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**DESIGN AND TRENDS
IN HOME INFORMATION
SYSTEMS**

Jacob Baal-Schem

CENTER FOR
INTERNATIONAL STUDIES
MASSACHUSETTS INSTITUTE
OF TECHNOLOGY
Cambridge, Massachusetts 02139

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Dr. Jacob Baal-Schem

Visiting Scholar
Center for International Studies
Massachusetts Institute of Technology

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Abstract

Among the most salient outcomes of recent developments in Microelectronics and Computer technologies is the advent of Home Information Systems. Innovations in Computers and Communication Systems will enable us in the near future to shop from the home, get our education in the home, perform a greater part of our work from the home and conduct most of our daily activities through home-based electronic systems.

This paper introduces the basic concepts of Home Information Systems, from Teletext to Interactive two-way wideband networks. It describes the Information explosion that we are witnessing and the development of the Post-Industrial society and examines the demand for an Information utility. Based on an overview of recent developments in Information technologies, the different technologies applied in Home Information Systems are discussed. Applications of Videotex in Europe, Japan and the US are listed and their functional and technical characteristics are analyzed. Cost considerations are discussed along with forecasts for future alternatives.

Formerly, Acting Director of the Interdisciplinary Center for Technological Analysis and Forecasting, Tel Aviv University, Tel Aviv, Israel. The author wishes to acknowledge the assistance of the Center for International Studies and of members of the MIT Research Program on Communications Policy.

After analyzing some aspects of the social impact of future home information systems, the paper concludes by examining ways to prepare society to cope with the recent technological innovations in information systems for the home.

Author's Note

Jacob Baal-Schem holds a Bachelor of Science and a Master of Science in Electrical Engineering and a Doctor of Science in Industrial and Management Engineering from the Technion, Israel Institute of Technology.

In 1981 he was appointed Acting Director of the Interdisciplinary Center for Technological Analysis and Forecasting at Tel-Aviv University, Israel. His main research activities are in Future Telecommunication Systems and their societal impact.

Dr. Baal-Schem is the author of several books on Computer Systems and is Chief Editor of the Israel Communications and Electronics journal.

He is a Senior member of the IEEE and Conference Coordinator of the IEEE for Europe, the Middle East and Africa.

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Introduction

Recent developments in information processing and in telecommunications technology and the forecasts for additional innovations in those fields in the near future, constitute one of the foremost technological challenges to our present way of life.

Developments in communications technology can be linked historically to phases in the progress of mankind. In an increasingly information-based society, modern technology has to adjust to the tremendous problem created by the vast amount of information that we now have at hand. Each citizen is constantly exposed to information and each step in modern life is based upon the use of up-to-date information. The exchange of information and the creation and transfer of knowledge have already become critical factors in economic growth of nations, rather than the accelerated consumption of natural resources. Systems that enable one to gather, retrieve, analyze, communicate, organize, transform, generate, modify and file information now play an indispensable role in almost all aspects of social and economic activity, including those at home.

Home information systems are the outcome of innovations based upon the interweaving of dramatic developments in microcomputer technology with great achievements in telecommunications.

By combining computing and communication technologies in integrated systems comprising information banks, indexing structures, hardware, software and system management features, a great variety of services can be provided to a great number of users, in environments chosen by the user.

The emerging of the "electronic cottage" through the use of home information systems will fundamentally change the way people shop, bank, work and communicate, and might subsequently change the way they think. It will impact on many aspects of daily life and therefore the widespread implementation of home information systems might lead to substantial changes in the social environment. The rapid diffusion of colour television and of home computers in the US and in other countries provides a possible indication of the pace of acceptance of technological developments. This points to the urgency for analyzing cautiously the possible interactions of the new home information technologies with society on the personal and national level, and to identify policy implications, in order to maximize both the economic and social benefits of future home information systems.

The Information Society

The Information Explosion

Information, and the capacity to use, process and transmit information, emerges as the key resource in modern society. As remarked by John and Magda McHale (1978), information and organized knowledge have several unique properties which are different from other forms of resources:

a) All other resources are dependent upon them for their perception, evaluation and use, i.e., the extent of your information determines the availability of other resources. For example, a hundred years ago aluminium was a scarce metallic curiosity, radioactivity a laboratory phenomenon, and many of our present key metals were regarded as waste impurities in other ores.

b) As resources themselves, information and knowledge are not reduced or lessened by wider use and sharing -- rather they tend to gain in the process.

c) Information and communications can replace and reduce consumption of other resources -- either directly by symbolic substitution or by identifying other substitutions and alternative modes of resource use, e.g., in work, by replacing physical transportation with electronic communication.

The concept of information as basic resource has profound future consequences for the forms of society and culture and for social and cultural values. The new wealth generators of information, communications and their organizational and resource capacities are not depletive but cumulative in use. They do not decrease in value or amount by wider distribution, access, participation and sharing -- they can only gain.

The generation and diffusion of information went on at a slow pace during the centuries. The printing press of the eighteenth century was little

different than that used by Gutenberg three hundred years before. The first appearance of two scientific journals was in the mid-seventeenth century and by the middle of the eighteenth century there were only 10 scientific journals.

In the twentieth century we are witnessing a huge explosion in information with mass production of newspapers (with millions of copies of a single issue printed overnight), magazines and books. A UNESCO report in 1971 estimated the number of scientific journals being published in the world to be between 50,000 and 70,000.

An OECD study in 1973, reviewing different studies of the growth in scientific knowledge concluded that in all the case studies this growth follows an exponential curve with a growth rate varying from 3.5 percent yearly to 14.4 percent yearly (Anderla, 1973). According to another research published recently, man's total knowledge, as measured by scientific publications, doubles now every 5 years, compared to the fact that 150 years ago it was doubling every 50 years. Each minute, 500,000 pages of reports, documents and books are printed over the world and added to the store of existing knowledge. In the 1900-1970 period, the 85 major American libraries were doubling the number of books in their shelves every 17 years, with an annual growth rate of 4.1 percent.

All this vast amount of information has to be transferred from any part to any other part of the world, and even into the cosmos, and some of it is requested on real-time, which means that a greater part of the information has to be transmitted at the very moment it is produced.

As stated by Daniel Bell (1980), "The information explosion is a reciprocal relation between the expansion of science, the hitching of that science to a new technology; and the growing demand for news, entertainment,

and instrumental knowledge, all in a context of rapidly increasing population (of greater literacy and more schooling), a vastly enlarged world that is now tied together, almost in real time (that is, instantaneously), by cable, telephone and international satellite; that is made aware of each other by the vivid pictorial imagery of television; and that has increasingly available, on national and international bases, large data banks of computerized information. Given this huge explosion in news, statistical data and information, it is almost impossible to provide any set of measurements to chart its growth."

Clearly, if the "explosion" in information is bound to continue, as it appears to be, it can only be handled through the expansion of computerized, and subsequently automated, information systems.

The Post-Industrial Society

The revolution in the organization and processing of information and knowledge, in which the computer plays a central role, has as its context the development of what Daniel Bell (1976) calls the Post-Industrial Society.

As stated by Bell, the concept of the post-industrial society deals primarily with changes in the social structure, the way in which the economy is being transformed and the occupational system reworked, and with the new relations between theory and empiricism, particularly science and technology.

The three main dimensions of the post-industrial society are:

- a) The changes in the social structure, from a goods-producing to a service society.
- b) The centrality of theoretical knowledge and its role, when codified, as the director of social change. Knowledge and its applications replace labor as the source for "added value" in the national product.

c) The creation of a new "intellectual technology" as a key tool of systems analysis and decision theory. While modern science, like almost all human activities, has moved toward a greater degree of specialization, in its pursuit of more detailed knowledge, the more important and crucial outcome of its association with technology is the integration of diverse fields or observations into single conceptual and theoretical frameworks offering much greater explanatory power. New methods have been developed whose concern is with the problems of organized complexity (information theory, cybernetics, decision theory, etc.), seeking to substitute an algorithm (i.e., decision rules) for intuitive judgments. These algorithms may be embodied in an automatic machine or a computer program and represent a "formalization" of judgments and their routine application to many varied situations. According to Bell, "intellectual technology" is as central a feature of postindustrial society as machine technology is in industrial technology.

A comparative schema of the formal properties of postindustrial society and those of industrial and preindustrial society is provided in Table 1.

Table 1

The Postindustrial Society: A Comparative Schema (Bell, 1982)

| | <u>Preindustrial</u> | <u>Industrial</u> | <u>Postindustrial</u> |
|---------------------------|---|--|--|
| <u>Mode of Production</u> | Extractive | Fabrication | Processing; Recycling |
| Economic sector | <u>Primary</u> Agriculture Mining Fishing Timber Oil and gas | <u>Secondary</u> <u>Goods-producing</u> Manufacturing Durables Nondurables Heavy construction | <u>Services</u> <u>Tertiary</u> Transportation Utilities <u>Quinary</u> Health, education Research, government, Recreation <u>Quaternary</u> Trade Finance Insurance Real estate |
| Transforming resource | <u>Natural power</u> Wind, water, draft animal, human muscle | <u>Created energy</u> <u>Electricity --</u> oil, gas coal, nuclear power | <u>Information</u> Computer and data-transmission systems |
| Strategic resource | Raw materials | Financial capital | Knowledge |
| Technnology | Craft | Machine technology | Intellectual technology |
| Skill base | Artisan, manual worker, farmer | Engineer, semiskilled worker | Scientist, technical and professional occupations |
| Methodology | Common sense, trial and error, experience | Empiricism, experimentation | Abstract theory, models, simulations, decision theory, systems analysis |
| Time perspective | Orientation to the past | Ad hoc adaptiveness, experimentation | Future orientation: forecasting and planning |
| Design | Game against nature | Game against fabricated future | Game between persons |
| Axial principle | Traditionalism | Economic growth | Codification of theoretical knowledge |

As might easily be seen from this table: A pre-industrial society is essentially based upon raw material; an industrial society is organized primarily around energy and the use of energy for the productivity of goods; a post-industrial society is organized around information and the utilization of information.

The most salient phenomenon of the 1980s will be the gradual transformation of most Western societies into post-industrial information societies.

Economist Mark Porat (1977) has given an empirical demonstration of the scope of information activities in the US and of the dramatic change in the American economy over the last century (see "Post-Industrial society workforce distribution" chart in Molitor, 1981). Up to the end of the 19th century, the largest single group in the work force was in agriculture. In the next period, until the early 1950s, the predominant group was industrial. In 1920, 53% of the American work force was employed in manufacturing, commerce and industry, 28% were engaged in agriculture and extractive industries and 19% were employed in information, knowledge, education and other service enterprises. By 1976, only 4% of the American work force were engaged in agriculture, 29% in manufacturing, 17% in "other services" and 50% -- one half of the work force -- were information workers. In Porat's scheme, the information sector includes two main subdivisions: there is a primary information sector which includes all industries that produce information machines or market information services as a commodity (computer manufacturing and services, telecommunications, printing, media, advertising, accounting and education); and there is a secondary information sector including the public bureaucracy and those private bureaucracies whose activities are not directly

counted in the national account as information services -- such as the planning, programming, scheduling, and marketing of goods and services -- yet who are actually engaged in information and knowledge work. Extrapolating the curves, one finds that by the year 2000, a mere 2% of the American work force will be engaged in agriculture, 22% will be employed in manufacturing and 66% -- two thirds -- will be allied with the information sector. This is the basic profile for a Post-Industrial Society.

