodisc segment with the rest of the encyclopaedia.

Several other configurations might be considered, but none offer the tremendous versatility that comes with having the entire database managed by a fast main-frame computer. For example, it will be suggested that the entire text could be put on one or two videodiscs, thus eliminating the need for on-line transmission. We don't think this is a viable alternative, because while you can in fact store trillions of bits of information on two videodiscs (many times the amount of text currently in EB), accessing this material through the small home computer, even as powerful as they are likely to be 10 years

from now, will not be sufficient to give the user access to whatever level of information and knowledge he requires, or allow him to change levels with ease.*

~~(Footnote:~~ * This is not to say that sometime in the next several years, it might not be appropriate to issue a videodisc version of the 15th Edition. It is likely that advances in the presentation of text on a video screen will make such a product feasible. While it certainly would not be what we mean by an electronic encyclopaedia, EB may decide principally from a marketing perspective, that in the interim, it wants to produce such a disc.)

An Electronic Encyclopaedia and the Structure of EB

The Fifteenth Edition is a magnificent attempt to present the entire "Circle of Learning" in a format that takes into account both the reference and educational functions of an encyclopaedia. The Micropaedia, Macropaedia, and Propaedia represent a brilliant step forward in the structural organization of knowledge, reflecting as they do the division of the knowledge domain into discrete facts, in-depth knowledge of a particular subject, and the sweeping view of knowledge in its totality. In fact, however, the average user experiences considerable difficulty finding his way through the materials. This conclusion was unanimous among the dozen or so librarians we queried. While they have tremendous respect for the overall content of Britannica, in practice, they say having the material on a given subject in at least three volumes has proven quite cumbersome. They are also unanimous in pointing out that the indexing system is not powerful enough for the complexity of the

presentation.

If the entire text were on-line, with a sufficiently elegant index and search procedure, one would come a lot closer to reaching the goals of the Fifteenth Edition. With the text on-line, the computer would do the job of coordinating searches on the various levels of the encyclopaedia. The ability to travel at the touch of a few keystrokes to any destination within the whole work would transform the encyclopaedia into a much more powerful and useful tool. The confusion and cumbersomeness associated with the present Britannica should definitely not be attributed to the conception of the structure; rather it is the fault of the static nature of print as a medium for delivering text. The dynamic medium of the computer will prove what an important epistemological contribution this new Britannica really represents.

Beyond Nexis/Lexis

What we are envisioning will of course transcend anything the user can do now with Encyclopaedia Britannica on the Nexis/Lexis database. For those who are not familiar with Nexis/Lexis, let us describe briefly what it does, from the user's point of view. Let's say you are interested in studying about energy. Nexis/Lexis searches key words. So you key in the word "energy," and in a very short time (Nexis/Lexis can go

through the entire Britannica in just a few seconds) you are told that there are 3,000 articles that include the word "energy." These titles, or selected portions of actual articles, can then be printed out. Since that is obviously too large a number to deal with, you can limit the focus of the search to "energy and pollution," or to "energy and pollution and petroleum" or even to "energy within ten words of pollution." The result is a smaller list, but the fact is you get absolutely no sense, until you read the articles, about how the terms are related in the particular articles. Nor do you get any hint as to what other articles and group of articles (that do not meet your specifications) might be relevant to your inquiry. The free-text retrieval or key word searching Nexis/Lexis currently performs, rapid and powerful though it may be, is only useful if the user has a very clear understanding of his needs. This low-precision retrieval does little or nothing to reveal the interconnections or structure of the database.

Advances in "artificial intelligence" and the development of natural-language query systems make feasible the construction of an "intelligent encyclopaedia," one that will serve as both a guide and tutor. Such a work would not just regurgitate factual information, but it could also use its "knowledge" to carry out some of the inferential steps associated with human reasoning. For example, if you typed "energy," the intelligent computer might respond, "That's a very broad term. Here is a

representation of the different ways the word 'energy' relates to the overall structure of knowledge. In which relationships are you interested?" The computer would then present a map with "energy" in the center, and related terms on the periphery; the nature of the relationships would be indicated as well. You would be asked to choose an initial direction. If you had typed "energy and pollution," the computer would execute a similar procedure, helping you to focus your search precisely. Along the way, you would be learning a lot about what other topics were related, and in what ways, to your original interest. On the other hand, if you went into the database at a very specific level, the "effect of petroleum fuels on air pollution," for example, the encyclopaedia would not only answer your specific question but suggest related areas in which you might be interested, but had not thought of.

The intelligent encyclopaedia will be so conversant in ordinary language that it wouldn't matter whether you asked it for "Charles Dickens' birthday" or "The date of Charles Dickens' birth" or "When was Charles Dickens' born" or even "What was the birthday of the author of 'A Tale of Two Cities'?" The computer would locate the fact that you seek. Certainly, this ultimate fact-reference tool will eliminate problems of "not knowing where to look" or "not knowing how it's listed."

To teach the user the basics of a subject like chemistry or quantum mechanics on a level at which he is able to actively

apply that knowledge (where he has recreated the knowledge in his own mind), the intelligent encyclopaedia will provide an instructional sequence (including audio and visual components via videodisc if appropriate) so that the user has the opportunity to learn by doing. This "understanding tutor" will respond to the user's questions, evaluate the user's understanding, prescribe alternative ways of curing his ignorance, and in general carry on an intelligent dialogue.

The hardware to run the user's end of this system exists right now. Any of the basic microcomputers now sold by dozens of companies could access and interact with an intelligent encyclopaedia over phone lines or two-way cable. An ordinary consumer videodisc player can be hooked up to a computer. Material on the disc would be then under computer control. What is not yet available is computer software sophisticated enough to manipulate so complex an encyclopaedic database. But active research is currently resolving many of these limitations. Without being unduly optimistic, we think advances over the next ten years will certainly facilitate construction of an intelligent encyclopaedia for mass distribution that incorporates the essence of what we have projected.

Apart from developing the technology for accessing a complex database, one must also design and construct the database itself. These two tasks are not unrelated. Britannica's stake in research on artificial intelligence,

electronic data retrieval, interactive video, and other areas matches the contribution its experience could make to researchers in those same fields. Cooperation between those developing the technology for "delivering" the database and those developing the database itself will expedite and improve results obtained from both efforts. (See suggestion #2 in Chapter 10.)

Other Advantages of an On-line Electronic Encyclopaedia

- An on-line encyclopaedia can be continuously updated. It can always be current, never out-of-date. The on-line format frees you from the complicated and costly problem of having to reprint an entire book to revise a portion of it. Space will not be a consideration when revising. If a subject suddenly mushrooms in importance, or significant new data demand inclusion, a section can be expanded without squeezing other topics into a smaller space. Obviously the videodisc component cannot be revised so easily, but this will be a much smaller problem than having the whole encyclopaedia frozen in print. If the text is being revised continuously, we think people will feel confident that they have a "current edition" of the Britannica, even if some of the visuals are dated (pictures of personalities, reports on scientific breakthroughs, etc). This can be dealt with in several ways. A videodisc yearbook could be issued as part of the user fee (to be discussed below), and

the on-line component could identify outdated visuals where appropriate.

- Space considerations do not constrain an on-line electronic encyclopaedia. You might add access to a much larger database than the encyclopaedia alone. For example, the Great Ideas Series or the Annals of America would amplify the database. The Great Ideas Series becomes much more than a collection of important books. Imagine being able to ask the encyclopaedia what Aristotle had to say about education and have the intelligent encyclopaedia pick out appropriate passages. Then you could ask, "Well, what did Rousseau have to say on the same subject?" The computer wouldn't do the work of reading and understanding, but it could surely make approaching these works more manageable and therefore make the works themselves more useful.

- An on-line encyclopaedia would permit immediate user feedback, via the computer. Users could criticize the accuracy, style, and usefulness of the content, indicate needed corrections, suggest new subjects, and so forth. The ability to receive such feedback and make appropriate changes would equal a much stronger encyclopaedia.

New Markets and Patterns of Distribution

The on-line electronic encyclopaedia would have a fundamentally different pattern of distribution and could

penetrate and create new or previously unexploitable markets. Because the heart of the encyclopaedia would be on-line and continuously updated, subscribers would not actually "purchase" the encyclopaedia. There would be no such thing as the "1990 Edition." Instead, it seems likely that people would subscribe to the encyclopaedia by paying a monthly or yearly fee. Instead of buying an encyclopaedia once in their lifetime, people would pay for the use of the encyclopaedia as long as they are still actively learning, which increasingly is for a whole lifetime.

