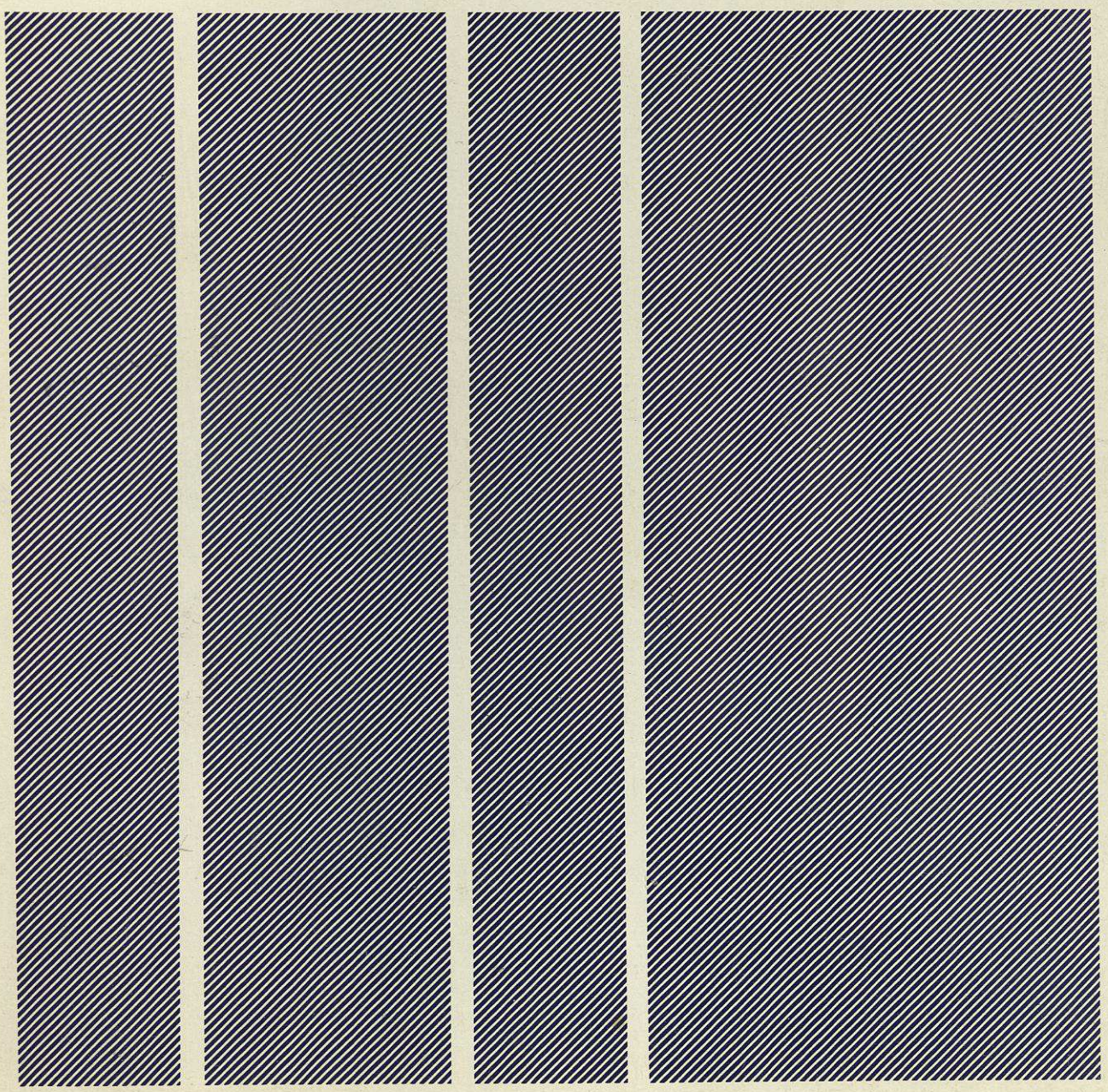
Report Series
No. 27

Developments in Videotex

March 1982



The Butler Cox Foundation

THE BUTLER COX FOUNDATION

REPORT SERIES NO. 27

DEVELOPMENTS IN VIDEOTEX

ISSUED MARCH 1982

Abstract

Videotex, or viewdata as it has been called, is a fast developing field of information technology. Major advances in the development and application of videotex technology are taking place in Europe as well as in North America and elsewhere. Videotex can be applied both to systems in the public domain and to those for private use within organisations.