Demand For an Information Utility

The growing quantities of information available to the user and the technological opportunities provided by developments in computers and telecommunications and their convergence (to be discussed in a subsequent paragraph) create new options for the development of "information utilities" to supply information and computing facilities as the traditional utilities supply water, gas and electricity. Since any form of information utility represents a major capital investment for providers and consumers, it is unreasonable to expect widespread adoption, unless perceived needs of consumers can be served.

In Fig. 1 (Raz/Baal-Schem 1979) a morphological tree is presented, describing communication demands in the personal sector and systems developed to satisfy these demands. A demand is defined as the effective expression of wants (the individual's own assessment of his condition) and needs (a logical construction derived from observation), moulded by social and cultural pressure.

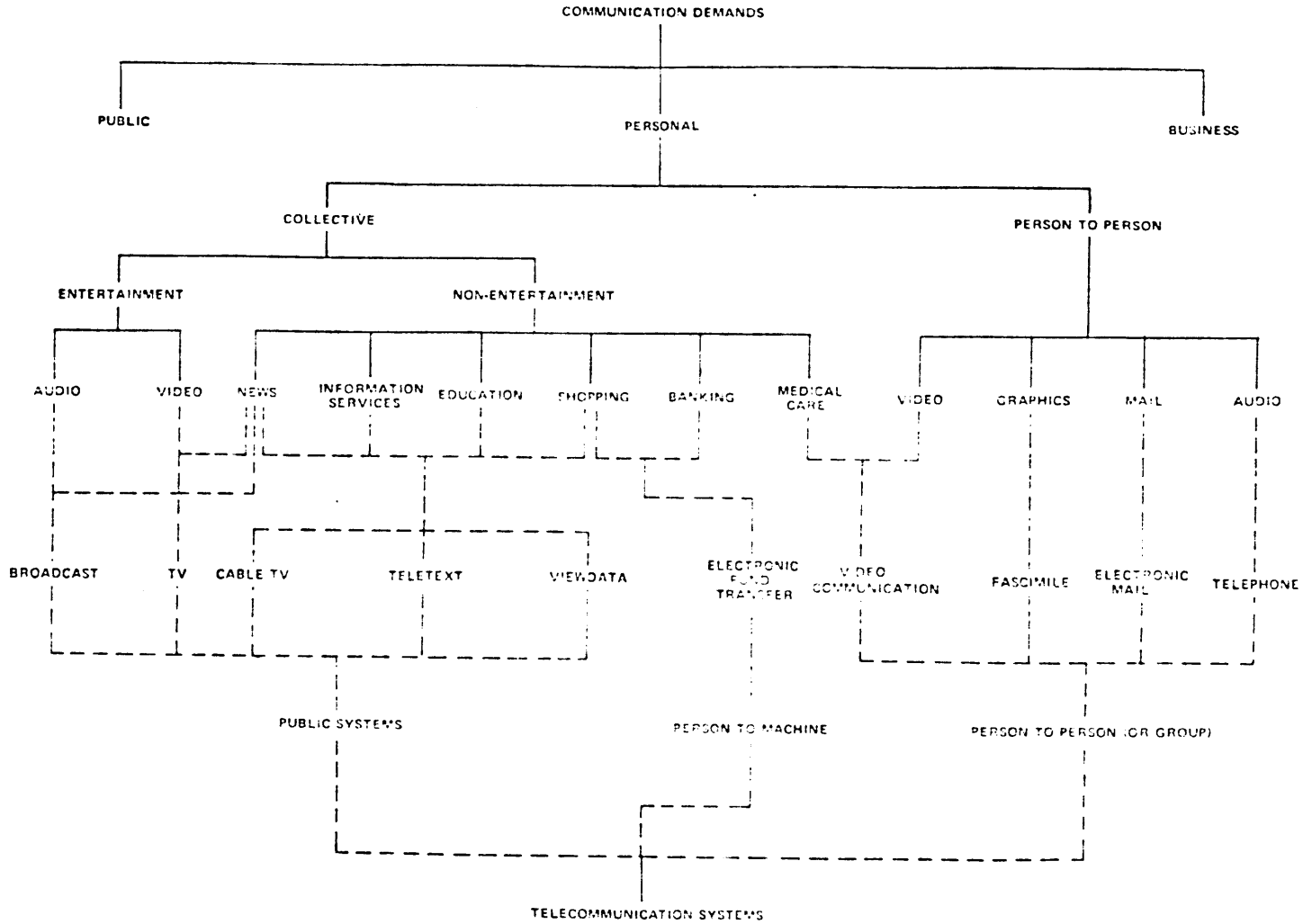


Fig. 1 -- Morphological Tree of Communication Demands and Telecommunication Systems in the Personal Sector

One of the basic demand functions is entertainment, mostly already available to the modern consumer. In the non-entertainment domain, news and information services are easily amenable to fit into an information utility. Electronic libraries or filing cabinets containing a range of information from

personal documents to work-related data to recipes offer the consumer a more manageable information storage and retrieval option than current print-based options. Computer-assisted access to travel, entertainment and other directory information is an increasingly apparent reality.

In the area of education, programmed learning, word processing and student-related coursework from the home offer seemingly attractive opportunities.

On the economic side of the ledger, there are applications that promise the consumer greater convenience or cost savings in managing financial assets. Budget, task and financial analysis; electronic fund transfer, utility bill verification and exception reporting, investment portfolio management are all familiar possibilities. The often mentioned possibility of shopping from the home via electronic catalogues is a popular interactive function that promises the consumer convenience. Nutrition/dietary analysis and management as well as some aspects of medical care can also be proposed as interactive alternatives for a home information system.

In the person-to-person communication area, the home information utility can provide for electronic mail and facsimile transmission of documents, in addition to the already available telephone connections, with a future possibility for video communication through the information utility.

As shown in Fig. 1, all of these demands can be satisfied by technologically available services, developed in recent years. Most of these services can be provided by upgrading facilities already existing in most homes -- as the telephone and television set.

The provision of these information services is based upon recent developments in information processing and telecommunications technology, to be discussed in the following chapter.

Information Technologies

Microelectronics and Computers

The advent of what has been named "The Microelectronics Revolution" stems mainly from a specific technological innovation: the creation of the first transistor by the Nobel-prize winning team of Shockley, Bardeen and Brattain of Bell Laboratories in 1947. This historical development in electronics was based upon a systematic theoretical and experimental effort directed towards the use of semiconductors.

The creation of the first transistor was a cornerstone in technology, but the real unpredicted breakthrough was the surge of solid state technology which revolutionized the computer industry, the key factor being an increasing ability to install logical functions on a single chip.

The first digital computer, ENIAC, built at the University of Pennsylvania in 1945, contained 18,000 vacuum tubes, sprawled over 1,500 square feet and weighed 30 tons. Its tubes failed at an average of one every seven minutes. The same computing power is available today in an integrated circuit the size of a sugar cube (including the packaging). This technological advance is due mainly to Large Scale Integration (LSI). In 1950, one transistor occupied one chip. By 1970, the same surface held more than 1000 transistors and in 1980 this surface held 100,000 logic circuits and more. Progress in silicon semiconductor technology has now reached the point where over 500,000 logic circuits may be fabricated and interconnected on one chip of silicon to produce devices as complex as microprocessors, random access memories, etc.).

The trend in cost of logic elements is as dramatic as that of density. Computer circuitry that in 1955 cost \$1 million can be bought today for about one 1955 dollar and the rate of reduction in price is expected to continue. The price of small, general purpose computers of comparable power, in dollars per instruction executed per second, has been dropping at an annual compound rate of about 25 percent per year since the early 1950s.

In addition to size reduction, speed of operation has drastically improved as well as reliability. Circuits are 10,000 times more reliable today than they were 25 years ago. One computer expert has illustrated the trend by estimating that if the automobile business had developed like the computer business, a Rolls-Royce would now cost \$2.75 and run 3 million miles on a gallon of gas.

At the beginning of the 70s, semiconductor technology reached a point at which it became practical to build a complete small computer on one or two silicon chips. The Microprocessor, resulting from combining this microcomputer with appropriate memories of similar size, is capable of performing a very wide variety of high speed control or computation functions. The advent of the microprocessor and of dense electronic memories has already brought us into a new era of technology, providing a wide range of new services to the benefit of the individual and society.

As computer hardware drops in cost, programming accounts for a major part of a typical computer's cost (see Fig. 6 in Branscomb, 1982). This programming includes that built into the computer as well as that done by professional programmers and by users themselves. Although the productivity of systems programming groups has been improving by about 10 percent a year over the last 10 years the cost of software in a typical computer in the 1980s is 85% of the system's overall cost.

Future goals for technological developments in microcomputers include optical scanning of hand-printed and handwritten characters for information input, as well as speech recognition, in order to provide more "user friendly" systems.

Transmission Systems

The enormous advances in integrated chip technology have combined in recent years with major advances in communication technology to create a Computer-Communication environment -- sometimes called Communications -- that promises to have major technological and societal impacts.

A significant advance is the use of digital transmission, by which voice or video (e.g., television) waveforms are transformed into binary digits (or bits) of information and are manipulated, stored and transmitted in digital form. With digital processing the error rate is much lower than in analog systems. Moreover, digital transmission allows the use of digital computer type equipment for the modulation, multiplexing and switching of traffic and enables voice and video information to flow along the same transmission channels used for computers.

The capability of generating and storing ever-growing quantities of information puts a tremendous demand on transmission channels. In 1940, long distance cables carried 60 telephone conversations; in 1960 they carried 3,600; and recent waveguide systems carry more than 200,000 voice calls simultaneously. Long-haul telecommunication possibilities have developed enormously since the initial appearance of communication satellites, in the late 60s. In one decade, we have witnessed a 10-fold increase in satellite communications capacity, a 100-fold increase in their effective radiated

power, and roughly a 100-fold decrease in costs. More than a hundred communication satellites now orbiting are only the forerunners of additional high-power satellites with multiple-spot beams launched to communicate directly with low-cost earth stations on the top of business and residential buildings.

In terrestrial communications, the fiber optics technology is now a candidate to replace the conventional metallic conductor. Since the frequency of light, which is transmitted through the fiber, is some 10,000 times higher than the highest frequency used in conventional electronic communications, the amount of information that can be carried on a light signal should be multiplied by a similar factor. Available optical fiber cables already provide an information carrying capacity of over 150 simultaneous television channels in parallel, at a cost comparable to that of the conventional copper wire pairs used for the telephone. The use of these fine fibers of optical material promises to further lower the cost of information transmission, in which a four-fold reduction in cost per circuit-km has been achieved in the past 25 years.

Display Systems

During the last 20 years, great advances were made in the development of solid state flat-panel displays. Plasma discharge panels, cathode-luminescent devices, electroluminescent devices, liquid crystal displays, etc., have been developed in several countries, mainly the US and Japan.

Meanwhile, the 80-year old CRT display is still improving. Since the introduction of color in 1950, CRTs have increased in brightness by

approximately 17 percent per year compound and since the early 1950s, luminous efficiency has increased from about 0.3 to 8 lumens per watt. Longevity, color, performance and most of the other parameters have also continued to improve.

The main disadvantage of the CRT is its size. In recent years, flat CRTs -- 2 inches deep -- have been developed, capable of presenting full-color video, as well as high information content alphanumeric data. Japanese and American firms have announced progress in liquid crystal flat panel displays. A Japanese firm has developed a flat-panel display, by using a memory-type thin-film electroluminescent panel. The display can freeze the picture at any instant.

The continuing competition between CRTs and flat-panel displays in performance and cost is likely to enable us to use a variety of displays for the different needs of the consumer.

Videotex Technologies

Introduction

The technological developments discussed in previous paragraphs and the demand for personal information services paved the way for the provision of a wide range of services to be used in the home. Most of these services can be provided by upgrading facilities already existing in most homes and business premises -- as the telephone and the television set.