The electronic encyclopaedia we have proposed could minimize the danger of piracy, a major concern related to electronic publishing. The database would be too large to "steal," although users would surely be encouraged to "save" results from their data searches. Since the intelligence component (the search procedures, the tutorial ability, etc.) would reside in the central computer, the encyclopaedia's main value would rest in its on-line status. Without the powerful indexing capability of the main computer, the words alone would not be very useful. Videodiscs cannot be copied except by large-scale, expensive machinery. Transfering videodisc program content to videotape, available on consumer videotape equipment, loses the still-frames, random access, and many other unique features of the videodisc.

Who Controls Distribution?

EB must consider who is actually going to control the distribution of the electronic encyclopaedia. With the print encyclopaedia, EB deals directly with the customer, controlling distribution all along the way, accruing profits corresponding to that investment. With the electronic encyclopaedia, the decision must be made whether to control physical distribution, that is, whether to handle the actual maintenance and transmission of the on-line portion of the encyclopaedia, or to license a company like Mead Data Central which owns Nexis/Lexis to distribute it for you.

This very complicated question has ramifications that we are not in a position to analyze fully. However, we think that the ideal situation would be one where EB was capable of controlling distribution all the way to the end user. If this were the case, the intelligent encyclopaedia itself could grow in scope, becoming in effect "The Britannica Information and Knowledge Service." Thus, besides the EB products discussed earlier, several other reference tools would make strong additions to the service. For example, a well annotated, up-to-date bibliography of the most significant 200 books or papers in every field could be included, for those who need to go further than the basic encyclopaedia content. It may prove both feasible and desirable to make the entire text of important books and periodicals available through the on-line service. Established indexes like the Reader's Guide to Periodical

Literature could also be included. The larger the database on which the encyclopaedia drew and with which it surrounded itself, the more powerful an instrument it would become.

If EB were to control the distribution and transmission of the intelligent encyclopaedia, it could also expand its operation to include an active research service. Since the system is capable of two-way communication, users could request information. EB personnel would then research the question and send an answer back over the line.

Costs, Partners and Potential Income

To grasp the potential market for an on-line encyclopaedia service and the possible income it could generate, let's look at the following figures. By 1990-95 over 90 million homes will be wired for two-way communication (via telephone lines or cable-TV systems). If only 5% of these households subscribed to the Britannica Information and Knowledge Service at $10 per month, consumer market revenues of $540 million per year would follow. While this figure of 5% represents a greater figure than Britannica's current penetration, we believe it is reasonable given the following: A) The very high cost of development will preclude there being more than one or two intelligent encyclopaedias of the magnitude described here. B) As the "information society" becomes a reality and access to information and knowledge becomes increasingly important, the

Britannica service would assume a more significant overall role in the average person's life than the print encyclopaedia does today. Further, since its content would encompass far more than today's encyclopaedia, it could well become the central feature of the consumer's electronic library--the one service no one could be without. C) The trend toward lifelong learning will mean that people will, on the average, want to have access to an encyclopaedia, especially an intelligent one, over a greater proportion of their lives than currently. For example, many 50-year-old people, who rarely buy an encyclopaedia today, would subscribe to the Britannica Information and Knowledge Service.

The more than 140,000 schools and libraries would pay fees for the encyclopaedia based on the number of terminals they have accessing the service, the number of users, per use, or some combination of these. Although the actual level of use for each institution would differ, an average yearly revenue of $1500 represents an additional $210 million. This is based on the assumption that while small "one room" schools might pay only $120 per year, university libraries with perhaps hundreds of terminals accessing the encyclopaedia might pay tens of thousands of dollars per year.

This comes to $750 million just for the U.S. consumer and educational market. When you add in the Canadian market, international distribution via satellite, and the potential for business subscribers to the service, the total revenue could

quickly approach $1 billion annually.

This $1 billion figure is even more significant in light of the costs involved. While the front-end editorial costs will be much higher than any previous edition, at least $100 million, the costs associated with distribution will be much lower. Consider two points. First, all EB sales today involve the printing, warehousing, and shipping of an actual product and (with the exception of automatic yearbook sales) there are high sales costs as well. With the Britannica Information and Knowledge Service, the principal component is on-line, and once the database is constructed ~~and placed in the main-frame computer,~~ the costs of physically maintaining the database are far less than the equivalent costs of printing, shipping, etc. Mead quotes a cost of 10 cents per 1000 characters to physically maintain its Nexis/Lexis database. At approximately 43 million words or 300 million characters, this amounts to about $30,000 per year for the current Britannica. Second, once people have bought into the service (perhaps at a dollar amount covering the manufacturing cost of the videodisc component), they remain paying subscribers with no additional cost to Britannica beyond the updating, maintenance, and transmission of the database and the cost of administering subscribers. Not only will the revenues generate considerable sums for the editorial costs associated with updating and expanding the encyclopaedia, but the Britannica service, once in place, becomes a "cash cow,"

producing substantial profits year after year.

While the final shape and structure of such a business cannot be predicted, we are certain of one thing— Britannica will need a substantial partner or partners to help develop the intelligent encyclopaedia. Not only are the start-up costs too high for EB to assume alone, but considerable expertise and strength is needed in various areas, including computer hardware and software and data transmission. (There is further discussion of this point in Chapters 8 and 9, Production Considerations and Joint Ventures.)

SUPPLEMENTS

During the next several years, as electronic publishing is just getting underway, and Britannica's economic strength continues to depend on the sales of its printed materials, a logical use of the videodisc would be an audio-visual supplement to the current edition of the Britannica. Recognizing this we considered three ways to construct such supplements: In each case the goal was to design a series of ten discs following the topical organization of the "Circle of Learning" outlined in the Propaedia. The three ways we considered making the supplements were as follows:

A) Taking footage from existing films plus still photos and combining them "as is." Thus the disc dealing with biology would have short sequences covering different aspects of biology, taken from different movies. The sequences on the disc would be cross-referenced to the encyclopaedia and vice versa.

B) Reformatting footage from existing films with still photos and some new production so as to utilize the videodisc's capabilities as much as possible. For example, footage showing a frog dissection would be edited so that it could be compressed in real-time and played back in slow motion, thus saving considerable space on the disc.

C) Designing and producing fresh content specifically for

the videodisc.

After much deliberation, we decided, either for programmatic or financial reasons, not to recommend any of these possibilities. The first type, which could be done relatively inexpensively, especially since EBEC would probably make its films and filmstrips available at little or no direct cost, was rejected for two reasons. First, we think there is no way to transcend the cut and paste method used to make the product. Films are designed as a whole and sequences taken out of context can easily lose their meaning. Second, while videodisc technology makes it possible to compress a much greater amount of information in a given length of film, the footage must be specifically designed for the videodisc. Given the limit of one hour per disc, the use of unreformatted sequences from standard linear films would make it impossible to provide adequate coverage of enough topics to consider the result a genuine supplement to the encyclopaedia.

Reformatting of existing materials would permit some compression of information, but the cost would be prohibitive for a product whose potential market is realistically no larger than the number of people and institutions who at this point own both a set of Britannica and a videodisc machine. Whereas a program made of "as is" materials provided by EBEC could be produced for under $100,000 per disc, any substantial

reformatting, plus the small amount of new production that would be necessary to increase the utility and density of information, could push this figure as high as $150,000 per disc. If this cost seems inflated for programs consisting largely of existing footage, which EB would get at no or low cost, consider the huge research job involved in culling through thousands of films, filmstrips and photos, and then the even greater job of assembling the snippets and photos onto one master tape.

A multi-disc supplement made from entirely original material would be even more expensive and would probably take as long as three to five years to complete.

Alternatives

However, since the idea of producing an audio-visual supplement to the Britannica is still valid, we would like to suggest several alternatives to a multi-disc supplement that has meaning only in relation to the print encyclopaedia. First, the individual programs described in Chapter 1 are in effect supplements to the Britannica. The broad scope of the proposed programs and the fact that they would be cross-referenced with the Britannica makes their promotion as supplementary materials quite appropriate. Also, as mentioned earlier, they would make perfectly suitable sales premiums.

The Britannica Great Film Series

An interesting alternative to the cut and paste problems described above that would make use of existing films is to assemble a series of the best educational films from EBEC as well as other film companies. (What we are proposing here differs from the EBEC licensing of its films to MCA in two ways. First, we are suggesting a complete series that would be marketed and promoted as such; the EBEC-MCA films never enjoyed any promotion whatsoever. Second, the EB Great Film Series would consist of only the best educational films that have ever been produced.) While we have argued throughout this report against using the videodisc simply to repackage old materials, the thrust of that argument has been aimed at those who repackage old materials and yet claim they represent something new. On the other hand we do believe that the use of the videodisc as a low-cost distribution and delivery system for linear media is important. Many excellent educational films have not been seen by many people because no mechanism exists to distribute them.