The purpose of this report is to provide Foundation members with advice about the role of videotex in the context of the organisation's overall information processing strategy. The report first reviews the status of videotex both in Europe and on a worldwide basis. It then explores the potential of videotex in general, but emphasises the potential of such systems for private corporate use.

Research team

The team that researched and authored this report was:

— *Tim Chapman:* a senior consultant with Butler Cox & Partners. As a member of the Videotex Research Unit he has conducted research on videotex applications and the response from the marketplace.

— *Fred Heys:* a senior consultant with Butler Cox & Partners specialising in new product and marketing strategy studies. He has conducted studies with the Videotex Research Unit in the fields of international standards, videotex technology and private videotex systems.

— *Roger Woolfe:* Butler Cox's Director of Research and manager of the Videotex Research Unit. He led the Butler Cox multiclient studies on the potential impact of videotex in the United States and Europe, and he manages the Videotex Report Series programme.

The Butler Cox Foundation

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THE BUTLER COX FOUNDATION

BUTLER COX & PARTNERS

Butler Cox is an independent management consultancy and research organisation, specialising in the application of information technology within commerce, government and industry. The company offers a wide range of services both to suppliers and users of this technology. The Butler Cox Foundation is a service operated by Butler Cox on behalf of subscribing members.

OBJECTIVES OF THE FOUNDATION

The Butler Cox Foundation sets out to study on behalf of subscribing members the opportunities and possible threats arising from developments in the field of information systems.

New developments in technology offer exciting opportunities — and also pose certain threats — for all organisations, whether in industry, commerce or government. New types of systems, combining computers, telecommunications and automated office equipment, are becoming not only possible, but also economically feasible.

As a result, any manager who is responsible for introducing new systems is confronted with the crucial question of how best to fit these elements together in ways that are effective, practical and economic.

While the equipment is becoming cheaper, the reverse is true of people — and this applies both to the people who design systems and those who make use of them. At the same time, human considerations become even more important as people's attitudes towards their working environment change.

These developments raise new questions for the manager of the information systems function as he seeks to determine and achieve the best economic mix from this technology.

MEMBERSHIP OF THE FOUNDATION

The majority of organisations participating in the Butler Cox Foundation are large organisations seeking to exploit to the full the most recent developments in information systems technology. An important minority of the membership is formed by suppliers of the technology. The membership is international with participants from the United Kingdom, France, Sweden, Switzerland, Denmark, The Netherlands, Belgium, Italy and the United States.

THE FOUNDATION RESEARCH PROGRAMME

The research programme is planned jointly by Butler Cox and by the member organisations. Each year Butler Cox draws up a short-list of topics that reflects the Foundation's view of the important issues in information systems technology and its application. Member organisations rank the topics according to their own requirements and as a result of this process a mix of topics is determined that the members as a whole wish the research to address.

Before each research project starts there is a further opportunity for members to influence the direction of the research. A detailed description of the project defining its scope and the issues to be addressed is sent to all members for comment.

THE REPORT SERIES

The Foundation publishes six reports each year. The reports are intended to be read primarily by senior and middle managers who are concerned with the planning of information systems. They are, however, written in a style that makes them suitable to be read both by line managers and functional managers. The reports concentrate on defining key management issues and on offering advice and guidance on how and when to address those issues.

FOLLOW-UP TO THIS REPORT

The research team who prepared this report would welcome the opportunity of discussing its findings with small groups of members. If you would like to participate in such a discussion, please contact your local Foundation address shown on the back cover of this report, and let us know the points on which you would like the researchers to expand. We will then contact you to arrange a suitable date and venue.

THE BUTLER COX FOUNDATION

REPORT SERIES NO. 27

DEVELOPMENTS IN VIDEOTEX

CONTENTS

PREFACE

Videotex, or viewdata as it has been called, is a fast developing field of information technology. Major advances in the development and application of videotex technology are taking place in Europe as well as in North America and elsewhere. Videotex can be applied both to systems in the public domain and to those for private use within organisations.