One of the most dramatic developments in mass media in recent years is a technology that enables the dissemination of verbal and graphic information by wholly electronic means, for visual display on an adapted home television receiver, under the control of the user. The generic term for the variety of information services provided is VIDEOTEX, including both one-way information services and two-way services. The term TELETEXT is used to describe one-way broadcast information services for displaying pages of text and pictorial material on the screens of adapted TV sets.

Another new medium that may provide easy access in the home to large amounts of stored verbal and pictorial information is the laser videodisk. The videodisk might complement the Videotex system in the home as an interactive standalone system for random access to full-text, pictorial information or full-motion video.

The Home Information System might be enhanced in the future into a two-way interactive video communication system. By replacing the telephone line by an optical fiber connection and adding a microphone and a camera to the keyboard and TV set already available at the subscriber's premises, an additional variety of services can be provided to the home.

In the following paragraphs we will explore the technologies and possible applications of Videotex Systems from the user's perspective. In a following chapter, existing systems will be discussed. Videodisks and two-way Wideband systems will be discussed in a forthcoming chapter.

Teletext

With a Home Information System that has been developed in Europe, television viewers need not wait for scheduled news to get the weather forecast, the latest sports scores or stock market prices. The system, controlled by TV networks, uses the VHF and UHF bands to transmit data to the home television receiver. Called TELETEXT, the service allows subscribers to view the data at any time.

In the Teletext broadcast data system (Fig. 1 in Tydeman, 1982), the information to be transmitted is assembled in a data base, by the information provider. The information, which may be news, sports results, weather information, financial data or consumer reports, is formatted into numbered pages of text and simple diagrams. These are then coded in binary digital form and are transmitted over the regular TV network.

A TV picture is formed by a fast moving electron beam which illuminates small areas of phosphor deposited permanently on the back of the screen. The beam sweeps across the screen in a succession of horizontal scan lines, each displaced below the one above. The beam starts at the top, sweeping from left to right. It is switched off during the return between lines. After reaching the foot of the screen, it returns to the top to repeat the sequence. A complete series of horizontal scan filling the whole screen is called a field. On a normal TV, the lines of alternating fields are interlaced to

increase the vertical resolution of the resulting picture. A cycle of two interlaced fields is called a raster. The raster has twice the number of scan lines of a single field. In Europe, a raster of 625 lines is repeated 25 times per second. In North America, a raster of 525 lines is repeated 30 times per second.

In the 625-line system only about 575 of the scan lines are actually used to form the picture on the screen. About eight lines are used for vertical synchronization while the remainder are blanked to allow the scanning beams at the camera and receiver to carry out the vertical retrace at the end of each field scan. In North America, the vertical blanking interval consists of 21 lines.

The encoded Teletext data is multiplexed onto a video signal and transmitted with the TV signal on unused lines in the vertical blanking interval. In the British system, the Teletext transmission is such that one row of written text occupies one line. Each row of text is encoded and transmitted during one TV line period. Since two TV lines are used in each field and a full page of Teletext occupies 24 rows, it takes 12 field periods to transmit a complete page. At the European television rate of 50 Hz, this works out to $12/50 = 240$ milliseconds. Thus, the system has to store a page in the receiver, where the information can be assembled relatively slowly, and then read it out at a faster rate to the TV display. Also required in the receiver is a character generator to convert the binary numbers back into alphanumeric symbols.

The page format most closely resembling a sheet of paper is the 40 x 24 display (24 rows of 40 characters each). This proposed European standard is being disputed in the U.S., given that the US scan-line raster television

system has only 525 lines compared to the 625 in Europe. Recent evidence shows that 24 rows do not reduce quality on the US system, so it seems that the 40 x 24 page format will be universally accepted.

To transmit data to the home, the TV broadcaster first assembles a "magazine" of 100 or so pages. Transmission of the magazine is on a continuous sequential basis, each sequence lasting $n \times 240$ ms, where n is the number of pages in the magazine. Hence, it takes 24 seconds to send 100 pages. The first line of every page -- termed the page header -- incorporates special information identifying the page number, the name of the service, and the date and time of day.

At the receiver end, the viewer keys in the desired page number, using a simply numerical keypad that is usually combined with the receiver's remote-control unit. Special receiver circuitry is used to inspect the page header information, identify the page, and store the data.

While it appears that the viewer must wait for one complete transmission (24 sec. for 100 pages) before the information shows on the screen, in practice, the average delay is half that time. First, not all 24 lines are transmitted for a less-than-full page; this shortens the average transmission time per page. Second, since each page is individually identified, the pages can be transmitted out of sequence. Pages of special interest or importance -- such as the index page for the magazine or topical news -- can be inserted more than once in a given pass to assure fast access to them.

Most significantly, additional pages of memory can be installed in the receiver at small cost. This allows pages on preferred topics to be available for viewing within the first few seconds after the receiver is switched on. Thereafter, these pages are available on demand or updated, as necessary, from the ongoing transmission.

At the present time the data signals for Teletext in Europe are inserted on lines 17/18 during even field scans and 330/331 on odd scans. It is possible to use more scan lines for Teletext data to allow an increase in the amount of information provided on a channel. To permit this the specification allows for Teletext data to be inserted on any lines from 7 to 22 and 320 to 335 during the blanking intervals of a 625 line signal.

In the 525 line system, lines 14 through 18 and 20 and 21 have been approved for Teletext use (the use of line 21 is currently restricted to captioning for the hearing impaired). In the future, the FCC will consider approving the use of lines 10 through 13.

In addition to being piggybacked on a conventional broadcast signal, Teletext can be transmitted on a full-channel basis, either over the air or via cable. An entire broadcast channel could be devoted to Teletext information on a full or part-time basis. By transmitting Teletext alone without the accompaniment of a regular broadcast signal the operator can use all the lines on the screen to receive the signal, and can thereby include thousands more pages of data with the service.

Apart from the normal display of alpha and numeric text symbols the Teletext specification also provides for an elementary form of graphics display. This facility can be used for presenting simple diagrams, such as a weather map. The graphic mode may also be used to produce extra large text characters such as those used for page titles. It is also possible, by using the graphics mode to display quite effective pictures.

One of the more attractive features of the Teletext system is the ability to display the information, either graphic or text, in a range of different colours. A standard colour receiver uses a colour picture tube having three

separate electron guns, one each for red, green, and blue. By selectively switching the video drives to these three guns all of the colours required for a colour picture is achieved by allocating one bit of a control code to each of the primary colours red, green, and blue. These bits are used to switch the dot pattern drives to the red, green and blue guns of the picture tube to produce the various display colours.

The Teletext system also incorporates a number of other options which can control the display format or increase the total number of different pages of information that can be directly addressed by the viewer. One of these options is that of providing subtitles for some viewers without interfering with the normal program picture. One approach which is used for presenting subtitles for the deaf is to blank off a strip of the picture area at the bottom of the screen and to insert the subtitles into the blank space that is produced. This process is also used for presenting newsflash pages. The blanked out areas are called "boxes" and the display mode is called boxed display. It is possible to have the decoder select the boxed mode automatically for this type of page. Newsflashes will be left on the screen and the screen will be cleared of text by pressing a command button at the decoder. If the information presented on the newsflash is changed the new text will be displayed immediately.

Competing Teletext Technologies

Three distinct Teletext technologies from three different countries have been competing to achieve predominance in the North American market: the British, French and Canadian.

The British approach is a derivative of British Ceefax technology, developed jointly in 1974 by the BBC and a British software firm called LOGICA and operated commercially in England since 1979. In the British approach (the alphamosaic approach), the screen is divided into an invisible grid, and the transmitted signal instructs the decoder how to fill in each square, as if it were creating a mosaic.

The French competitor is Antiope technology, developed by Telediffusion de France. The French also choose alphamosaics, but with a slightly different approach to encoding the information being sent to the decoder.

The Canadian Telidon technology was developed by the Canadian Department of Communications. Here the decoder draws graphics by obeying geometric instructions transmitted to it. This approach is called alpageometrics.

The major operational differences in these technologies exist between the British Ceefax system and the other two services, whose standards are identical. Ceefax technology is generally considered less flexible than its competitors but alpageometrics requires a more sophisticated decoder than alphamosaics. The "defined format" of Ceefax provides for most of the Teletext signal processing at the head-end rather than at the decoder, whereas under the Antiope and Telidon "variable format" processing is concentrated at the decoder rather than the transmitter and the language is independent of the transmission system.

For graphics, Telidon technology is superior to the Antiope and current Ceefax system. Telidon is able to accommodate high-resolution alpha-geometric graphics while Antiope and Ceefax can accommodate only "block" graphics.

In the US two proposed standards were delivered to the FCC in 1981: the United Kingdom Teletext Group proposed a standard based on the British Ceefax

system and CBS and Telidon Videotex Systems proposed a standard which included new technology developed by AT&T, known as Presentation Level Protocol (PLP) for the coding of text, graphics and control information. AT&T interest is primarily in the Videotex area but PLP was designed to take into account the needs of Teletext since it is desirable for the coding of text and graphics to be compatible between Videotex and Teletext.

The Federal Communications Commission in the US has refused to rule on a broadcast Teletext transmission standard, preferring to let market forces determine the standard.

The BBC is now embarking on the development of the fifth generation of Ceefax technology, designed to be compatible with the first, which is the one now operating in Britain. The fifth generation of Teletext can display pictures of photographic quality and transmit computerized data or software to specially equipped TV receivers. These Teletext computer programs, called "telesoftware", might prove to be an important development in the history of communications, transforming the home television set with an adaptor box into a specialized computer with capabilities now found in home computers. With the addition of telesoftware, broadcast Teletext emerges as an interactive medium.

Videotex

The Interactive Videotex system (also known as Viewdata and to be referred to as Videotex) differs from Teletext in two essential ways: It is transmitted over a cable network -- either telephone lines or two-way cable television lines -- and it is interactive.

The basic components of a Videotex system (see fig. 2 in Tydeman 1982) are:

- A modified television set to receive and display the information, with a keypad used to select the required information. The receiver set can be fully integrated with the decoder, modem, auto-dialer and terminal identifier or an external adaptor can be used to plug into existing sets. The same set or adaptor is used for Videotex and Teletext. In a business environment, small screen desk-top sets may be used.
- The ordinary household or office telephone line, used to link the user with the database. In some systems, two-way cable-TV lines may be used for the connection to the database.
- A service center with a local database or a network of service centers and databases. At the computerized service center a number of administration and control functions are carried out: validating subscriber, password, and closed-user group numbers; storing test pages, messages, control and usage statistics, and accounting and billing data; and maintaining lists of subjects and high-level indexes. A local database may store detailed indexing and information pages. Alternatively, the database may be remote, with the service center acting as a gateway or switching point to the remote database, of which there may be more than one.
- The information providers, supplying updated or fresh information into the database directly from their own offices, using an editing terminal with remote access. Some of the organizations charge the user for each page of information accessed and some provide their information free of charge.

The most appropriate transmission medium to connect users with service centers is the public switched telephone network (PSTN). Local communications

between subscribers and exchanges are, with few exceptions, through copper wires designed for analogue signals at a bandwidth of roughly 4 kilohertz, but these lines can also carry the digital signals need for Videotex.

Most Videotex services developed in the past were designed for transmission speeds between service centers and users of 1200 bits per second, using short haul (and low cost) modems. The speed of transmission in the reverse direction is mostly 75 bits per second, enough for a keying rate of about 8 characters per second.