"The Britannica Great Film Series" main difficulty would be securing the rights to the films. As EB would want the very best, they will likely be both expensive and not easily released. However, for at least another year, we think EB might be able to purchase rights to most educational films on a non-exclusive basis. Most educational film companies are not in a position right now to invest in videodisc publishing and they

might be very interested in allowing a company like EB to distibute their films in a prestige showcase like the EB Great Film Series.

\\ The Circle of Learning //

As a by-product of the work done to produce the Compton's Videodisc Encyclopaedia and as a precursor to the intelligent encyclopaedia, within five years a ten-videodisc series could be developed which would provide an audio-visual introduction and overview to each of the components of the "Circle of Learning." This would differ from the all-new-material supplement discussed above, because while functioning as a supplement to the print encyclopaedia, the whole set and each disc within it would be designed to stand on their own as well, and could enjoy a market beyond the encyclopaedia owners. For example the disc on Earth Sciences would not be just a collection of short, unrelated sequences, but would have a unifying structure and narration. Taken as a whole, the set would be like a mini-video encyclopaedia. Individually the discs would provide a general introduction to the particular topic. Such a project would probably only be financially feasible if it borrowed significant amounts from other videodisc projects like the Compton's Videodisc Encyclopaedia and some of the individual topic programs.

MANUFACTURING COSTS AND METHODS OF DISTRIBUTION

Film and videotape will never be cheap enough to become mass distribution media principally due to the high costs associated with the raw materials and the method of manufacture. Consider that a one-hour videotape requires over 2000 feet of high quality recording tape, an expensive cassette, and the high cost of real-time replication, i.e., it takes one hour to record a one-hour program. Videodiscs on the other hand are pressed from relatively small amounts of inexpensive plastics and other materials and can be replicated in approximately 30 seconds.

The expensive factor in videodisc manufacture is the very high cost of the machinery itself. Most reports suggest that a minimum investment for a videodisc replication plant would run in the $10 to 15 million dollar range. For this reason, at the early stages, a relatively small number of large companies are likely to control the manufacturing of discs themselves. As of now there are only four plants in the world capable of replicating optical videodiscs--two in Japan (Sony and Pioneer) and two in the U.S. (3M and DiscoVision).

Because the bulk of videodisc production to date has been for industrial and government applications, the rates quoted publicly by the manufacturers reflect the small, custom-runs that such business usually requires. For example, the lowest price quoted publicly by any company is $5 per side by

DiscoVision. Sony and 3M both quote prices approaching $10 per side. In fact, these prices bear no relation to what it would cost for large runs of discs for the consumer market. DiscoVision has been unwilling to quote a price to us short of our presenting them with definite production plans, but there is no question they would charge much less than the $5 price. Note that Paramount currently sells a two-disc, four-sided set of "Star Trek" for under $35 retail. Obviously they don't pay $5 per side or $20 for replication alone. Our guess is that they are paying under $10 total. Sony was the only company willing to offer at least a "ball-park" figure for a large run. Their representative said "It only costs us pennies to actually press the disc" and proceeded to offer a quote of no more, perhaps less, than $3 per side on runs of 10,000. While the economies involved in large runs are not as impressive as with book production, the replication cost would decrease even further with larger runs.

Over time, as more companies go into the replication business and the overall manufacturing capacity increases, the cost of a replicated disc will likely settle around $1.50 - $1.75 per side. Reports that the price will go below $1.00 are probably unrealistic given the cost of materials and machinery.

Yields

When videodiscs first hit the market, many press reports

focused on the difficulties DiscoVision was having in turning out usable (playable) discs. Reports that only one in five was any good were common and probably accurate. Most problems could be traced to the inclusion of microscopic dust particles in the videodisc during the bonding process. However, most videodisc manufacturing now takes place in controlled "clean room" environments, which has dramatically increased not only the overall quality but the percentage of perfect discs. Manufacturers now claim that their rejection rates are comparable to, or even lower than, those in the audio disc industry.

VHD and RCA

At this point neither the VHD consortium nor RCA are willing to press discs on a custom basis. Either they will issue a program on their own label as part of their catalog, or they won't press it at all. This situation will certainly change but for now one can only guess at the possible costs. In general the manufacturing process for capacitance discs is simpler than for the optical discs, but both RCA and VHD require plastic caddies to protect the disc. This may mean that for large runs, manufacturing costs for VHD and RCA discs will be slightly higher than optical discs.

Methods of Distribution

At this time two channels of distribution predominate. The principal avenue is through the stores which actually sell the players. Of secondary importance are the video stores that have sprouted up over the last several years, primarily as outlets for pre-recorded videotape. (Included in this category are the many record stores that have begun to carry videotapes.) The first significant change in this pattern will be the development of mail-order sales, both on the part of independent publishers who have discs to sell but no established distribution network, and by mail-order retailers who will promote discs through magazine ads and videodisc mail-order clubs.

Our prediction is that these will remain the only significant methods of distribution as long as the bulk of the programming is movies and musical presentations. However, as the quantity of education-oriented programming increases, book stores will begin to carry videodiscs. The type of programming publishers like EB will produce is a natural extension of products bookstores already carry. People are far more likely to go to their local bookstore for a videodisc on archaeology than the local record or video store. (As movies are often referred to as the modern-day cultural equivalent of the novel, it is not far-fetched at all to expect that bookstores will be carrying movies as well.) Recent discussions with executives at Walden's and Dalton's confirmed these thoughts. Both stores deemed it a matter of when, not whether, they would begin

selling videodiscs in the stores. Walden's will be testing the sale and rental of videotapes at a number of their stores early in 1982.

Looking into the future, five and ten years down the road, we foresee the growth of "media" stores which would be equivalent to the modern bookstore in scope, but would stock materials across the full range of print and electronic media including books, videodiscs and computer software.

THE VIDEODISC PUBLISHING MARKET

Assessing the market for a fundamentally new technology is fraught with all sorts of difficulties stemming from the fact that you are trying to measure something that hardly exists, either in fact, or in the case of the man on the street, in the imagination. Consider the difficulty of predicting the market for printed materials right after Gutenberg invented movable type. The first products off the press were the same bibles and other religious materials that until then had been copied by hand. Only a relatively small number of people could even read. Can you imagine in the year 1490 trying to predict the market for novels or newspapers based on consumer surveys of the time? The problem is that a fundamentally new technology doesn't just displace an old technology by doing the same old thing better, rather it makes it possible to do things that never could be done before. With electronic publishing in particular, the situation is even more complex as several new technologies have arrived on the scene at the same time, some complementing each other, some in competition.

We are quite suspicious of the market predictions made in this field over the past several years. Some which are wildly optimistic are poorly documented or else naive in their arguments, ignoring significant developments or contingencies. (We had occasion to speak with a Wall Street analyst, the author

of a major report on videodiscs, widely quoted in the press, who admitted that the market projection figures in his report were largely made up off the top of his head.) Others are hopelessly mired in the present, trying to define a market that has yet to develop in terms of the market that exists now. The classic example of this is the type of survey that identifies only a limited consumer market for educational materials since the educational movies that have been issued so far on videodisc have sold poorly. No matter that the educational films on disc are mainly direct transfers of rather ordinary linear films. No matter that many of the initial purchasers of videodisc players are single males, not usually the biggest purchasers of education-oriented materials.

Rather than quote a lot of statistics supposedly proving a big market, we would like to define how large the total videodisc market is today and then share some observations which we think both answer some of the pessimistic estimates and indicate a positive future.

The Present Videodisc Universe

As of October 1981 the number of consumer videodisc players actually in homes is less than 100,000 for the optical and RCA formats combined. This number breaks down into approximately 60,000 for the optical system and slightly over 30,000 for RCA. The number of players in schools and libraries is negligible.

The optical player hit the national market in the fall of 1980; the RCA machine in March of 1981. The sales trends for the RCA and optical formats are evidently quite different. Although no company will release exact sales figures, it is widely known that RCA is experiencing sluggish sales while Pioneer, the principal optical player manufacturer, is now showing sales with a healthy upward swing. The third videodisc system, VHD, will not be launched in the U.S. until June of 1982.