The field of videotex was reviewed in Foundation Report No. 6 — Viewdata — which was published four years ago in March 1978. Videotex has progressed a long way since then, and the contents of that report no longer provide an accurate guide to the possibilities of this type of system. Four years ago videotex was little more than a curiosity. Today it could be described as a healthy infant industry — still immature, but growing quickly. A particularly striking recent development is the growth of interest in private videotex systems for corporate use. Such systems can be used both for internal communications, and as a new way of disseminating information to, and collecting information from, customers. This development alone is bringing videotex increasingly into the domains of the management services and data processing departments of companies that rely on computer systems for their day-to-day operation.

Purpose and intended readership of this report

The purpose of this report is to provide Foundation members with advice about the role of videotex in the context of the organisation's overall information processing strategy. The report first reviews the status of videotex both in Europe and on a worldwide basis. It then explores the potential of videotex in general, but emphasises in particular the potential for private corporate use.

The report is intended to be read by managers with a responsibility both for defining corporate information processing strategies, and for evaluating alternative system technologies. Typically, these managers will have a brief to improve internal corporate communications. They may also have a brief to improve communication with casual and non-professional users beyond the immediate confines of the organisation — such as branch office staff, sales people in the field, and customers at large. The report therefore should be of particular interest to managers in service companies reaching a wide market, such as telephone companies, computer and equipment suppliers, banks, retailers and publishers.

Scope and structure of the report

The report is arranged in six main chapters. Chapter 1 provides a general introduction to the subject. It describes the main characteristics of videotex, and identifies the participants in the videotex industry. It also reviews the status of public market trials, commercial services and private operation of videotex systems.

Chapter 2 describes the market for videotex. Although the emphasis in this report is on the business market, prospects in the residential marketplace also are considered in this chapter. Chapter 3 contains a review of the different configurations, components and cost elements of videotex systems.

Chapter 4 discusses videotex technology. It begins by comparing the similarities and differences of the rival coding and display schemes, and then considers the question of standards, placing videotex standards in the context of a complete network architecture for open systems interconnection. Chapter 4 also includes a discussion on the topical issue of gateway links to host processors in a videotex network. The chapter concludes with a review of the prospects for videotex network interconnection.

Chapter 5 describes (in five representative case histories) the experiences of pioneer users of private videotex systems.

Finally, chapter 6 identifies the main trends in the videotex industry. It begins with a prediction of the commercial, technological and market trends that can be expected in the next few years. The chapter concludes with a discussion of the role that videotex could take in the future in relation to an organisation's information processing strategy.

A short list of references is included at the end of the report.

CHAPTER 1

REVIEW OF WORLDWIDE VIDEOTEX DEVELOPMENTS

This chapter is for readers who require a general introduction to the subject. It begins with a description of the main characteristics of videotex, and then describes how videotex has become an international phenomenon. The next section reviews briefly the participants who are involved in the industry. The chapter continues by introducing the three main types of videotex technology — Prestel, Antiope and Telidon. Finally, the chapter reviews the status of the various market trials and commercial services in the public domain, and the status of private videotex systems.

THE CHARACTERISTICS OF VIDEOTEX

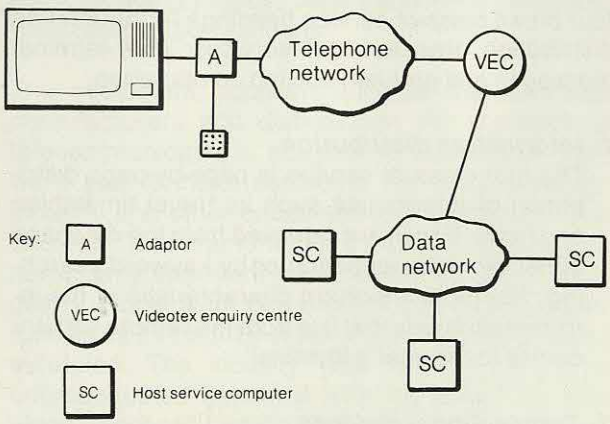
Videotex is a generic term for a type of on-line information service that is designed for use by the general public, and that is able to use adapted televisions as terminals. It is distinguished from other on-line information services by its low cost and ease of use. Nevertheless, the precise meaning of the term 'videotex' is still not defined in a way that is universally accepted. After describing the main characteristics of videotex, this section attempts to remove the confusion that surrounds the term 'videotex' (and other related terms). It also describes the various ways in which videotex can be used.