At turn-on of the Videotex terminal in a system using the switched telephone network, the initial telephone call to the service center is made automatically by the receiver. When computer contact is acknowledged, the viewer keys in a code to use the system and initiate the billing procedure. Subsequently, a broad index of subjects appears on the screen. The viewer keys in the desired page number, and that page alone is sent to the receiver. Each character is represented by a 10-bit word: seven bits define the character coding, a parity check is included and start-and-stop bits identify each character. Thus, a full page of 960 characters is sent from the database to the home receiver at 1200 bits per second, in exactly 8 seconds. This rate is adequate because the system begins transmitting instantaneously upon request and the characters are written faster than most people can read.

A typical Videotex system will contain many thousands of information pages and the goal is to provide a means of data access which is quick, cheap and easy to use. The key to information retrieval is the indexing method. The method widely associated with Videotex is indexing with numbered choices. In this method, each page is uniquely numbered and the indexes are arranged in a hierarchy of increasing detail. A user works through the indexes by

signifying the selection of a numbered choice through the corresponding numbered key on a keypad. The index looks like the inverted branches of a tree and therefore this arrangement is often called a tree structure.

Since each page of a Videotex base is assigned a number, an alternative selection method is available in which the page is selected directly by use of additional keys. These access pages are stored and printed in a directory.

Another approach to indexing is the keyword method. Here, each page of subject matter has one or more keywords associated with it. A separate index relates keywords to page numbers. With this method a user enters a keyword or keyword combination through his keypad, to be presented with a list of corresponding pages. By refining the keywords, the list can be reduced.

The selection of a known page is not considered interactive. However, Videotex users have (at least in theory) the power of a large computer at their disposal. Users are potentially able to execute complicated communications and transactions from home or office terminals. Electronic banking, home shopping, bill paying, and sophisticated videogames are only some of the interactive services that exist. Furthermore, because the text, graphic, and control coding is stored in the head-end of the host computer, Videotex page capacity is limited only by the storage capacity of the host. Due to the two-way capability of Videotex, in-home hardware must necessarily be more sophisticated and expensive. A more sophisticated terminal might include input devices such as a typewriter keyboard and microprocessors to allow for the processing of user input.

One exciting aspect of interactive services is that some of them will be provided through a gateway switch to the actual institution involved. For instance, if a user wants to conduct an electronic banking transaction, he

will call up the service and the computer will automatically reroute him to the on-line central computer at the bank with which the user will conduct his business. This capability dramatically expands the scope and power of a Videotex system.

A valuable feature is a message service in which subscribers can communicate with one another. Even by using the numeric keyboard, a subscriber can select a message from a preformatted list and store it in the computer for pickup by the addressee. All subscribers are informed of any message waiting for them whenever they access the system.

In Videotex systems the database need not be completely available to all users; there are specialist, or "closed" groups of users. They insert and update pages from special terminals and these pages are available only to the identified members of the group.

Although two-way equipped cable lines are a superior transmission medium in areas where two-way cable service is available, and could eventually emerge as the dominant medium for Videotex, telephone lines seem to be the medium most likely to be used for large data-based two-way Videotex for the foreseeable future.

Competing Videotex Technologies

In terms of presentation of text and graphic data, the technologies employed in Videotex services are the same as those used in Teletext.

In terms of technical standards, the British have developed an entirely separate technology for Videotex, known as Prestel. Prestel was developed by the British Post Office in conjunction with a number of television set manufacturers and information providers. The original repertoire for Prestel

was chosen to comply with that provided by conventional typewriters in the U.K., and to maintain compatibility with broadcast teletext. It did not agree with the repertoire of characters used for data processing, and so was allocated a different set of codes for transmission. The British Ceefax technology, proposed for the US is not applicable to Videotex.

Prestel technology and Antiope technology, both of which share the use of alpha-mosaic or block graphics, have been incorporated into a combined standard for Videotex in 26 European countries under the umbrella of the Conference of European Postal and Telecommunications Authorities (CEPT).

The AT&T-Telidon-Antiope Presentation Level Protocol (PLP) has been offered as the basis for a Videotex standard in the US as well as a teletext standard for the coding of text, graphics, and control information. PLP is emerging as the de facto North American standard.

The fact that CEPT and PLP systems are currently incompatible creates barriers to the development of a worldwide standard, although, in the absence of plans for international transmission of Videotex, a worldwide standard does not seem to be necessary. CEPT representatives would prefer that the PLP standard be modified to be compatible with CEPT alpha-mosaics. If this can be done a worldwide standard could be proposed that incorporates both systems. AT&T is attempting to develop a technical solution that would allow for accommodation of a number of different protocols including, presumably, the CEPT technology.

Videotex Information Services

Introduction

The advent of electronic information systems means that people will be able to get more up-to-date information in their areas of interest than is possible with the present methods. Access to data banks is one of the key services to be offered by "information utilities".

Another area is that of interactive services. Many computer data banks are interactive, that is, instead of simply reading what they contain, users can add information of their own to the existing store. It is also possible to take information from a data bank and process it through another program involving calculations or other computer processes. This applies also to educational programs.

The growing use of home computers may greatly speed up the use of Videotex type information utilities, especially if telesoftware is available through these utilities. Through Videotex systems the home user can take advantage of much greater computing power to support the home computer, as well as a wide range of other services.

Videotex systems can provide users -- especially those equipped with more sophisticated terminals or with home computers -- with messaging capabilities, games, personal files for remote storage of material supplied by the user (e.g., programs, documents or personal directories) as well as possibilities for electronic banking and teleshopping. Another application to be offered widely on two-way cable systems is likely to be some form of home security protection.

Accordingly, five generic classes of information services to be provided by Videotex have been identified (Tydeman et al., 1982):

- Information retrieval
- Transactions
- Messaging
- Computing
- Telemonitoring

Information Retrieval

The most fundamental Videotex service is information retrieval. In this category, the user gains access to information in a computer's database. The information may include general news bulletins, financial quotes, entertainment listings, basic directory services or subtitles for TV programs. "On-line" updated encyclopedia information can be provided to the user, drawing together all of today's reference books, scholarly journals, research reports, specialized encyclopedias, atlases, lexicons, and so forth into one system. Information can be delivered in either a one-way teletext or a two-way Videotex system but some future applications (e.g., pictures, motion video, music or specialized newsletters) might require a substantially higher transmission rate than the rate used currently and, therefore, a full cable communication channel of 8 Mbits/sec.

There are three basic parameters that describe the type of information retrieval service:

- The specificity of the information being accessed. This can range from very general data on news, weather, and sports to information specifically for a professional group or a small class of users.

- The volume of information stores.
- The frequency with which the information requires updating.

The basic general user information service has low specificity, low volume, but frequent updates. This is analogous to the daily newspaper or to the hourly news. The encyclopedia type service of specific, high volume and slowly changing information is mainly for a specifically focused user group.

Information retrieval systems might be enhanced toward the end of the century by speech recognition input and synthesized speech output. Users will be able to request information verbally and receive a spoken output if desired.

In some applications there may be a need for paper copy of the displayed information and a local printer, coupled to the Videotex terminal, could automatically output the pages selected.

A special but potentially significant retrieval subcategory involves educational applications of Videotex. These applications might include:

- Access, study and record from information banks
- Conduct of on-line library/database searching
- Administrative procedures
- Interaction with lecturers and tutors for course work
- Contact with other students
- Carrying out Computer-Assisted-Instruction (CAI) lessons and instructional sessions
- Establishing databases and create records.

If Videotex systems do become effective educational tools, it is likely that they would be utilized in schools, much as personal computers are now being rapidly adopted. A number of attributes of Videotex -- ease of use, low

cost, emphasis on colour and graphics -- make these systems attractive as an educational aid, particularly with younger students.

From the consumer's viewpoint, the area of do-it-yourself instructional and educational enrichment seems particularly promising. There may also be more educational applications in the area of job-skill training and professional development.

Transactions

This area involves user interaction in order to register an opinion, make a reservation, purchase a product (teleshopping) or manipulate financial accounts (telebanking). Various levels of sophistication are possible, from simple "yes" or "no" responses to full capabilities with ordering and payment systems built in.

As transactions require the user to interact with at least one external computer, the basic service for transactions requires a two-way capability. A relatively slow transmission speed to and from the individual undertaking the transaction is adequate.

The basic teleshopping service is a directory type of service which will allow the viewer to shop, order and pay for merchandise directly on the system. One of the important features of the directory service is the range of ways in which the viewer can access product information. He or she might be able to "shop" by merchant, product, brand name, lifestyle, special occasions, bargains, etc. Teleshopping might also be offered through a video shopping channel connected with the Videotex service. The programming on the video channel will then include demonstration shows of products and services, fashion shows, "how to" shows and commercials, and the viewer will be able to place orders directly through the Videotex system.

One service customers and professionals seem to want is banking. At a time when it currently costs the banking industry an average of 82¢ to process one check and when all those who render bills, the cost is about 42¢ per bill, financial institutions are looking for alternatives to current checking and banking procedures (Trabucco, 1982). Customers are also interested in the ability to transfer funds, access account information, and pay bills from a home terminal, and Videotex might certainly provide an economical alternative to current banking procedures.

As the use of Videotex systems for financial transactions becomes increasingly widespread, system security is likely to become a major concern to users. Such concern is likely to stimulate the use of more secure system enhancements, e.g., card readers and speech recognition. Smart cards, coded with a fixed amount of money, might become especially important for activities that do not allow credit. In the "cashless society" the smart card might not only serve as a means of identification but also become the means to obtain "ready cash"; cards are recharged by authorizing a transfer from the user's bank account to the special card account.

Electronic Messaging

This service application allows the user to communicate with others on the system, or possibly with others on other systems or even with those not on any system (via downloading messages for mail or print distribution). The sophistication of the messaging capability depends on the type of input device the user has. A regular keypad limits the user who wants to send a message to the choice of one out of a list of preformatted messages. The user who has a full keyboard terminal, on the other hand, can send a full-text message. Full

message service requires a Videotex two-way system, but general messages may be downloaded on one-way systems.

The mail messaging system has to be supported by a remote computer, which stores incoming messages until the addressee clears his or her "mailbox." The service resembles store-and-forward messaging currently available on computer timesharing and packet switching networks. The introduction of electronic messaging to the home might result in a number of interesting applications, such as referenda and consumer action. Message authentication will also be an attribute of enhanced message services. Initially card identification (similar to today's credit cards) is likely to evolve, but authentication ultimately may be achieved by speech recognition techniques.

Computing

The computing service may be considered in its most basic form in terms of the physical location of processing and, possibly, storage functions. The terminal may merely act as an outline interface to a computing service, similar to existing computer timesharing services. Alternatively, downloaded "telesoftware" supported by user-created programs would require an "intelligent" terminal with considerable memory to operate in an off-line mode.

The basic computing service has two possibilities. The first requires two-way transmission (at relatively low speeds), a visual display unit, and a numeric keypad. No processing or storage is necessary because the computing is undertaken remotely, with the user providing numerical input in response to formatted requests.

The second basic form of computing is a one-way service with high transmission speed (e.g., 2400 bits/sec. or higher), local CPU processing

power, and a local storage device. Both black and white display and alphanumeric input are adequate. The applications are limited only by the size of the CPU and the extent of local storage.

In remote computing, the user requires rapid response to inputs (e.g., two seconds). In the downloaded situation, the acceptable waiting time to download a program into the user terminal appears to be as long as 15 to 60 seconds. In this latter case, of course, once the program is downloaded, response times are virtually instantaneous.