The RCA Experience

Six months ago, most analysts were predicting that RCA would run away with the videodisc sweepstakes. Today RCA is laying off workers in its videodisc plant, while Pioneer cannot even meet demand. ~~Basically what happened is that~~ Evidently the analysts (and RCA) underestimated the sophistication of the consumer. It was assumed that movies and movies alone would be the driving force behind the videodisc market, and that the average consumer would not be interested in the unique capabilities of the laser optical system. Following from this, it was assumed that the consumer would opt for the cheaper RCA machine ($500 list vs. $750 list) which can play movies just fine. Well, when the consumer went into the store (often drawn in by RCA's $12 million ad campaign), and was faced with the RCA machine which can't do anything but play a linear program straight through, and with the Pioneer machine's full stereo,

scanning, slow-motion, and still-frame capabilities, the consumer either opted for the Pioneer player or decided on a videotape recorder which, although it cost more, offered more versatility than the RCA videodisc player. RCA evidently has learned their lesson and has hinted that future generations of its player may have some of the laser system's capabilities.

The Chicken and the Egg

Everyone recognizes the chicken and egg aspect to the videodisc market. The machines won't sell until there is programming, but no one wants to produce the programming until a certain number of machines are in place. (Actually when you realize that there is only one program designed originally and specifically for the videodisc player actually on the consumer market today--"The First National Kidisc"--the sales of 60,000 players is quite impressive).

We suggest book publishers should have less trouble with the chicken and egg contradiction than others. The publishing industry has long recognized that profits are made on the backlist. While it will be difficult to make an immediate profit on programming produced for videodisc, 3 to 5 years from now, when the market has matured, those firms that are forward-looking enough to commit themselves now to the production of high quality programs will have an established reputation in the field and a valuable backlist to draw on.

The other side of this is that because so many companies are taking a wait-and-see position, the demand for original videodisc programming is actually outstripping the supply. Companies which put a well-conceived product in the marketplace within the next year can expect to make sales to an unusually high percentage of the total player universe. For example, the "First National Kidisc" referred to above rapidly sold out its initial run of 10,000 copies.

Videotape Vs. Videodisc

In the long run there is not an "either/or" relationship between ~~these two.~~ Videotapes and videodisc players will perform essentially different functions--the tape player will be used for "time-shifting" (recording off-air and playing back when convenient) and for showing ~~home video movies.~~ video home movies. The videodisc player will be the principal technology for playing pre-recorded materials.

Paramount Pictures recently revealed some very telling figures to the effect that even with the miniscule number of laser videodisc players compared to the number of videotape players, over the current fiscal year, Paramount expects to sell more than 1 million videodiscs, which is far in excess of the number of prerecorded videotapes they will sell. Paramount reports that on a per-machine basis, ~~sales of~~ videodiscs outsell pre-recorded videotape on a ratio of 15 to 1. Parenthetically

we would suggest that the price of videodiscs is low enough to approach being an impulse item, which has definitely not been the situation with videotape. ~~We conclude that~~ The market for videodiscs cannot be guaged simply by measuring the videotape market.

The Role of the Industrial/Education Market

Magazine pundits when writing about videodiscs are fond of raising the specter of quad stereo and Cartrivision as technologies which "should have caught on" but never did. Aside from the fact that the videodisc represents a more fundamental technological development, both quad stereo and Cartrivision were solely consumer items. The videodisc on the other hand already has a solid foundation in industrial applications. GM, Ford, IBM, and the government (particularly the defense department) are very big users of the technology on many different fronts, from training to consumer education. This means that whether it takes 2, 3, or 5 years for the consumer market to mature, the technology is not going to go away. In fact it will undergo continual refinement and development.

The ABC-NEA Schooldisc program, expected to place 5-6,000 players in U.S. elementary schools this year, may provide a similar foothold for the technology in educational institutions.

2 Million Copies of Cosmos

As mentioned in the beginning of this chapter, it's foolhardy to try to measure the potential market for certain types of videodisc programming by polling the early buyers of videodisc or even videotape machines. Mainly, they have been attracted by the movies which make up the bulk of the current offerings. A better indication of the potential sales of videodisc programs like those suggested for Britannica is the popularity of some of the offerings on the Public Broadcasting System, and the sales of books relating to those programs. Until now, PBS has been the major source of serious video-based treatments of non-fiction subjects for the consumer. Over the last several years, a number of PBS programs have achieved very high ratings, enjoying audiences numbering in the millions. But as good as the programs are, the linear nature of broadcast TV requires the viewer to consume them all at once without the opportunity for reflection, review or repetition. A few of these programs, including "Cosmos," "The Ascent of Man," and "Connections," have each yielded excellent books which not only cover the points made in the program, but delve further into the subject matter than was possible within the TV format. As of September 15 of this year, 2 million copies of Cosmos have been sold and it is still solidly entrenched on the bestseller lists. Clearly, a large number of people are interested in far more than movies. We think if a videodisc presentation of Cosmos were on the market right now, its excellent sales would be

instrumental in developing the market for related programming and videodisc players among a whole strata of the population. It is precisely this role that the proposed Britannica programs could perform.

One additional indication of the strength of this potential market is the tremendous growth in readership of a number of serious, mainly science-oriented magazines, including some that have been publishing for years like Scientific American, The Smithsonian and Nature, and others that are relatively new, at least in their current form, such as Science Digest (Hearst), Science '81 (The American Society for the Advancement of Science), and Time Inc.'s Discover.)

MOVING AHEAD

The next twelve to eighteen months present a unique opportunity to Encyclopaedia Britannica in the area of video publishing. At the present time some of the large companies like Time-Life and CBS which figure to be very active in videodisc publishing are channeling most of their efforts, relative to the new video technologies, in the area of cable-TV and related projects such as videotext. Clearly the strategy of Time-Life and others is to put maximum effort and money into cable now, and to go into videodisc publishing later, when the videodisc market has matured somewhat. With their well-developed distribution networks and their backlog of excellent video programming, companies like Time-Life can afford to hold back in videodisc publishing. If the market develops faster than they anticipate, they can shift gears and within a few months have a significant number of products on the market.

Frankly, this turn of events leaves a space for smaller companies like EB to move in to the videodisc field now and establish a firm position, before the bigger communication conglomerates make their move. The individual videodisc programs described in Chapter 1 are intended as a vehicle for Britannica to enter the videodisc market at a relatively low cost, but with maximum effect. As we wrote earlier, the series

of individual programs is designed to "protect Britannica's position in the consumer/educational market as that market moves increasingly into electronic media. As the Britannica name comes to be associated with top quality video (and electronic) educational materials, people will begin to look to it as the leader in that field as they currently do in the field of print."

Let us describe a possible scenario for EB's initial efforts. We suggest that EB launch a program to publish in the course of the next one-two years at least six videodiscs similar to those suggested in Chapter 1.*

*(Footnote: ~~We recognize that~~ When starting out in electronic publishing the tendency is to want to do one program as a test case. We strongly recommend against this approach. First of all, one program is not enough to have the type of impact that is necessary. Second, the economies of scale work heavily against you ~~with this approach~~. The cost of production and manufacture will be higher for one program produced by itself, and the cost of marketing an individual disc properly is prohibitively expensive. The result is that the test case is skewed toward failure, and even if you sum it up accurately, recognizing the reasons for the failure, you have lost valuable time and money.)

Further, that EB choose one overall partner for the entire series to share the investment and to provide either production expertise or a means of distribution. In addition to the one overall partner, we suggest that EB enlist the participation of Optical Programming Associates, a consortium representing the principals in the laser videodisc camp, MCA, Discovision, N.A. Phillips, U.S. Pioneer, at a level sufficient to ensure the most

favorable manufacturing costs and the widest distribution, but not so great that DPA would insist on too long an exclusive for the optical system, which would prevent issuing the programs in the VHD format when that becomes practical. (The whole question of joint partners will be discussed in greater detail in Chapter 9.)

Small Risk Now, Big Profits Later

One thing that should be clear from the discussion of the videodisc market is that the existing market is so small that immediate returns can only be minimal. To put this another way, if only the next couple of years are considered, more money can be made by investing in bonds than in videodiscs. On the other hand, and this is the argument we have made above, the application of a carefully designed program now can minimize risks and put EB in a position to realize impressive profits in a few years when the market matures. Three years from now, when other publishers are scrambling to develop video programs, EB will have a prestigious collection that will already have a reputation for excellence and enjoy wide sales as a result. Furthermore, the individual programs we have described are designed to be classics that would be sold for many years.

A final consideration relates to the collaboration with the Smithsonian and the Library of Congress. These are unique institutions and although neither is likely to grant anyone

exclusive access to its collections, it would be invaluable for EB to establish itself now as the principal partner of either or both in the development and publication of videodisc programs based on their collections.