For the purposes of this report, videotex is:

- —An on-line information service that connects terminal users to remote databases and services.
- —An unsophisticated general-purpose medium that is used for information distribution, for transaction processing, for messages and for simple problem-solving computation.
- —Designed for casual use by the public both in the residential and business communities.
- —Suitable for use with inexpensively adapted monochrome or colour television terminals (although other more conventional types of display terminal may also be used).
- —Characterised by its display of static screenfuls of text and graphics. (Screenfuls may alternatively be called pages or frames, and both these terms are used in this report.) Simple animation and audio accompaniment are both possible, but at an additional cost.
- —Easy to use, because it has few operating instructions and requires no special training. Pages are often arranged in a database in the form of a tree structure, so that the information can be indexed by simple numbered menu choices. Although this is a common characteristic of videotex, it is not an essential requirement. Other access methods (such as selection by keyword) can also be used.
- —A service using two-way communication networks. The most usual network connection is via the normal analogue voice telephone line into subscribers' premises, although two-way cable is an alternative. Information is transmitted in digital form, and the transmission speed is usually fairly slow so that low-cost modems can be used.
- —Potentially a mass-market medium, but its success in the mass market depends on it being sufficiently inexpensive. With videotex, low cost and volume usage go hand-in-hand. The low-cost potential of videotex arises from the prospects of large-scale use, which in turn leads to inexpensive terminals, minimal software overheads, and minimal system cost per user.

A diagram of a typical videotex system is shown in figure 1. The figure shows an adapted television terminal and remote host computers (also called service computers) linked together through a videotex enquiry centre.

Figure 1 Videotex system diagram



Confusion of terms

Videotex is now almost universally the term used to describe the subject matter of this report, but an

alternative term is 'viewdata'. The term viewdata was popular in the 1970s, particularly in the United Kingdom where it was coined. Information services that use adapted televisions as terminals can be either one-way (broadcast) or two-way (interactive) services and, following a recommendation by the CCITT, the term videotex is sometimes used to embrace both types of service. The recommendation has not been fully adopted, however, and this has led to some confusion. Often, as in this report, the term videotex is used only for two-way services, and the generic term teletext is used for corresponding one-way services. Teletext should not be confused with the similar-sounding term teletex, which is the name of a standard for text communication.

Another term, videotext, also can cause confusion. Videotext is an unofficial term that is sometimes promoted as a generic term that embraces two-way videotex, one-way teletext, and hybrids of the two (which sometimes involve cable as the distribution medium; such a service has been called cabletext).

Although the individual features of videotex are found in existing media, they are combined in videotex in a way that creates a new medium. Videotex lies at the intersection of three previously unrelated, but now converging, industries — information technology (which itself is the result of the convergence of computers and telecommunications), video broadcasting and publishing. As yet, this phenomenon is neither well recognised nor well understood, and this helps to explain both the interest and the confusion that surround the subject of videotex.

Four broad classes of service

Because it is a general-purpose medium that connects subscribers' terminals with remote service computers, videotex can be used in a variety of ways. It is useful to classify the different uses under four broad class-of-service headings — information distribution, transactional services, inter-terminal messages and problem-solving computation.

1. *Information distribution*
   The first class of service is page-by-page distribution of information such as travel timetables and news. Pages are retrieved from the database either by menu selection or by keyword searching. The most important characteristic of the information flow is that it is from the remote enquiry centre to the user's terminal.

2. *Transactional services*
   These services consist of page-by-page data collection, for applications such as electronic shopping, reservations and the transfer of funds. For such transactions the information flow is from the user's terminal back to the enquiry centre.