The keyboard is likely to remain the major input device of any computing service; however, graphic input devices, such as light pens and graphic tablets, will be essential enhancements for many specialized applications such as telework applications. These are also likely to require a higher quality of display than is possible with a standard television receiver. Therefore, enhanced computing services are likely to emerge with dedicated video display units. It seems that in the near future, the processing power and storage of today's personal computers (8-bit microprocessors, 64K-byte RAM) will become the minimum available in enhanced Videotex computing applications. Local mass storage will be provided initially by floppy disks and hard disks and eventually by videodisks.

Telemonitoring

A Videotex computer can serve as the central monitoring point for emergency fire, medical and burglar protection for the home. The telemonitoring service provides a link between the host computer and a user-sensor network and involves two distinct services. The first is the transmission of user sensory data to the host computer for detection of fire,

security and electrical appliances malfunctioning. The second is an active, decision-oriented service that, in addition to monitoring, attempts to control various devices, e.g., an energy management system that aims at minimizing energy utilization by optimally setting thermostats.

The amount of information transferred between the user and the centralized computer for any telemonitoring service is extremely small; therefore, the speed of transmission is not critical. As voice-plus-data multiplexers are likely to become economically viable in the future, a dedicated link over the telephone network might be provided in addition to the voice channel and replace the dial-up link which can be unreliable.

Future Applications of Videotex

Assuming that Teletext and Videotex do achieve widespread penetration over the next 20 years, what might these systems be like? What services might they offer.

A series of three "futures" workshops was held as part of a technology assessment project conducted by a research team at the Institute for the Future, with Dr. John Tydeman as Principal Investigator. More than 50 potential applications generated at the workshops are listed in the following table.

Applications are categorized according to their primary functional classification along with a brief identification of likely providers and users of the service.

Table 2

Future Teletext/Videotex Applications

| <u>Application</u> | <u>Description</u> | <u>Providers</u> | <u>Users</u> |
|--|---|--|--------------------------------------|
| I Information Retrieval | | | |
| <u>Application area: electronic publishing</u> | | | |
| Electronic newspapers | Text from local papers and wire services. Ability to retrieve background stories. | Local newspapers, national news services | Everyone |
| Specialized newsletters | High-cost newsletters with timely information. | Small and large publishers | Investors, collectors, professionals |
| Electronic encyclopedia | Online reference service with frequent updating to include new developments. | Encyclopedia publishers | Students |
| <u>Application area: library and reference service</u> | | | |
| Database access | Opportunity to access specialty databases from home. | Specialized database providers, libraries | Professionals, researchers |
| Catalog review | Listing of all library materials. Capability of reserving/requesting items from library. | Public libraries | Researchers, writers |
| <u>Application area: community services</u> | | | |
| Community bulletin board | Listing of local events accessible by subject type, place etc. Also proposed as a public information utility. Electronic referral services. | City government, local newspaper, community groups | Local residents |
| Transit/travel information | Bus, train and airline route schedules plus intercity connections. In enhanced version, trip planning capabilities are available. | Transit authority, airlines, travel agents, AAA | Travelers |

(continued)

| Application | Description | Providers | Users |
|------------------------|--|--|--|
| Emergency information | Latest reports on accidents, road conditions, weather, air pollution, etc. | Local government, highway patrol | Local residents |
| Housing availability | Multiple listing service. House, apartment, condominium sales and rentals. Hotel and motel space availability. | Landlords, realtors, hotels and motels | House hunters, |
| Comparison shopping | Umbrella group collects information on current prices for particular products. | Nonprofit community groups | Consumers |
| Electronic hotlines | Match requests to information (e.g., poison control information -- type of poison entered and recommended action immediately displayed). | Special interest groups (e.g., poison control problems center) | Residents with emergencies |
| Foreign language | Translations of community announcements, emergency, and other information. | Local government, ethnic community groups | Non-English speakers |
| Captioning | Subtitling of TV programs, news, etc. | Caption center, broadcasters | Hearing-impaired |
| Electronic directories | Open or closed systems for providing listings of employees, buildings, stores, hours of service, etc. Telephone white pages. | Companies, associations, phone company | Employees, customers, group members, phone users |

Application area: education

| | | | |
|--|---|-----------------------------------|----------|
| Course listings | Extension courses, night school classes, private school offerings available by subject, location, fee, etc. | Schools, adult education programs | Students |
| Computer-assisted instruction/ computer-managed instruction | Course material programmed to move with individual learner's speed and capability. | Schools, specialized companies | Students |

(continued)

| Application | Description | Providers | Users |
|--|---|--|--|
| Special services for home-bound students | Interactive "correspondence" courses | Schools | Students |
| Supplemental materials for education TV programs | Online "Sesame Street" type materials to practice lessons/ideas from broadcast program. | CTW, local school district, public TV | Young children |
| Do-it-yourself training | Step-by-step instruction for home repair, car repair, cooking, etc. | School systems, product manufacturers, specialized companies | Do-it-yourselfers |
| Literacy | Basic language and mathematical skills. | School districts, training community colleges | Dropouts, older students, new arrivals |
| Retraining | Tutorial programs including linking new job interest and positions available. | Unions, companies, community colleges | Unemployed |

Application area: health

| | | | |
|---------------------|--|---|--|
| Storefront medicine | Systems with details on diagnosis, treatment, drugs, health risks, costs, etc. | Hospitals, medical associations, specialized publishers | Professionals, para-professionals, consumers |
| First aid | What to do in case of..., could include follow-up numbers to call. | Red Cross, drug companies | Anyone with emergency |

Application area: entertainment

| | | | |
|--------------------|--|-------------------------------|--------------------|
| Electronic jukebox | Access to large library of recorded music, lectures, old radio shows, etc. | Radio, TV stations, libraries | General community |
| On-demand TV | Dial-up program selection of movies, TV shows. | Cable, broadcast companies | Pay-TV subscribers |

(continued)

| Application | Description | Providers | Users |
|--------------------------------------|---|---|-----------|
| <u>Application area: advertising</u> | | | |
| Electronic yellow pages | Directory-type information on products and services updated regularly, accessed by categories. In enhanced version, could be combined with order-taking capability. | Telephone companies, merchants | Consumers |
| Supplement to TV advertising | National ads with local dealers and price information. More detailed description on product. Could have order-taking capability. | Advertisers | Consumers |
| Classified advertising | Similar to newspaper classified advertising but with more capabilities for indexing and retrieval. | Individuals, retailers | Consumers |
| Display advertising | Show weekly specials and product information. Could be used in conjunction with other ads. May include ordering capability. | Retail merchants, chains, department stores, supermarkets | Consumers |

II Transactions

| | | | |
|---------------------------|---|--|----------------|
| Electronic checkbook | Purchase made over system; purchase amount automatically deducted from purchaser's checking account. | Banks, savings and loans | Bank customers |
| Electronic funds transfer | Bank customer has access to all accounts via home terminals. Can manipulate accounts and make transactions. | Banks, savings and loans | Bank customers |
| Electronic credit cards | Account number is entered in system for purchases, bill paying, etc. | Banks, savings and loans, credit card companies, retail stores | Bank customers |
| Electronic catalogs | Online access to catalogs with order-taking capability. | Catalog merchants (Sears, Consumer Distributors) | Consumers |

(continued)

| Application | Description | Providers | Users |
|-----------------------|--|-------------------------------------|----------|
| Gambling | Quotations, pool size, risk information. Potential extension of off-track betting offices. | State agencies or private companies | Adults |
| Entertainment options | Electronic box office service. Leisure-time planning. Vacation options. Could include reviews, ratings, guidebook information. | Ticketron, travel agents | Everyone |

III Messaging

| | | | |
|---------------------------------|--|--|-------------------------|
| Electronic mail | Point-to-point messages for personal correspondence, bill paying, advertising, etc. | System operators, post office, specialized carriers. | Anyone |
| "Videotexgram" | Efficient way of sending same message to multiple locations. | Businesses | Customers, suppliers |
| Conferencing | Shared textual space by group. | Videotex system operators | Special interest groups |
| Serendipity machine | Unplanned meeting with people of like interests via system. | Videotex system operators | Anyone |
| Electronic welcome wagon | Information on community and neighbors provided by online welcomer. | Local chamber of commerce | Newcomers |
| Referenda or quasi referenda | Citizen input to government officials on controversial issues. | Local government | Citizens |
| Consumer action | Complaints and reactions to products or services are channeled through consumer ombudsman service with feedback to participants. | Nonprofit community group, Better Business Bureau | Consumers |
| Electronic gossip | Links residents with similar interests to share information, opinions, and ideas. | Community groups | Local residents |
| Internal business communication | Intraoffice memos; closed-user groups. | Companies | Employees |
| Market research | Use of new product is tracked through online polling of consumers. | Retailers, manufacturers | Consumers |

(continued)

| Application | Description | Providers | Users |
|--|---|--|---|
| IV Computing | | | |
| Video games | Interactive games with potential of adding multiple players. Could be combined with TV programs so that participants at home influence course of program. | Teletext/Videotex system operator | Anyone |
| Home computing service | Provide additional computing power to home terminals. | CompuServe, The Source, etc. | Personal computer owners |
| Personal information storage | Private electronic files for home-related information. | Videotex service provider | Anyone |
| Financial management | Personal finance management. | H&R Block, CPAs, etc. | Anyone |
| Telework | Text editing, file maintenance, data entry, and analysis. | Companies, service bureaus | Employees |
| Extensions of corporate management systems | Available to workers at home and at other convenient locations (e.g., hotel rooms). | Companies | Employees |
| Inventory/stock control | Extension of present computerized systems to smaller and more decentralized companies and franchise organizations. | Companies | Branch offices, local dealers or distributors |
| V Telemonitoring | | | |
| Home security | Remote sensors. Emergency fire, police notification. | Cable companies, phone companies, security companies | Residents |
| Health and safety monitoring systems | Assist in at-home care (e.g., ECG, blood pressure readings). | Public health agencies, medical groups | Chronically ill, elderly |
| Energy | Control and regulation of household energy use. Meter reading | Gas and electric utilities | Residents |

Source: Tydeman, et al., 1982

Worldwide Applications of Videotex

United Kingdom

A British research engineer, Sam Fedida, is generally recognized as the inventor of Videotex, or viewdata, as it was then known. With other members of his team at the Post Office Research Center, Fedida developed this concept during the mid-1970s to the point of a practical working system, based on the idea that TV sets should be linked through the telephone network to computerized stores of information. In 1974 a working model of viewdata was demonstrated and in 1976 a public pilot trial started, with a few information providers and a few dozen viewdata sets in their premises and those of the British Post Office (now British Telecommunications). A full commercial service, known as Prestel began in 1979.

During the same period, engineers at the British Broadcasting Corporation and the Independent Broadcasting Authority were developing broadcast teletext services (named respectively Ceefax and Oracle) and in 1976, both the BBC and the IBA received full government support to begin nationwide public teletext services (Tydeman et al. 1982).

At the end of 1982, Prestel had about 15,000 users (more than 90% of whom are business firms) and was gaining about 400 new users a month. Nearly 500,000 British homes were receiving broadcast Teletext on one or more of the three British networks and the number of TV sets bought or leased in Britain that are equipped with the special decoder for receiving Teletext signals has been growing at a rate of 30,000 to 40,000 per month (Edwards, 1982).

Prestel offers a wide range of topics from antiques to washing machines, and from book reviews to job vacancies. Actually, much of the information on

the system is business-oriented (since most users are businesses), such as international commodity prices (updated every five minutes) and various financial data bases. Flight schedules for 57 airlines are published on Prestel and ten of these provide direct booking on the system (a form of transactional Videotex service). TWA's flight schedule, which is distributed at no charge (except in connect fees), provides information on stand-by availability for departing flights.