The following charts are intended to give a sense of the financial risks involved in the individual topic programs. The figures are constructed to show a worst-case situation. Although the chart includes figures for as few as 10,000 copies, we expect that any of the proposed programs would sell far in excess of that number within 2 years of publication. The only costs and revenues shown are from sales of laser videodiscs. No sales of linear versions of the programming or sales in other videodisc formats are assumed. Neither is there consideration of the possible income from sales of book versions of these early programs.

The figure for manufacturing assumes a cost of $7 per disc (including packaging) for 10,000, $6 for 30,000 and $5 for 50,000. Royalty payments to the producers of the programs would be subtracted from the net amounts. It is assumed that the wholesale price is approximately 2/3 of the retail price.

We are assuming that the distribution of these initial videodisc programs would not follow EB's normal direct-to-the-consumer sales pattern. In fact, we expect that EB will arrange for a third party, presumably OPA or the main partner mentioned above, to handle distribution to the consumer

through channels described in Chapter 6. (It will be necessary to consider how to distribute these programs to the educational market as it develops. However, since the role of EBEC vis a vis the educational market for EB's products is not entirely clear to us, we thought it better simply to raise this as an important question to be addressed.)

Great Moments in History

Number of discs sold	10,000	30,000	50,000
Editorial/production	125 000	125,000	125,000
Manufacturing	70,000	180,000	250,000
Promotion/advertising & distribution costs	25,000	150,000	250,000
Total cost	220,000	455,000	625,000
Revenue from distributors ($20 wholesale price)	200,000	600,000	1,000,000
Net	-20,000	145,000	375,000

Space Exploration

Number of discs sold	10,000	30,000	50,000
Editorial/production	200,000	200,000	200,000
Manufacturing	70,000	180,000	250,000
Promotion/advertising & distribution costs	25,000	150,000	250,000
Total cost	295,000	530,000	700,000
Revenues from distributor ($22.50 wholesale)	225,000	675,000	1,125,000
Net	-70,000	145,000	425,000

Our conclusion is that EB has little to lose and everything to gain by moving ahead now. The only sure way to lose is to let the opportunity pass. Perhaps it bears reiteration that while the individual programs are seen as initial efforts in the sense that they would be the first EB product to reach the marketplace, it is assumed that planning and developmental work on the Compton's Videodisc Encyclopaedia and the Britannica Information and Knowledge Service (or variations) would begin immediately as well. Given the long lead time for these projects, even if work was begun tomorrow, the market would be ready well before the product was.

PRODUCTION CONSIDERATIONS

This section summarizes how Encyclopaedia Britannica might begin to organize the publishing projects suggested earlier. Publishing video and electronic materials, while more varied, involving more steps and more people, basically follows the same overall pattern as print publishing. Projects are conceived and planned as part of an overall program, writers (and filmmakers and computer programmers) are commissioned, work is coordinated along the way, finished products are fed into a distribution network, etc. Commissioning a video sequence to be included in the Compton Videodisc Encyclopaedia would then resemble the process of developing written articles and illustrations for current EB publications. The point here is not to gloss over the complexities, but to demystify the process.

A traditional book publisher should not be intimidated by a "high tech" delivery system, and allow technological considerations to insert themselves into a primary position. Whether with videodiscs, computer programs, or intelligent encyclopaedias, you are still disseminating information and knowledge. While you should learn to trust the filmmakers and computer programmers you work with about how best to convey the subject matter, in the long run, the publisher must still retain control over content.

We recommend establishing a high-level committee of

representatives from all key areas within EB: editorial planning, sales and marketing. The editorial contingent should include at least one educational media specialist who occupies a fairly responsible position at the editorial level. This committee would be entrusted with overseeing all of EB's initial efforts in electronic publishing. Developments are likely to be so fast in this area that such a committee will be necessary to guide the work successfully--maintaining an accurate picture of all the product possibilities and how they relate, avoiding needless duplication of efforts, and making sure the lessons in one area are transmitted to others as rapidly as possible. Also, a coordinating body like this would be able to recognize areas where the actual work on one project might be applicable to another. A line of research connected to one project might have bearing on another, or perhaps footage shot for one program could be used appropriately in another. That many of the projects will probably be developed in partnership with other companies does not diminish the need for such a committee within EB itself. In fact, co-production makes the overall picture more complicated, giving the committee even greater importance.

As we discuss the recommendations related to particular projects, the following analogy may be helpful. The process of creating a videodisc program is similar to developing a manuscript. Many more people are involved in film and video production, but you have the same sort of creative process,

albeit more complicated. One substantive difference is that with a book or article, the publisher can edit the final delivered manuscript, whereas with a film, the publisher's "editing" role is performed in the course of production. In any case, the fundamental role of helping to shape the final product is not changed.

At this time we do not recommend that EB establish its own in-house production unit. The expense of such a unit would be tremendously high, but the main reason is equivalent to why you don't do all your writing in-house either. The high quality that you require in your articles can only be achieved by approaching established scholars and experts. With video and computer software, the quality that you will want for your products can only be achieved by working with the most creative people in their respective fields.

The question of who is creative needs to be addressed with an open mind. The videodisc, with its ability to mix all existing media, is in fact a new, complex medium. Of all its components, however, the visual aspect is primary, and therefore the key to the design and production will be people who are masters at the visual communication of ideas. EB has always relied on the most accomplished scholars to write articles. If the video programs bearing the Britannica name are going to approach the same standards of excellence, it is reasonable to engage "visual writers" of a similarly high caliber. As a way of

emphasizing this point, consider the possibility that the Compton Videodisc Encyclopaedia would be a joint product of the Encyclopaedia Britannica Co. and firms such as Lucasfilm (creators of Star Wars) and the Children's Television Workshop (creators of Sesame Street).

The individual programs and the encyclopaedias differ in scope and complexity, requiring appropriately different organizational and production strategies as discussed below.

Individual Videodisc Programs

Once you decide on the topics for the initial programs, we think it makes sense to look for one, or at most two, production companies to develop all of them, in order to oversee the productions as efficiently as possible. While working with a larger number of outside companies will never be easy, it would be a definite drawback during these early stages, when as a company you are in a learning phase and want to maximize efforts and concentrate experience. Someone from EB would be assigned to work closely with the production company to ensure that the product as it develops meets EB's standards. This person's role is analagous to that of a book editor.

How, specifically, would this work? Essentially there are two steps, development and production. In the first stage, EB and its partners in the projects would sign a development

agreement with Company A. For an agreed-on fee, Company A would take EB's description of the program and put together a team consisting, perhaps, of a subject expert, a writer, and a filmmaker to develop a script and a detailed budget. If EB was satisfied with the script, with the proposed budget, and with Company A, a contract would be signed and the project would go into production, with Company A expected to deliver completed videotapes, ready for mastering and replication, by a certain time. EB's "editor" would be a participant in this process all along the way.

An important consideration is how Company A would be paid for its contribution. The two possibilities are a flat fee or a fee plus royalties. We would argue strongly for the second. Basically you are going to get what you pay for, and the ~~mighty creative~~ people you are going to want to have making Britannica videodiscs are accustomed to having a continuing financial interest (royalties) in exchange for the high level of involvement that such imaginative work demands. A helpful analogy might be that the (producer/director/writer) ~~creative~~ team that produces a videodisc has an investment in terms of overall contribution to the final product that is analagous to the relationship an author has with a book.

Videodisc/Electronic Encyclopaedia

The Compton's Videodisc Encyclopaedia and the Britannica

Information and Knowledge Service present a very complicated problem. On the one hand, they probably represent the future of EB itself, and you therefore do not want to (nor could you) simply farm them out. On the other hand, they require expertise EB just doesn't have in certain areas. (In addition, the sums of money are probably so great that EB would have to look for appropriate partners.) We suggest that in the case of both projects you would need to choose as your partner--or one of your partners--a company that has demonstrated the capability for high quality film and video production. The intelligent encyclopaedia requires a partner who is competent and well established in the area of computer hardware and software as well as data transmission. Acquiring in-house capability through a partner is necessary to accomplish projects of such magnitude. We are not saying that everything necessarily has to be done in-house, but that EB and its partners must function as the overall production company. For example, all the work on the visual component wouldn't have to be done in-house, but EB and its partner would have to be capable of handling the design and final assembly of the videodisc all the way up to the manufacturing stage itself.