3. *Inter-terminal messages*
   These are page-by-page text messages that can be transmitted from one terminal user to another. Messages may be transmitted through a mailbox at the service centre or, alternatively, they may be transmitted direct between subscribers' terminals. Direct transmission does, however, require the added expense of terminal buffers and symmetrical transmission.

4. *Problem-solving computation*
   This class of service is characterised by the processing of information, in addition to its entry, retrieval and transmission. Parameters (for example, for a tax or payroll calculation) are entered from the subscriber's terminal. The processing software may either be executed at a service computer or it may be downloaded from the enquiry centre to the subscriber's intelligent terminal. (Software for downloading in this way is called telesoftware.)

Information distribution has been the most popular class of service in early videotex systems, although the other classes of service, particularly transactional services, are now gaining ground. In chapter 2, we consider the applications that are likely to be the most successful in the future.

AN INTERNATIONAL PHENOMENON

Videotex has now become a truly international phenomenon. At first, the momentum of the videotex industry came from Europe. The early lead of Britain and France in the 1970s was soon followed by Holland and West Germany, and by 1980 virtually every country in Europe had made a commitment to the medium. But developments in North America are now also proceeding at a rapid pace. By the late summer of 1981, 16 separate videotex trials and commercial services were current or imminent in Canada, and in the United States the number of trials was closer to 40 (including teletext-only trials).

Videotex is no longer the curiosity that it was, and the rate at which the industry has grown during the past two years is particularly striking. Today, more than 20 countries are involved seriously with videotex, and there are more than 2,000 independent organisations providing services through videotex. Worldwide, there are about 50 public market trials underway or imminent. The number of on-line information pages available can be counted in the millions, and the total number of user terminals connected to the various systems is measured in tens of thousands. Videotex industry observers estimate that the amount of money committed or spent by the participants in the industry had exceeded $500 million by 1981 (reference no. 1).

Certain key events during the past twelve months have also served to lend credibility and respectability to the videotex industry. For example, IBM now supplies several videotex software products, and it has been chosen by the West German PTT as the prime equipment supplier for that country's commercial Bildschirmtext service. AT&T, in its announcement of the Bell System presentation-level protocol, has endorsed the principle of videotex. And the European PTTs, after years of arguing, have agreed to a common technical standard for videotex.

The optimism produced by these events has, however, been tempered by several set-backs. For example, most of the trial programmes have been subject to delay, and the publicly available services originating in Europe that are now operated on a commercial basis (Prestel in Britain, Viditel in Holland and Telset in Finland) have yet to achieve the expected number of subscribers. In addition, there has been continuing discord — even acrimony — on the question of standards, often motivated by political as well as technical considerations.

Although videotex is still largely a technology-driven, rather than a market-driven, product, the emphasis is beginning to change. The focus of the industry is now beginning to move more towards evaluating both the needs of users and the commercial prospects for the service participants.

THE INDUSTRY PARTICIPANTS AND THEIR MOTIVATIONS

The success of a publicly available videotex service depends on the mutual co-operation of participants from very different industries and with very different motivations. Videotex is already demanding that these formerly disparate industries should work more closely together in the future, and often the participants from these different industries make unnatural associates. The participants can be conveniently classified under the four headings of system operator, service provider, distributor and equipment supplier.

The system operators have the overall responsibility for developing and operating the services, for providing service centres, and for co-ordinating the efforts of the other participants. The system operator is usually the main source of the capital that is required to establish the videotex service. The service providers are independent organisations that maintain information databases and they use videotex to provide the services that are of interest to their users. The distributors are the telephone companies and cable operators that provide the signal transmission media, and the equipment suppliers provide the computers, software, transmission equipment and terminals.

Frequently, a single organisation may participate under several of these four headings. For example, the European PTTs commonly perform the dual roles of system operator and distributor, as do the independent telephone and cable companies in North America. (In Europe, many of the PTTs regard themselves as the natural providers of nationally available public videotex services.) The desire to use videotex to generate more traffic on existing telephone and cable equipment is an important driving force, and telecommunications companies can further that aim by undertaking the additional role of system operator.