In total, Prestel offers some 220,000 pages of computer-stored information inputted by more than 150 Information Providers (IPs).

The technical configuration of Prestel service centers is based upon GEC 4000 series computers, with four 70-megabyte discs on one of the external multiplexors, and a total of 208 lines (expected to increase to a maximum of 384 later) on the other four multiplexors (the sixth channel is used for local peripherals). Four megabyte discs can hold 250,000 frames at 1 kilobyte per frame. Higher capacity 270-megabyte discs are available for the GEC 4000 series computers, giving a four-fold increase in storage capacity to around 1 million information pages per four-disc system.

Prestel service centers will be distributed across Britain to be within local call telephone reach of the majority of the population.

The total "information costs" for using Prestel 10 minutes per day (as at September 1980) would be 2.73 British pounds per week for call rates, computer access and information provider frame charges, and adding up the increase in TV rental charges, this would sum up to about 285 pounds per year (+ VAT) (Winsbury 1981).

The three British TV networks (BBC-1, BBC-2, and ITV) offer some approximately 100-page magazines that are frequently updated and changed during the day.

The services offered on Ceefax include news, food-guide, news flashes, finance, an entertainment guide, an alarm clock, sports, weather and travel, and some subtitling on BBC-1. BBC-2 provides news background, fun and games, TV and radio programs, a finance spectrum, sport features, consumer reviews and other pages. The ITV service, which is now heavily supported by advertisers, also offers regional Teletext services around the United Kingdom.

Both the BBC and the ITV recently increased the number of vertical blanking interval lines providing their Teletext services from two to four, reducing the total time to transmit a 100-page magazine to 15 seconds. A recent development in Ceefax technology enables the transmission of pictures of photographic quality as well as the transmission of "telesoftware."

France

Teletext and Videotex also emerged in France during the 1970s. In the early 1970s, the French Center for the Study of Telecommunications and Television (CCETT) was established in Rennes as a joint research center to develop new technologies for the French PTT and the French broadcasting authority, TDF. The outcome of this work was Antiope, a system incorporating both broadcast Teletext services and interactive Videotex services. In 1978, France adopted a national plan based on the recommendations of Simon Nora and Alain Minc (1980) to develop an integrated information services network using the Antiope system.

The first major implementation was the French PTT's Teletel Videotex service, which began in 1981 as a home-based trial in Velizy, a suburb of Paris. In this trial, 2,200 households were equipped with Antiope-adapted color television sets connected to the telephone lines via a modem. A

computer center run by the Ministry of Telecommunications was put at their disposal for the duration of the trial and some companies or organizations offered services, including: the state railway's seat-reservation system, checking from the home, a message switching service, mail-ordering, etc. In addition, 1,000 of the 3,000 sets used in the trial allow access to the Antiope services offered by the TV networks, and distributed by TDF. According to a recent report (International Videotex Teletext news, September 1982), during the first year of the trial, each of the 2,200 homes participating in the test averaged two calls per week, with typical access times of 13 to 15 minutes per contact. During each session, users looked at three or four different IPs' pages. The most frequently accessed services were news and press information, specific reference data (e.g., train schedules) and teleshopping. For the test, customers had free use of terminals and no-charge access to databases, but paid for telephone connect time.

French PTT is renting Minitel terminals to users of its Teletel service. The black-and-white stand-alone terminal will be rented for 70 francs (US \$10) per month. Nearly 60 services will be available via Teletel, including an electronic publishing network, home banking, electronic shopping and travel information. Also, services for specialized user groups (construction, banking, finance, shipping) will be offered.

In 1982, a start was made to equip all 250,000 telephone subscribers in the Ille et Vilaine region of France with a black-and-white special Videotex terminal, to be used as an "electronic directory." Using it, they will be able to look up the names of all other telephone subscribers, at first in Ille et Vilaine, and later in the whole of France. Equally, they will be able to

consult the "professional list" (equivalent to the Yellow Pages), and have access to supplementary information of an advertising nature. If the trial in Ille et Vilaine is a success, the service will be progressively extended to the rest of France and, by 1992, about 30 million electronic directories would then be in use, instead of the printed directory.

West Germany

The West German Bundespost announced in April 1977 its contract with the British Post Office for the supply of Prestel software and know-how and demonstrated its virtual Bildschirmtext system that autumn (Woolfe, 1980). Starting in 1978, a pilot trial of two years was set up to demonstrate the system.

In 1980 a public market trial began, involving about 3,000 participants. Two GEC 4082 computers were installed in Dusseldorf and a second dual GEC 4082 system was installed in Berlin, to support more market trial participants. At the end of 1979, 40,000 pages of information were entered and by February 1981, 80,000-90,000 pages were available in each center (CSP, 1981).

The technical structure of the German Bildschirmtext system is different from the initial structure of the Prestel database, in order to allow access to remote databases. In addition to operating as a Videotex service in its own right, each Bildschirmtext-Zentrale computer together with front-end processors acts as the interface (Gateway) for the 25 experimental external computers currently being tested by information providers. Gateway systems offer a very cost-effective way to enable customers to carry out a wide range of transactions and the Bildschirmtext network is the first to provide extensive field experience of the Videotext Gateway concept.

A key application of Videotex in Germany is expected to be catalog shopping and reservations, much of which is already computerized by companies offering these services, such as mail-order houses, banks, and tour operators. Therefore, the need for external databases, without centralized duplication (as in Prestel) was seen to be of paramount importance. A major limitation to this configuration is the absence of a central update center, and therefore information providers must repeat the update process for each database. As of June 1982 the Bildschirmtext system had over 7,000 users (IVTN). In autumn 1983 the service is to be introduced nationwide for individual communication. It is expected that there will be 40,000 subscribers by the end of 1983 and approximately 1 million by 1986 (Schmidt, 1982).

A Teletext system based on the British Ceefax technology and operated by the Association of German Radio Broadcasters (ARD/ZDP) had 140,000 users in 1982.

The Netherlands

Holland had in mid-1982 a Teletext service reaching 170,000 users and a Viditel Videotext service with 4,700 users (International Videotex Teletext news). The PTT in Holland has acknowledged that several Videotex networks can exist side by side, and therefore has issued specifications regarding the use of the public telephone network, enabling private network operators to offer their own Videotex services.

The Viditel Videotex system is based on Prestel technology and uses the same GEC 4082 computer as Prestel. The initial configuration had a page capacity of 140,000 pages, which can be expanded easily.

Finland

A public trial of a Videotex system was started on June 1978 by Sanoma Publishing company (responsible for supply of information), the Helsinki Telephone company (telecommunication equipment, modems and connection to the telephone network) and Nokia electronics (computers, business terminals and software). The system is functionally identical to Prestel as seen from the subscribers' point of view, but the computer is of the PDP-11 type. The database uses about 10,000 frames of the total capacity of 50,000 frames available. As of 1982, the system had about 310 users.

Two other Videotex systems were announced: Tampere, with 95 users and Turku, with 20 users.

Denmark

The Danish Teledata electronic information system was started in 1982, with 200 terminals (100 with private users, 25 in public places and 75 in industrial companies). The two teledata centers are located in Copenhagen and Arhus, respectively. Each center has an initial capacity of 80,000 pages and the two centers will be stocked with the same information. The system is run by a coordinating group representing the four Danish tele-administrations, the teledata centers are based on CR80D computers and the terminals were supplied by Bang and Olufsen with built-in modem and decoder for the reception of Teletext and Videotex.

Other European Countries

According to International Videotex Teletext news, the following additional systems were operated, or planned, in Europe as of mid-1982:

- Austria: Teletext system with 120,000 users.
- Belgium: Videotex system to begin operation in 1983.
- Greece: Teletel system in process of installation by Bank of Thessalie, with 8,500 users.
- Italy: Public Videotex system with Prestel format to begin operation in late 1982 with 20,000 users.
- Norway: Teledata system with 100 users.
- Sweden: Teletext system (Text-TV) with 100,000 users and DataVision to begin commercial operation in 1982.
- Spain: Videotex system with 400 users.
- USSR: A contract was signed with Rediffusion Computers to sell a private Videotex system to the Soviet Ministry of Gas to control the supply of spare equipment for the gas pipeline project (IVTN, September 1982).

Japan

The main telephone-based Videotex experiment in Japan is the CAPTAIN system (Character and Pattern Telephone Access Information Network system), which was started as a test trial on 25 December 1979. Captain is similar to the British Prestel system, but because of the need to generate up to 3,000 different characters to accommodate the use of Kanji (Chinese characters adopted in Japanese), the character/pattern generator is located at the Videotex service center rather than in the decoder unit in users' terminals. The signals describing the patterns of characters and figures are directly transmitted to the users. This transmission system adopted by Captain has both advantages and disadvantages. Because images are transmitted in patterns, the system can reproduce much finer-grained displays; there is less corruption of the transmitted characters; and the system permits simplified

and less expensive terminal equipment. But it has a major drawback in that the time required for transmission is necessarily longer compared with coded transmission.

The Captain system can display as many as 3,500 characters, including Kanji, Katakana (the square form of Japanese syllabary), in addition to alphanumerics and special symbols. Character display is available in three different sizes: up to 120 standard characters (16 x 18 dots) can be displayed on one page, but the number can be increased up to 480 characters by using a smaller size (8 x 11 dots).

The Captain system was developed by NTT public corporation and sponsored by the Ministry of Posts and Telecommunications. The trial service of Captain includes a total of 1,000 receiver terminals selectively installed in households in Tokyo, and is being conducted free of charge to any of its participants (users and information providers) except for the use of the telephone.

Among the 165 information providers who inputted a total of 100,000 pages of information into the Captain computer, there are 23 newspapers and news agencies, 30 magazine and book publishing houses, 8 broadcasters and 22 advertising agencies. In addition, there are department stores, travel agencies, public transport companies, banks and some government agencies and public corporations.

Commercial service is expected to begin in 1983 and users are then expected to buy adapted TVs, designed and manufactured by Fujitsu and to pay connect-time and page access fees on similar lines to the Prestel public services.

Canada

During the mid-1970s, the Department of Communications in Canada became interested in Teletext/Videotex developments. By the end of 1978, an integrated Teletext/Videotex system called Telidon had been developed by the DoC Research Center. In 1979 the Canadian government approved a four-year program for Telidon field trials and further development of the system's components.

As of mid-1982, more than 10 field trials were announced (IVTN), with over 3,000 participants. These included:

- Project VISTA, run by Bell Canada in Toronto and Montreal on the normal telephone lines to 400 homes. During this trial 10,000 pages of information will be available and it is believed that it will be moved directly into a public service.
- Project Grassroots in Manitoba, run by the Manitoba Telephone System and testing an interactive system offering farm data and monitoring. Of the 320 homes connected to the system, some will be wired to test meter reading, fire, and burglar alarms. About 20,000 pages will be available on this system. Grassroots is scheduled to begin full commercial operation in mid-1983.
- VIDON, run by Alberta Government Telephones with 30 participants, using a second paired wire into the home which in effect means that Videotex can be used without tying up the normal telephone lines.
- Teleguide in Toronto with 2,000 participants.
- TV Ontario, a Teletext system trial with 50 participants.
- BASIS, a private commercial system.
- British Columbia Telephone's system in Vancouver, with 200 participants in the test.

As far as is known, all of these trials use Telidon alpha-geometric technology, sending the characters of the displayed information independently of the resolution and then recreating them in the terminal (which is more expensive).