Formative Research

Because it can mix all previous media, the videodisc is a fundamentally new medium in its own right. Designing for this

along

medium will require people to stretch their imaginations around the full range of the disc's capabilities. In many cases, this requires dealing with new and untested applications. While a lot more is known today about how people learn from visual media, the question is certainly not solved. It would not do to invest large sums of money and time to put a videodisc encyclopaedia on the market only to find that such and such a segment "doesn't work" the way you thought it would. A key element in the production of the videodisc encyclopaedia will be active on-going research which illuminates all the components at all stages of production and highlights areas needing redirection.

Geographical Considerations

Expertise in film and video production as well as computer hardware and software is concentrated in just a few areas. Los Angeles and New York are the leaders in film and video, while the San Francisco Bay Area and Boston are the most important in terms of computers. If Britannica is going to produce the highest quality electronic and video materials, it must rely heavily on the creative people in these areas. We would assume that especially in the case of a large scale project, EB might want to seriously consider setting up a base of operations in one of these locations.

JOINT VENTURES

Joint efforts between vast companies characterize the electronic media field. DiscoVision Associates, the principal developers of the Laser system in the U.S., is a joint venture of IBM and MCA. Warner-Amex, probably the most innovative company in the cable-TV field, is a partnership between Warner Communications and American Express. Twenty-two partners including General Electric, Matsushita, and Thorn-EMI have joined forces as VHD Programs, Inc. to produce materials for the VHD videodisc system. And daily, the newspapers report more.

Even the biggest companies want someone with whom to share the risk. But a more potent motivation fueling such partnerships is the reality that electronic and video publishing represent an integration of high technology delivery systems and expertise in publishing, communications and entertainment-related activities. Companies are scrambling to team up with others who are strong in areas where they are weak.

We believe that for EB to successfully enter the electronic media market it will have to find partners with whom it can work. Fortunately, EB is in a wonderful position. With the most respected and well-known name in reference and educational publishing, EB is highly regarded as a potential partner by any

company looking to make its mark in electronic publishing. As part of our work for this report, we spoke with representatives of many companies that we thought might make suitable partners for EB on a number of projects. Everyone we talked with indicated considerable interest in pursuing the possibility of a joint venture with Britannica. As we see it, EB has a wide range of companies to choose from and moreover will be able to construct very favorable partnership arrangements.

At this point we would like to note particular companies with whom we have talked about teaming up with EB on various projects.

Optical Programming Associates and MCA Inc. - OPA is itself a consortium, consisting of MCA, North American Phillips, and U.S. Pioneer, which creates programming specifically for the laser optical videodisc system. Their first two discs utilize the capabilities of the optical system for the consumer market ("The First National Kidisc" and "How to Watch Pro-Football"). Several more are in production ("Cooking with Craig Claiborne," an encyclopaedia of children's games done in conjunction with Scholastic, Inc., etc.). An OPA executive said they would be very interested in a joint venture with EB. If OPA were to put up as much as half the money, they would want to restrict distribution to the optical system. They would not object to giving EB the right to use the same materials in other

non-videodisc formats. The advantage of going with OPA on these programs is that they are tied directly to the main distribution network of laser videodiscs and have a very favorable arrangement with DiscoVision with regard to mastering and replication charges. The principal disadvantage is their requirement to limit production to the optical format. However, this might be negotiable, as they may be willing to settle for only a six-month or one-year window in which distribution is limited to the laser system.

The person we contacted at OPA wears two hats and is also the vice president of MCA Videodisc, Inc. She suggested that EB might be more interested in dealing directly with MCA, since MCA, despite their great financial stake in the laser system, is producing programming in all videodisc formats. MCA would also consider a joint 50-50 arrangement with Britannica. The principal advantage of MCA, as with OPA, is their extensive distribution network for video programming. One problem we have with both MCA and OPA is that we are not sure exactly how committed they are to high-quality productions. Going with either OPA or MCA would ensure EB significant sales of its initial efforts, but EB would have to retain the right to set the quality standards. MCA has indicated on many occasions its interest in developing a "videodisc encyclopaedia." However, we think it is doubtful that they will commit sufficient resources and effort to produce a video encyclopaedia along lines acceptable to EB.

VHD Programs Inc. and Thorn-EMI - VHD, as described above, is the counterpart to OPA for the VHD videodisc system. VHD expressed enthusiasm for working with EB along lines similar to OPA. Since the VHD system is not even scheduled for introduction to the U.S. market until the summer of 1982 and its impact will be even later, we caution against an arrangement with VHD which gives them exclusive rights. Thorn-EMI occupies much the same position within the VHD consortium as MCA does with the laser system, that of leading software producer. Discussions with a representative at Thorn revealed their keenness for producing programs with EB separate from their VHD commitments, which would permit them to produce and distribute programs in both formats. In our opinion, Thorn, unlike MCA, does have a commitment to first-rate, serious, education-related programs.

During September MCA and Thorn announced plans for a joint company to produce programs compatible with both the VHD and optical formats. This would be ~~a wonderful development~~ good for EB, which does not want to get trapped in the middle of the hardware wars and wants its product to be available as widely as possible. If this company gets off the ground, with a life of its own, EB should consider it as a potential partner for individual videodisc programs.

Xerox - As our understanding of the intelligent electronic encyclopaedia developed, Xerox came to mind as a very appropriate partner. It is not widely known, but Xerox probably has the most advanced research facility in the world studying precisely the sorts of questions in the field of artificial intelligence and natural machine-user interaction that are germane to the development of the intelligent encyclopaedia. The idea of having Xerox PARC (as the Palo Alto research center is called) working directly on the intelligent encyclopaedia is exciting. It would shorten the research and development phase, and certainly create a better product. In addition, Xerox is established at all levels of the computer industry, both micro and main-frame computers, and as such could be an excellent partner in an undertaking that would require significant investment in large-scale hardware. With Xerox as a partner it would be feasible to control the distribution of the intelligent encyclopaedia all the way to the consumer. Other aspects of Xerox which make it an attractive partner include the extensive distribution network represented by its publishing group, and the tremendous financial power at its disposal.

We had a long discussion with a corporate "strategist" from the publishing group, whose principal area of concern is electronic publishing. He expressed genuine enthusiasm at the idea of Xerox and EB working together on a project along the

lines of the intelligent encyclopaedia. We highly recommend following up on this initial contact.

CBS - As a leader in the field of both video and publishing (including prestigious Holt, Rinehart and Winston), CBS has extensive experience in video programming plus well developed distribution channels to the consumer market. Furthermore, CBS has moved aggressively in the area of the new video technologies. It has conducted numerous pilot projects with videotext and other consumer information delivery systems and has built a plant with the capability to produce videodiscs in both the RCA and optical formats. We think that CBS, through their publishing group, would make an especially strong partner for both the individual topic videodiscs and the Compton's Videodisc Encyclopaedia. Their publishing group president told us that despite their preference not to enter into joint ventures, they would certainly consider the idea of working with EB. CBS is perhaps not as "eager" as others we spoke with, but that largely reflects their overall strength; a partnership with them is definitely worth pursuing.

Children's Television Workshop - The producers of "Sesame Street" and "The Electric Company" possess a wealth of experience and knowledge in video production for children. In recent years they have branched out to computer software. A

subsidiary, the Children's Computer Workshop, is now marketing a whole line of microcomputer software for children. Although not endowed with large sums of money, CTW would make a great creative partner for the Compton's Videodisc Encyclopaedia. CTW is constantly besieged by companies who want to enter into joint ventures in order to be associated with the Sesame Street name. From our discussions at CTW we sense that they would be delighted to do something with EB, where they were being sought after for their experience, not just their name. CTW pioneered the whole field of formative research in video programming, which is another reason why they would be a strong choice.

National Geographic Society - The National Geographic Society is quite actively figuring out how to enter the electronic publishing field. Some rather complex legal restrictions limit its ability to enter into joint venture arrangements, but the representative we spoke with said that if it could be worked out, NGS would most likely be very interested in working with EB. With the Geographic's photobank of 5 million photos, their excellent documentary films and overall reputation, we couldn't agree more.

Sony - With the most respected name in television and video equipment, Sony has been moving aggressively into the laser videodisc field. Although its activities to date have been

limited largely to the industrial/institutional market, Sony is likely to announce its entry into the consumer market soon. A representative communicated to us that Sony might be very interested in co-sponsoring EB's initial programming efforts. The only drawback we can see to this is that Sony as of now has no distribution channels to the consumer (in contrast to MCA, OPA, etc.).

Houghton Mifflin - Of all the traditonal book publishers, Houghton Mifflin has taken the boldest steps in the area of the new technologies. Recently they completed production on their first videodisc program, based on Roger Tory Peterson's birdwatching field guide. Several more disc projects are in the planning stages as well as several computer software and videotext related projects. The executive at Houghton Mifflin guiding these projects expressed a desire to discuss possible joint efforts with EB.