The service providers (often referred to by the less general, and therefore less appropriate term Information Provider) represent a wide range of industry sectors, including publishing, advertising, retailing, travel, banking, education and local and central government. They are motivated by a variety of requirements, including the desire to cultivate new market opportunities, to gain first-hand experience of a new medium, to reduce operating costs, and to protect their future interests. In many countries service providers have formed their own national trade associations, which aim to help members to share their experiences, establish codes of practice, and influence the development of the videotex industry. The first such association was the Association of Viewdata Information Providers (AVIP) formed in Britain at the start of 1978. Similar associations now exist in the leading European countries, and also in Canada, the United States and Japan. An international body, called the International Videotex Information Providers Association (IVIPA) was formed in 1979; by 1981 IVIPA had members in Britain, Canada, Finland, Holland and Switzerland. Members in other countries, including France, Japan and West Germany, were being actively sought.

The equipment suppliers include the television manufacturers and distributors; the suppliers of telecommunications equipment; computer, software and terminal suppliers; the semiconductor industry and other equipment manufacturers. The television manufacturing and retailing industry is a particularly important participant, because this industry is looking for new product and market opportunities as its traditional television markets become saturated. The industry now faces a period of unprecedented upheaval with the advent of new video products, which are described briefly in chapter 2.

Market-creation strategies

Merely providing videotex will not be sufficient to ensure its widespread adoption. It will have to be

actively marketed as well, and this will be no easy task. A videotex system operator can adopt one of several different market-creation strategies, four of which we now describe.

One strategy is to concentrate on the business community, and to target selected market sectors which have specific needs. One promising sector is the retailing and distribution industry, which needs to make product, price and sales information available to its outlets. Another sector is the farming community, which needs advice on the weather, crop-spraying, feedstuffs and livestock prices. Real-estate agents, who require details about properties and prices, form another promising target sector for videotex. So do travel agents, who need up-to-date information about travel timetables and about availability of hotels and flights. They also need to make reservations. In Britain, the travel sector has responded to videotex more favourably than any other sector.

A second market-creation strategy that a system operator can adopt is to target upper-income residential users who have specific needs. For example, the owners of programmable television games and personal computers require software, and that software can be downloaded by videotex. PlayCable, a joint venture between General Instrument and Mattel Inc., has experimented with the downloading of television-game software over cable to owners of Mattel's Intellivision Home TV Game System. Later, the experiment could be extended to include a wide variety of videotex information services in addition to game software.

A common problem that confronts videotex system operators is the high price of terminals during the initial stages. A third market-creation strategy is therefore to avoid the problem by ensuring the wide availability of low-cost videotex terminals. To do this entails the speculative production of large volumes of terminal hardware. An example of this strategy may be found in Canada's Industry Investment Stimulation Program, through which the government of Canada and private industry are sharing (on a one-for-one basis) the cost of funding about 10,000 terminals. A second example can be found in the plan of the Direction Générale des Télécommunications (DGT — the telecommunications arm of the French PTT) to distribute electronic directory terminals free of charge to volunteering French telephone subscribers. The directory terminals could be used also to access the French Télétel videotex service. Such massive intervention in the market, however, can be supported only at government level.

A fourth market-creation strategy is to create a videotex service in a prescribed geographic area. This strategy will require the active participation of local service providers, such as banks and department stores. It may also require the addition of other services, such as security monitoring and remote meter reading. Local services of this type are being developed in Canada, the United States, France, West Germany and Japan. In the United States, for instance, it is now the norm rather than the exception for cable operators to offer several two-way services (including videotex) when they bid for new cable franchises.

PRESTEL, ANTIOPE AND TELIDON

The international videotex scene is characterised by rivalry between three different technologies — Prestel from Britain, Antiope from France, and Telidon from Canada. This rivalry has tended to cloud the more basic issues, such as the response of the marketplace to videotex and the prospects of commercial success for the participants. The competition between the three technologies has encouraged technical innovations, but it has also led to an instability that has deterred some prospective participants.

Each of the three rival technologies has gained a wide recognition and a wide following in its country of origin, where each has been promoted as the basis of a national videotex plan. All three have achieved a measure of success in export markets as well. We now describe briefly each of the three technologies in turn.