The United States

The Videotex scene in the US is characterized by a proliferating number of trials and service plans. Some are aiming at the business marketplace, others at the residential marketplace. Equipment, standards and information services are different and fluid. No clear pattern has yet emerged regarding the distribution of functions among the parties interested in providing Teletext/Videotex services. In some instances, a single organization plays all three roles of information provider, system operator and communications network provider. In other trials, different groups play each of these roles.

Table 3 lists US Videotex trials and services and Table 4 lists US Teletext trials and services. A list of application areas provided by these systems is provided in Tydeman, 1982. As of 1982, no single display format has emerged as standard in the United States. Among the most developed systems, The Source uses a display format of 80 columns and 24 rows, while CompuServe uses a 32 x 16 display. Clearly, there is little, if any, compatibility in the systems and trials proposed thusfar. The various Teletext and Videotex systems not only are incompatible with systems within their own generic class but also are incompatible from one class to another. Standards setting, whether by industry or government, has yet to penetrate many dimensions of this technology.

Table 3

US Teletext Trials and Services: The Participants

| Teletext Trial | Information Service Provider | System Operator | Communication Network Provider | Target User Group | Location | No. of Users (Nov. 82) | Status |
|----------------------|-------------------------------|---------------------------------|--------------------------------------|-------------------|-----------------------|------------------------|---|
| KSL | TV station | TV station | TV station | TV viewers | Salt Lake City | | Launched in 1978 |
| NCI captioning | National Captioning Institute | National Captioning Institute | TV station | Hearing-impaired | | 60,000 | Operational service |
| WFLD | Publisher | Private co. | TV station | TV viewers | Chicago | 100 | Commercial service |
| KNXT KCET KNBC | TV stations and others | TV network Public TV station | TV stations | TV viewers | Los Angeles | 80 | Test began April 1981 |
| WETA | Various | Research organization | TV station | TV viewers | Washington | 50 | Test began June 1981 ceased August 1982 |
| KPIX | TV station | TV station | TV station | TV viewers | San Francisco | 75 | Test began in 1982 |
| Cabletext | Publisher | Satellite carrier | Satellite carriers, cable company | Cable subscribers | Atlanta | | In-service from February 1983 Decoders rented to cable operators |
| Time Inc. | Publisher | Satellite carrier | Satellite carriers, cable company | Cable subscribers | Orlando/ San Diego | Goal: 5,000 | Test began November 1982 |
| WGBH | TV station | TV station | TV station | TV viewers | Boston | 25 | Test began November 1982 |

*Sources: IVTN and Tydeman (1982).

Table 4

US Videotex Trials and Services: The Participants

| Videotex Trial | Information Service Provider | System Operator | Communication Network Provider | Target User Group | Location | No. of Users Nov. 82 | Status |
|----------------|------------------------------|-----------------|--------------------------------|--|------------|----------------------|---|
| QUBE | Various | Cable co. | Cable co. | Cable subscribers Home computer users | Columbus | 38,000 | Operated since 1977. Since January 1981 testing home computers as terminals |
| The Source | Various | Private corp. | Telco, Packetnets | Home computer users | Nationwide | 23,000 | Commercial service began June 1979 |
| Compu-Serve | Publishers, others | Private corp. | Telco, Packetnets | Home computer users | Nationwide | 31,500 | Commercial service began July 1979 |
| Comp-U-Star | Private corp. | Private corp. | Telco | Consumers | Nationwide | 200 | "Shopping by satellite" starting fall 1982. |
| BISON | Publishers | Publisher | Telco | Residential | Dallas | | Suspended in May 1982 |
| OCLC | Library, bank, others | Private corp. | Teleco | Residential | Columbus | | Operated to 100 households in early 1981 |

(continued on next page)

| | | | | | | | |
|-----------------------|--------------|------------|--|---------------------------|--------------|--------|-------------------------------------|
| Green Thumb | Various | University | Telco | Farmers | Kentucky | | Test conducted in 1980 |
| Dow Jones | Publisher | Publisher | Telco, satelite carrier, cable company | Investors business-people | Nationwide | 50,000 | Commercial service since 1980 |
| EIS | Telco | Telco | Telco | Residential | Albany | | Test conducted in 1979 |
| Viewtron | Various | Publisher | Telco | Residential | Coral Gables | | Commerical trial to begin in 1983 |
| INDAX | Various | Cable co. | Cable co. | Cable subscribers | San Diego | 25 | Commerical service began in 1982 |
| Times Mirror | Various | Publisher | Telco, cable co. | Residential | Los Angeles | 350 | Commerical test began in March 1982 |
| CBS/AT&T | Publisher | Telco | Telco | Residential | Ridgewood | 200 | Test began in 1982 |
| Continental Telephone | Various | Telco | Telco | Residential | Manassas | 100 | Test began in 1982 |
| Express Information | Bank, others | Bank | Telco | Bank customers | Knoxville | | Test conducted in 1980-81 |

*Sources: Tydeman (1982) and IVTN.

Other Countries

Brazil

Project Videotex of Telesp, the Brazilian telephone company's test, is based on French equipment. Plans call for 1,500 terminals to be installed throughout Sao Paulo, but at the end of 1982 only 60 were in place.

Australia

After two years of Teletext trials involving U.K., Teletext and Antiope, the Australian government has approved British Teletext for use by Australian television broadcasters. Captioning services for hearing-impaired viewers will begin in early 1983.

The Austel nationwide Videotex network has nearly 200 terminals linked, in Sidney and Melbourne. The Brisbane Teletext system has about 4,000 users as of the end of 1982.

Hongkong

The initial Videotex system in Hong Kong (designated Viewdata 1) was modelled closely on British Telecom's Prestel. It began to operate on a limited and exploratory basis in the summer of 1981. The number of users is believed to be (as of July 1982) in the range of 200-250 (CPS in Context update, August 1982). The system operator -- Hong Kong Telephone Company -- stresses Videotex message services and gateway operations and encourages the use of communicating personal computers as a means of access to Videotex.

Viewdata 1 has been supplemented by a separate service, Viewdata 2, which is available to all Viewdata 1 subscribers. Viewdata 2 is based on a separate Data General C350 minicomputer and emphasizes applications in which Videotex pages control the execution of interactive programs as interactive games, on-line telephone directory and a message service, interconnected to international Telex.

South Africa

As of the end of 1982, the Beltel system had 500 users.

Wideband Interactive Services and Videodisks

Wideband Interactive Services

Most Videotex systems are based either on broadcasting or on the use of the user's telephone line. The expansion of "Cable Television" systems and the development of optical fibers open new possibilities in the field of Home Information systems.

Historically, coaxial cables have provided quality reception of broadcast television for remotely located consumers. Cable began to expand in the US in the mid-1970's and today cable subscribership stands at approximately 28 million in the US, and the industry reports that 250,000 households per month are being wired for cable and that half the homes having access to cable subscribe to it (Kahn, 1983). Cable systems installed today promise upwards of 100 channels, offering local communities a varied, and unprecedented, communications menu.

In 1972 the US Federal Communications Commission decided the CATV systems should include a reverse channel capability, in order to develop interactive systems. Newer systems in the US now offer the option of consumer-originated messages. These may take the form of polling, emergency calls, or requests for information.

The best known two-way American system is Warner-Amex's QUBE, used by 38,000 residents of Columbus, Ohio. Using the five-button keyboard distributed to every household served by QUBE, consumers transmit elementary messages that are processed by a computer at the operator's central facility. For example, viewers may request a copy of a recipe demonstrated on a cooking program by flicking a switch on their home terminal; they will later receive a copy of the recipe by mail (Kahn, 1983).

One important feature of an interactive cable service, is the ability of the system to deal with the wide choice of TV programs or material required to satisfy minority groups, which may be as small as one, the individual subscriber.

An interactive wideband service can provide educational services for various grades of school children who may be confined at home due to illness. The interactive facilities permit responses so that the teacher can be in touch with each individual student. By virtue of access-denial facilities, an interactive system can provide "update" information to groups as doctors, police, etc., without unauthorized persons being permitted to view.

Applications in Japan

By adding a microphone and a camera to the keyboard and TV set already available at the cable-subscriber's premises, a two-way video interactive communication system is set up between the system's center and the subscriber's home. Two such systems have been installed in Japan.

CCIS (Co-axial Cable Information System) is the name of the two-way cable experiment conducted among 500 selected households in Tama New Town, in the suburbs of Tokyo.

The trial began in 1976 and Phase I was completed in 1978. During this period ten different types of service were made available to samples selected from among the participants including a videotex type service, which enabled still information stored at the center on microfiche to be selected by the user and presented on his TV set. A selection of 6,000 pages of information was available, ranging from notices of community activities to recipes.

During a second phase of the trial, only six of the ten services were continued including the videotex-type service; regular TV; original TV

broadcasting of local community TV programs; automatic repetition telecasting (a form of participative program preparation); flash information (surimposed on the regular picture) and memo copy -- for handwritten messages between users and the center, and between users (Woolfe, 1980).

HI-OVIS is a two-way cable experiment using optical fiber cables to provide a variety of services to participant homes. It is the first large-scale two-way cable experiment of its kind in the world and is being conducted under the guidance of the Japanese Ministry of Industrial Trade and Industry with the participation of private industries.

The HI-OVIS trial began in July 1978 with about 160 participating households in Higashi-Ikoma New Town, in Nara Precinct (near Osaka). Optical fiber cables connect the center facilities, through sub-centers to subscribers' homes. The terminal equipment used in the home for inserting queries and receiving the replies include a normal home-type TV set, a camera, a microphone and a keyboard. By means of program selection signals transmitted from the home terminal by touching the keyboard, the center computer system controls the video sources and establishes a transmission route between the center and the home terminal.

The services provided by HI-OVIS include (VISTA-MITI);

- TV retransmission of ordinary broadcast programs.
- TV studio broadcasting of local programs in which subscribers or local institutions (doctor, school, community officials) can participate from their normal location.
- Video request services -- provision of video programs from videocassettes in storage at the center, immediately upon subscriber's request.

- Still picture services, for distribution of information as local and national news, stockmarket reports, sports scores, weather, travel schedules, consumer services, and other up-to-the-minute information, in both alphanumeric and graphic forms. For information which varies constantly, a character generator is used to edit pictures, while for video information of large quantity (reports, books, or encyclopedias) microfiche retrieval equipment, which assures cheap storage and ease of display, is used.
- Consumer services include telepurchasing or home shopping in which prices of displayed articles are presented and the consumer can directly order these articles through his or her keyboard.

The HI-OVIS experiment is planned to be terminated in 1983.

Videodisks

Another new medium that may provide inexpensive access to large libraries of stored information is the laser videodisk. Pressed in plastic, a disk can contain on each surface 54,000 color television images -- equivalent to 10 million bits of coded information -- plus two channels of stereo sound. The contents of a 300-page book could, in principle, be encoded in each square centimeter of surface (Branscomb, 1982). A detailed description of Optical disk technology is provided in Goldstein, 1982.

Education in the home might be achieved through the use of a microcomputer-driven videodisk system. The following briefly describes how such a system works: "The system presents an audio instruction and an associated visual image via the television monitor. The learner responds by touching the television screen. The area touched on the screen is transmitted

to the microcomputer via a touch panel and the response is evaluated... There will be recorded segments on the disk for all possible conditions as well as a variety of positive reinforcements..." (Thorkildsen, 1979).

One of the major problems in using videodisks is cost of production. The production of a disk also requires a waiting time of 2-4 weeks, but this will certainly change in the near future.

Societal Impact

A Technological Scenario

In order to analyze possible societal effects of home information systems, basic assumptions have to be made as to the penetration of Videotex.