TAT/Tandem Productions - One of Hollywood's most high-minded and creative production companies, Tandem, under Norman Lear, has a stated interest in making a contibution to the development of innovative programming for the new video technologies. We met with the person at Tandem responsible for choosing and developing all the projects in this area. In brief, at this time, they would not consider putting their own money into, as

they put it, "a long-term R&D project" like the Compton's Videodisc Encyclopaedia. However, they are very interested in the idea of the single-topic programs which EB may be considering. They have yet to choose a vehicle for entering the videodisc market, and believe that teaming up with EB (and perhaps the Smithsonian) would be just right. In its favor, Tandem was the one company that in discussion consistently raised important social and philosophical questions about the potential uses of the new technologies. One of the best indications that Tandem is serious about this is their recent recruitment of Adrian Malone, the executive producer and originator of both the "Ascent of Man" and "Cosmos" for the BBC, ~~as a full-time Tandem employee.~~

Many companies should be considered that we haven't mentioned. Time-Life has many of the same characteristics as CBS, considerable experience in all areas of video, plus a very solid publishing organization well known for the strength of its distribution efforts. Time-Life's Home Box Office is the largest pay cable-TV programmer in the country, with over 5 million subscribers. The New York Times currently maintains an active database service based on its newspaper files. The extraordinary information-gathering power of the Times and the broad-ranging synthesis of knowledge represented by EB might make a fortuitous combination for an intelligent encyclopaedia. AT&T is actively

seeking partners who could supply a database that could be disseminated over phone lines. Similarly IBM, through its General Systems Division, could offer a lot as a potential partner.

MISCELLANEOUS SUGGESTIONS

1. A Conference on the Intellectual Tools of the Future

We propose that EB sponsor a small working conference on the intellectual tools of the future, focusing on the role of the emerging electronic media. The conference would assemble leading people in several relevant fields, including educators, librarians, computer hardware developers and software designers, videographers and filmmakers, and representatives from EB.

If such a conference were well conceived and carried out on a sufficiently high plane, one of the results would be a much sharper concept of what the intelligent encyclopaedia might be, including a good indication of the questions that still need to be answered and how to go about solving them.

The prestige of Britannica and a well-formulated prospectus would draw people to the conference. We think it likely that a foundation would cover the costs of the conference, including honorariums for the participants.

Participants might include:

Computer hardware developers -

Steve Jobs - designer of the Apple microcomputer

Allen Kay - designer of the "Smalltalk" personal computer system, Xerox

Lewis Branscomb - Chief Scientist, IBM

Computer software designers -

John Seely-Brown - leading researcher in the area of natural language machine-user interaction, Xerox

Marvin Minsky - leading figure in artificial intelligence research, MIT

Thomas Dwyer - computer scientist, University of Pittsburgh

Nicholas Negroponte - pioneering researcher in design of sophisticated retrieval systems, MIT

Video and film

Sam Gibbon - former producer of "The Electric Company"

Gavriel Salomon - leading researcher in field of media selection, University of Jerusalem

Adrian Malone - executive producer of "Ascent of Man" and "Cosmos"

George Lucas - creator of "Star Wars"

Miscellaneous -

James Licklider - expert in ~~information and~~ information retrieval, MIT

Fred Hechinger - education editor of the New York Times

Donald Oliver - professor of education, Harvard

Derek de Solla Price - professor of the history of science, Yale

Daniel Bell - professor of sociology, Harvard

2. Encyclopaedia Britannica should establish a close working relationship with at least one of the major university research centers specializing in the areas of information retrieval, artificial intelligence (particularly the development of

sophisticated natural language query systems), and intelligent videodisc applications. While university research facilities are not "for hire," research in media technology, especially the design of advanced delivery systems, must be done with existing products. EB should encourage the use of Britannica materials in the laboratory setting. For example, one of MIT's laboratories is working on the design of a powerful, easy-to-use information retrieval system. For part of this work, they needed a large on-line databank with which to experiment, and arranged with Mead Data to access the Associated Press files on the Nexis/Lexis system. AP also supplied them with their entire photo bank to see if that could be worked into the retrieval system. While the results of this work will have bearing on what EB does, imagine how much more valuable it might be for EB if the experimentation were being done with Britannica materials in the first place. Leading universities in this area besides MIT are Stanford and Carnegie-Mellon.

3. As soon as EB has begun to set its course in electronic and video publishing, it should embark on an active program to introduce teachers and librarians to the valuable reference and educational applications of the "new technologies." Taking the form perhaps of a series of hands-on seminars, this program would contribute to the monumental task of educating the educators. Perhaps even more significant than cost as an

obstacle blocking the widest use of electronic media in schools and libraries is the natural resistance produced by inertia and unfamiliarity. We are unlikely to see broad scale government programs in this area, leaving the responsibility to the private sector. Britannica, as the leading name in reference materials and education, can have a great impact in this area. If EB were to take the lead, some private foundations and other corporations might join in the effort. A by-product of all this would be to help establish Britannica's presence in the electronic publishing market.

APPENDIX: INFORMATION TECHNOLOGY

The phrase "electronic publishing" subsumes breakthroughs in several different areas: a) the development of new ways to deliver text and graphics exclusive of the medium of print; b) the discovery of methods for making movies and video programs available to the individual consumer on a one-to-one basis, making it possible to create products intended for a much narrower audience than with broadcast TV or feature movies; and c) the development of fundamentally new media which allow the publisher to mix text, graphics, motion, and sound in the same product, and to give the user control over the rate and sequence in which the material is accessed. While the traditional publisher may find all the permutations and combinations confusing, the task is complicated further by the liberal use of hype in the popular accounts of the technological advances. A common example is the oft-quoted statement that the entire Encyclopaedia Britannica could be transferred directly onto one side of one videodisc. While technically true, the resolution limits of current televisions preclude actually reading the words on the screen. Such statements have a dual origin. The writer may not understand the actual capabilities of the technology in question. Other times, he may be considering only the machine itself, and not the more important question, how the individual is going to use it. In this appendix we will offer a

brief description of the different technologies involved in electronic publishing, providing an understanding of what is possible today, and the likely developments over the next five to ten years from the point of view of the user or consumer.

Videodiscs

Today there are two different videodisc technologies being promoted on the consumer market, the optical laser system (MCA, IBM, Sony, Phillips, among others), and the capacitance system (RCA). A third system, the "grooveless capacitance" or VHD system (JVC, Matsushita, GE, Thorn-EMI, et. al.) will be launched in the United States in June of 1982.

Optical Laser Videodisc - In the course of this report the word videodisc is used to refer to an optical laser videodisc with the following characteristics. At its constant speed of 1800 revolutions per minute, each revolution is equivalent to one complete television frame or picture. Each frame has its own number or address, much like the pages of a book, and a given frame can be called up via a keypad. Chapters can also be denoted and accessed with the keypad. There are roughly 54,000 addressable frames on each side of a disc, which is equivalent to about 30 minutes of playing time. Material can be displayed in either forward or reverse motion and frames can be repeated or skipped to create slow and fast motion. A still frame is the

result of continuously repeating a single revolution. Single frames can be displayed indefinitely for detailed study, or the user can step through a sequence one frame at a time. Two entirely distinct audio tracks permit excellent stereo, the inclusion of a bi-lingual capability or even additional narration.

Another configuration of the optical videodisc permits the inclusion of up to one hour of linear programming per side, but at the expense of the still-frame random access and variable motion features.

In the future, key developments in the consumer models will be in the areas of compressed audio, computer interface, and digital storage. 1) Within three years it is likely that consumer models will have the capacity to store as much as 10 seconds of audio for every still frame. This would permit the programmer to include an extended audio explanation of a still picture without having to use up precious video real estate. It is estimated that one disc could include up to 75 or 100 hours of audio.

2) To link the consumer model videodisc player with a computer today requires an expensive, specially-made interface. Within a few years, as a result of consumer demand, we expect interfaces to be built right into the player itself. Linking a disc player to a computer will give the user dramatically greater control over the content of the disc. For example,

picture yourself holding a "joystick" (connected to a computer, connected to a videodisc player). On the television screen you are traveling down the streets of Aspen, Colorado. If you move the joystick to the right, you turn right at the next corner, center the joystick, and you come to a halt. If a building looks interesting, you can "go in" by touching the building on the touch sensitive screen. The computer then orders the disc player to present still pictures from the disc of the building's interior. Wonder how a street looked in 1900 or in the fall? The computer can instruct the disc to call up the appropriate pictures. This experimental disc from MIT gives a good sense of just one activity the computer-videodisc combination will bring in the future.

3) Linking the disc player will have important other applications as developers perfect the technique of storing digital information on the disc. The user will then call up entire computer programs (for example, a course in algebra) from a disc, or even the contents of whole books. Stored digitally, the full text of 3200 300-page books could be put on one disc and accessed by a computer.

VHD - The VHD (Video High Density) player is expected to make its market debut in June 1982. While the consumer version was originally designed mainly as a straight playback machine for movies, etc., the developers have since summed up the

positive response to the laser system and have made variable motion, still-frame and random access (to chapters) standard features as well as excellent stereo capability. (At least one of the VHD players, made by Sharp, will have frame addressability as an option.) Since there is some contact between a stylus and the disc, unlike with the optical system, some degradation of picture and sound quality may occur after repeated play. How significant this will be is unclear, since it is estimated that a single still frame can be played continuously for 12 hours before the degradation becomes noticeable. The inability to call up specific frames is a definite drawback for educational applications. In our opinion the VHD player will not be appropriate for much of the programming EB will be considering until it has addressable frames. Once this capability becomes standard (which is quite likely within a year or two), the functional difference between the VHD and laser systems, in terms of most consumer/educational applications, will be negligible.

In the long run, with the one exception of the possible wear on the disc, there is nothing that the laser system can do now or will be able to do in the future that the VHD technology can't be adapted to accomplish as well. Over time, we fully expect market pressures to force the VHD manufacturers to upgrade their machines to have addressable frames, compressed audio, and to allow for interface with computers, etc. The VHD

technology is compatible with the storage of digital information on the disc as well.

RCA - In its current configuration, the RCA machine is capable of showing standard linear movies and TV programs. The only difference between watching programs on an RCA machine, as opposed to broadcast TV, is 1) the viewer can in effect "lift the needle" and put it down on another part of the program and 2) the user "owns" the program and can play it as many times as he wishes at his own convenience. Stereo capability is likely to be added in 1982. The RCA system has sacrificed the variable motion and freeze-frame features of the other systems in favor of lower cost, but these functions have been demonstrated successfully on their equipment in the laboratory. Whether it will actually be practical to upgrade the RCA machines in this way remains to be seen. Without the ability to freeze on a frame, the RCA machine will be of only marginal use in educational applications.

Books

While electronic media will undoubtedly get cheaper over time, books, because of the cost of raw materials and shipping, will likely become more expensive, both absolutely and relative to electronic media. One interesting change related to books may be the growth of "printing on demand," where a person orders

a book at a bookstore or library, and the book is actually printed from a computer terminal and given to the customer or patron. This will be particularly useful for research into subjects for which demand is so small that it wouldn't pay a publisher to print them or for libraries to buy them.

Television

As mentioned earlier, the relatively low resolution of the home TV is what accounts for the fact that you would not be able to read the pages of the Britannica if they were transferred as is to a videodisc. Several long and short term developments are on the way however. To display text on the television, we can improve the quality of the TV or improve the quality of the text. One impending simple improvement is the receiver/monitor. In brief, this will permit the user to flip a switch on the TV, allowing a signal from a disc player (or cable TV) to bypass the broadcast channels, which tend to add "noise" to the picture. The result will be a sharper picture, with perhaps a 50% increase in the amount of text that can be comfortably placed on the screen. Within ten years, sets with double the present resolution are likely to be standard. This will give TV resolution characteristics approaching film, allowing for the reproduction of the most detailed pictures and the most elegant text. In the interim, special computer-generated "video" fonts promise sharply increased readability to greater text on

screens. MIT has developed a series of such fonts which are available now for commercial applications.

Over the next ten years, as flat-panel displays are perfected, it will be possible to have a 12" TV take up the same amount of space as a good-sized hardback book. The idea of a portable learning center (TV, videodisc player, computer, and telephone communication equipment) all in a large briefcase is on the horizon. The old rejoinder "But can you take it under a tree?" that book-lovers have laid at the computer proponents may lose its power, as not only will you be able to take it with you, but via a built in telephone hook-up you might be able to have most of the books in the world with you.

Videotape Recorders

The primary value of the videotape recorder to the consumer at present is its ability to record off the air, allowing the user to watch broadcast programs at his convenience. In the future, this feature may be surpassed in importance as the videotape recorder is used increasingly as a play back device for home (video) movies. While its true that newer models are capable of freezing and even accessing specific frames, the quality is not comparable to the videodisc and suffers from an interminably long "worst-case" access time of two minutes.

The high cost of raw materials and the manufacturing process required with videocassettes make it impossible to sell

videocassettes at the low prices possible with videodisc. Currently, videotape versions of a movie cost more than twice as much on videotape as disc, a difference of as much as $30 to $50. At that rate, the consumer who wants to be able both to record off the air and playback prerecorded programs, could buy a videotape player and finance the cost of a videodisc machine just with the savings that would accrue from buying 20 movies on disc rather than tape.

Videotex

There are several communications system which fall under the general classification of videotex. In general all videotex systems are designed to send textual and graphic information emanating from a central source (head-end) to the home television. All systems require an external controller such as a keypad or a keyboard to access the information. Any system capable of transmitting a signal--broadcast TV, cable TV, phone lines, satellite, etc.--are capable of carrying some form of videotex. There are two major subdivisions within videotex corresponding to whether the communication between the source and the user is one-way or two-way.

Teletext--One-Way

In teletext, one or more unused lines in the vertical blanking interval of the TV picture are infused with graphic and

textual information that is fitted on a "page." A page usually contains about 20 lines with a maximum of 40 characters per line. The broadcast system continuously cycles through a few hundred pages. A viewer displays a particular page by keying its number into a decoder that "grabs" the indicated page the next time it is broadcast. The information page is stored in an internal memory and displayed on the screen for as long as desired. The teletext viewer is thus interacting with the decoder, but not with the broadcast system, which transmits all pages all of the time. Implicit in this scheme is that the more pages in the system, the longer the viewer may have to wait for a requested page to appear. A system with 100 pages has a maximum wait time of about 24 seconds; for 600 pages, the waiting time might be as long as three minutes.

Viewdata--Two-Way

Where teletext provides the illusion of interacting with the data that is constantly being broadcast, viewdata allows actual interaction and control. There is no practical limit to the size of the database that the user can access via viewdata. A key distinction between teletex and viewdata is that since the latter involves a two-way connection, the user can be billed for each page he accesses. Teletext has to be either advertiser-supported or subsidized as a public service.

Microcomputing Network Services

Microcomputer networks are both computer timesharing systems and videotex systems. In the sense that a "dumb" computer terminal and a modem (a coupling device between computer and telephone lines) can be used to receive information, microcomputing networks are timesharing systems. In the sense that low cost computer terminals are available and are designed to hook directly into TV sets, they are videotext systems. The distinction is rather blurred. Computer terminals do not require decoders as do Telidon and two-way cable systems. Even so, special videotext terminals are widely available from various computer retailers.

Currently there are two consumer microcomputing networks, The Source (owned by Reader's Digest), and "CompuServe," (owned by H&R Bloch). Both networks are in place nationally and internationally. Information providers include all the major wire services, Dow Jones Information Services, a dozen of the nation's major newspapers including the New York Times, the Washington Post, the Los Angeles Times, etc. Since these data bases originate on magnetic media, they are transferred directly to the microcomputer networks, ~~who~~ which can ~~have~~ make them available almost instantly. Using a microcomputer network, a person in Moline, Illinois can read the New York Times before it hits the streets of the Big Apple.

Personal Computers

A "personal computer" is a small, portable version of a computer. Otherwise known as a microcomputer, the term personal computer is much more descriptive of the way these devices are being used. Each year, personal computer prices fall at a rate of 25%, and their capabilities increase at a rate of 60%.

Because of its prodigious power to organize, process and retrieve information, the computer is the single most important technology of the future. It will extend man's ability far beyond what can be imagined. However, in order for this to become a universal reality there need to be advances along several fronts all related to the ease with which man and machine interact. Touch-sensitive screens, voice rather than keyboard input, even interaction by eye-machine contact, are all being actively worked on in laboratories, and should eventually become standard features. Voice actuation is quite complex, and may take as long as 10-20 years to perfect. A related area is the development of "knowledge-based" systems which so thoroughly understands a subject and the user's grasp of the subject matter that they are able to assist the user to in the way a really good teacher (or librarian) would.

Significant breakthroughs in this area, artificial intelligence, can be expected in the next 5-10 years.