We will base the analysis on a "high penetration" scenario (Tydeman et al., 1982). According to this scenario, Videotex would have achieved in the year 2000 relatively widespread penetration. "It may not be in every home (in the US), but it is probably in a neighbor's home, and you might be considering getting the service yourself. It is used for all five classes of applications: information retrieval, messaging, transactions, computing, and telemonitoring. The service is paid for by information service providers, users, advertisers, and nonprofit/public organizations."

This scenario foresees widely developed digital network capabilities, easily accessed with low-cost terminals for a great variety of services. Most of the Television sets in developed countries would be interactive for both interconnect services (through telephone and cable) and for stand-alone uses (interactive videodisks). Microprocessors would have become commonplace, not only in communication technology but in scores of other home and business products as well (as security and protection devices) and much of the routine shopping and banking would be done from a home terminal.

"The office itself took on a new character, brought about by information and communication technologies. Many of the electronic innovations were integrated such that word processing, document storage, copying, and messaging were linked together. Videotex was part of this chain, as were other data resources. The electronic office now permitted greater flexibility in

location of office work: home or regional work stations are common. There is much less reliance on paper and more on electronic memos. Most office workers, including high-level executives, have a terminal on their desks.

Much more work is being done in the home. This work is primarily related to information production -- and in particular to "creative knowledge" activities -- programmers, software writers, data analysts, information brokers, journalists, authors, travel agents and so on. The office is integrated around electronic communications -- electronic meetings, text composition and editing, electronic daily appointment calendars, computer problem-solving and electronic file cabinets. Home-based, or at least decentralized, location of employees is widespread."

Societal Changes

Based on the above scenario, the major societal changes foreseen are (Tydeman et al., 1982):

- o The dwelling unit will also become a place of employment. This not only affects the type of structure, in terms of architectural layout, but also the geographic location.

- o The electronic household will facilitate a new home-based cottage industry in electronic products.

- o Home-based shopping, along with computer-aided production, will allow consumers to control the manufacturing process. Consumers will be able to order exactly what they want for "production on demand."

- o The family will determine the electronic schooling (or, more correctly, the education) required for children and for retraining adults. There will be a shift away from the traditional school and work socialization processes to ones in which peer groups and alliances are electronically determined.

o New skills and career paths associated with the management of information will emerge. these will range from information brokers who provide the "best" deal on a used car to gatekeepers who monitor politicians and corporate activities and selectively release this information to interested parties.

o There will be an increase in opportunities to participate in educational, social, and political areas as the interactive capacity of the new media allows greater involvement.

Interactions with Society

Should this view of the impact of the information revolution on society be a cause for alarm or a basis for optimism?

Are we reducing individuals to computerized and passive spectators in a media world or are we leading them towards an enriched economical and cultural environment in which each individual can develop his fields of interest via the variety of technological possibilities?

John and Magda McHale (1978) summarize some of the negative impacts:

Access to new information and communication potentials will be imbalanced for rich and poor -- individuals and countries.

Increased communication at-a-distance with greater reliance on machine interfaces could depersonalize and denature the range of interpersonal contacts.

Individuals may become stratified into divergent information communities whose ideas, needs and expectations may be in conflict."

To all that we may have to add the fear from Orwell's 1984, in which Big Brother controls all individuals' activities.

It seems that we are applying future consequences to considerations from the past. As Alvin Toffler notes, the new info-sphere both reflects and

intensifies what he calls "the third wave". The so-called "mass" quality of both form and audience is no longer applicable. We are witnessing a "de-massification" of our civilization, with an increasingly heterogenous environment and the Information Revolution adapts technology to this new type of civilization. "As the people around us grow more individualized or de-massified, we need more information to predict, even roughly, how they are going to behave towards us." (Toffler, 1980)

Looking back to the last decade, one may remark that the spread of information has contributed to an offspring of art and culture. Video and Electronic art is accompanied by the revival of painting, drawing and engraving. There is a resurgence of ethnic styles and folk cultures and even world book production has almost doubled in the past ten years.

The information revolution is based not only on technological opportunities but also on a sociological wave. The electronic newspaper as well as cable television enter into more and more homes because readers turn their interest from mass-media to what Toffler calls "de-massified media."

New communication means can and will enrich social contacts. A community interactive television system like the one experimented near Osaka, in Japan, where every viewer has a microphone and television camera on top of his TV set and can participate in the program from his home -- develops neighborhood relations and involvement in community problems.

Conclusion

Recent developments in computer and telecommunication technologies carry a great potential for future changes in our society. At the beginning of the next century we might be learning, shopping, and banking from our home and many of us might be doing most of their daily work from the home. This might bring substantial changes to actual conditions, as enabling mothers of infants or handicapped persons to continue their previous employment while they are not able to leave their home.

The "electronic cottage" might have transformative effects on family relationships as well as on social contacts. It might lead to depersonalization (arising from the fact that the counterpart is a machine) and to increased alienation. The enormous flow of information might become a threat to privacy. At the same time it provides for a broad spectrum of educational facilities and new possibilities for the development and diffusion of culture and arts.

The social impact of all those challenging technological developments will be positive if society is adequately prepared for the new opportunities as well as prepared to encounter possible threats.

It is therefore imperative to engage all our educational facilities in order to prepare our society to adapt to the new technologies and to learn how to use the new tools that we have at our disposal for the benefit of the whole society.

We ought to find ways to spread the new facilities to developing countries and enable all members of our modern society to get equal access to the use and control of the new technologies.

We have to launch a gigantesque educational campaign in order to provide the world citizens of tomorrow with the capacity to use, process and transmit information, as this will be the key resource in society.

By mastering the information technologies and making them available to a well prepared mankind, we can turn the future decades into a cause for optimism.

BIBLIOGRAPHY

- Anderla, G. (1973). Information in 1985: A Forecasting Study of Information Needs and Resources, OECD, Paris, 1973.
- Bell, D. (1976). The Coming of Post-Industrial Society, Basic Books, Inc., New York, 1976.
- Bell, D. (1982). "The Social Framework of the Information Society," in Forester (Ed.) The Microelectronics Revolution, MIT Press, Cambridge, MA, USA.
- Borrell, J. (1982). "Changes in the Landscape," ASIS Bulletin, February 1982, pp. 19-23.
- Branscomb, L. (1982), "Electronics and Computers: An Overview," Science, Vol. 215, No. 4534, February 12, 1982, pp. 755-760.
- Business Week (1981), "The Home Information Revolution," Business Week, June 29, 1981, pp. 74-83.
- Campbell, J.A., Thomas H.B. (1981), "The Videotex Marketplace," Telecommunications Policy, Vol. 5, June 1981, pp. 111-120.
- Clarke, K.E. (1980). "Home Communications: Videotex Standards," IEEE Spectrum, Vol. 17, NO. 3, March 1980, pp. 33-35.
- Cornish, E. (1981). "The Coming of an Information Society," The Futurist, Vol. XV, No. 2, April 1981, pp. 14-21.
- CSP International (1981). The Videotex Gateway: An Analysis Based on the Bildschirmtext Trials, April 1981.
- Dertouzos, M.L., Moses J. (Ed.) 1981). The Computer Age: A Twenty-Year Review, MIT Press, Cambridge, MA, USA.
- Edwards, K. (1982). "Broadcast Teletext: The Next Mass Medium?," The Futurist, Vol. XVI, No. 5, October 1982, pp. 21-24.
- Forester, T. (Ed.) (1982). The Microelectronics Revolution, MIT Press, Cambridge, MA, USA.
- Goldstein, C.M. (1982). "Optical Disk Technology and Information," Science, Vol. 215, No. 4534, February 12, 1982, pp. 862-868.
- International Videotex Teletext News (IVTN), published by Allen Communications, Inc., P.O. Box 40871, Washington, DC, USA.
- Jackson, R.N. (1980). "Home Communications: Teletext and Viewdata," IEEE Spectrum, Vol. 17, No. 3, March 1980, pp. 26-32.

- Kahn, R.D. (1983). "The Implications of Cable: More Messages from the Medium," Technology Review, Vol. 86, No. 1, January 1983, pp. 49-51.
- McHale J., McHale Cordell M. (1978). "Communications and Information: The global Context and Future Issues." In WFSF (ED.) The Future of Communication and Culture Identity. Cairo, Egypt.
- Mokhoff, N. (1980). "A Computer Center for the Homeowner," IEEE Spectrum, Vol. 17, No. 9, September 1980, pp. 73-77.
- Molitor, G.T.T. (1981). "The Information Society: the Path to Post-Industrial Growth," The Futurist, Vol. XV, No. 2, April 1981, pp. 23-30.
- Money, S.A. (1979). Teletext and Viewdata, Butterworth & Co., London, U.K.
- Neuman, R. (1981). "Putting the Communications Revolution in Perspective," in Fifth Report of MIT Research Program on Communications Policy, September 1981, pp. 2-11.
- Nilles, J. (1982). "Teleworking: Working Closer to Home," Technology Review, Vol. 85, No. 3, April 1982, pp. 56-62.
- Nora S., Minc A. (1981). The Computerization of Society, MIT Press, Cambridge, MA, USA.
- Noyce, R.N. (1977). "Microelectronics," Scientific American, Vol. 237, No. 3, September 1977, pp. 63-69.
- Pool, I. (1980). "Technology and Change in Modern Communications," Technology Review, Vol. 83, No. 2, November/December 1980, pp. 64-75.
- Porat, M. (1977). The Information Economy, U.S. Government Printing Office, 1977.
- Raz, B., Baal-Schem, J. (1979). "Future Telecommunications and Their Social Implications," in Science and Technology and the Future, Proceeding of World Future Studies Conference, Berlin, May 1979.
- Rossman, P. (1982). "The Coming Great Electronic Encyclopedia," The Futurist, Vol. XVI, No. 4, August 1982, pp. 53-57.
- Schmidt, K. (1982). "Further Development of Message Communication and Data Services," Telecommunications Journal, Vol. 49, September 1982 (Special Issue on FRG), pp. 625-627.
- Sutherland, R.A. (1982). "Home Banking," The Futurist, Vol. XVI, No. 2, April 1982, pp. 13-17.

- Thorkildsen, R., Bickel W.K., Williams, J.G. (1979). "A Microcomputer/Videodisc CAI System for the Moderately Mentally Retarded," in Harris, D. (Ed.), Proceedings of NECC 1979, June 1979, pp. 285-290.
- Toffler, A. (1980). The Third Wave, William Morrow and Co., New York.
- Trabucco, L. (1982). "Teleshopping," ASIS Bulletin, February 1982, pp. 14-17.
- Truxal, C. (1982), "Americanizing Videotex," IEEE Spectrum, Vol. 19, No. 11, November 1982, pp. 52-56.
- Tydeman, J. (1982), "Videotex: Ushering In the Electronic Household," The Futurist, Vol. XVI, No. 1, February 1982, pp. 54-61.
- Tydeman, J. et al. (1982). Teletext and Videotex in the United States. McGraw-Hill, New York, USA.
- Tydeman, J. et al. (1982a). "Videotex: An Evolving Technology," Videodisc/Videotex Vol. 2, No. 3, Summer 1982, pp. 188-205.
- Vail, H. (1980). "The Home Computer Terminal," The Futurist, Vol. XIV, No. 6, December 1980, pp. 52-58.
- VISDA, MITI, Optical Visual Information System, HI-OVIS, VISDA-MITI Juridical Foundation, Tokyo, Japan.
- Winsbury, R. (Ed.) (1981). Viewdata in Action: A Comparative Study of Prestel, McGraw-Hill, Maidenhead, Berkshire, England.
- Woolfe, R. (1980). Videotex: The New Television/Telephone Information Services, Heyden & Son, Ltd., London, U.K.