Britain's Prestel

Prestel technology was developed by British Telecom during the early and mid-1970s. The technology covers a coding and display specification, terminal interface standards and comprehensive system software.

The Prestel coding and display technology aims for simplicity. The character set consists of upper and lower case alphabetic characters, numbers, punctuation marks and symbols. It also includes a set of mosaic characters that are used to display simple graphics. (Prestel is called an alphamosaic videotex system for this reason.) The characters can be displayed either in monochrome, or in a range of six colours that, together with black and white, correspond to the eight basic combinations of the three primary-colour video guns in the television (called the RGB guns, for red, green and blue).

The basic Prestel display format is of fixed size, with 40 characters per row and 24 rows per frame, giving a frame capacity of 960 characters. The characters are transmitted serially to the terminal where they are stored in a frame memory. A character genera-

tor then interprets the stored information to display the characters on the screen.

British Telecom's Prestel software is written mainly in a high-level language (Babbage) which is peculiar to the GEC 4000 range of minicomputers used for Prestel. The combination of hardware and software has been designed to provide rapid frame retrieval. In addition to the basic retrieval software, the Prestel software includes a large number of administrative programs to assist with functions such as database editing, frame indexing, user identification, accounting, billing and security. Prestel software also provides network control programs that link several geographically distributed service centres (called retrieval centres) to a central master centre (called an update centre). The service centres provide local-call access to the user community.

British Telecom has promoted Prestel actively in overseas markets since the mid-1970s with the twin aims of establishing Prestel technology internationally, and of defraying some of its development expenses. By the middle of 1981, British Telecom had sold Prestel software and know-how to six overseas PTTs (those of West Germany, the Netherlands, Switzerland, Hong Kong, Austria and Italy), as well as to private companies in Belgium and the United States. Prestel technology is used, of course, in British Telecom's publicly available commercial service, which is also called Prestel (and which is described briefly on pages 9 and 10).

Several companies in the private sector in Britain and overseas have developed Prestel-compatible software products for sale in home and export markets. British Telecom has also demonstrated more advanced versions of Prestel. But, despite these successes, Prestel does not have the world market for videotex technology to itself.

France's Antiope

Antiope videotex technology was developed in the mid-1970s by French engineers working in Brittany at the Centre Commun d'Etudes de Télévision et de Télécommunications (CCETT), the joint research establishment of the telecommunications arm of the DGT and the state broadcasting authority, Télédiffusion de France (TDF).

Antiope is a coding and display technology, designed for use both with teletext and videotex systems. Like Prestel, it is an alphamosaic system, and in many ways it is very similar to Prestel. But there are differences that make the basic forms of the two technologies incompatible. The main differences between Antiope and Prestel concern the way in which characters are coded for transmission, and the way in which character attributes (such as colour) are coded. Antiope is referred to as a parallel-attribute system, whereas Prestel is a serial-attribute system.

Antiope technology lies at the heart of French teletext and videotex systems. A commercial teletext service is now available, and the DGT's public videotex system is called Télétel. A large-scale trial of Télétel began in south west Paris in the spring of 1981. Antiope technology also forms the basis of the DGT's electronic directory service. A market trial of this service began during 1981, and the DGT expects to install nearly 250,000 terminals by 1983 in an extended trial in Brittany.

Antiope-compatible videotex products have been developed in France by private organisations, notably CAP-Sogeti, Steria and Télésystèmes. These products, as well as Télétel and its derivatives, have been promoted actively in overseas markets, and they have achieved some considerable successes, particularly in the United States and South America.

Canada's Telidon

Telidon technology was developed at the publicly funded Communications Research Centre of the Department of Communications in Ottawa during the mid-1970s, and was announced officially at the end of 1978. Like Antiope, Telidon is basically a coding and display technology, but, unlike Antiope, the Canadian system makes use of the geometric display principles well known in the field of computer graphics. As a result, Telidon technology is able to display graphic images that have a higher resolution than the coarse mosaic graphics of Prestel and Antiope. (Telidon is an example of an alphageometric videotex system.)

As with Antiope, Telidon technology forms the basis of both teletext and videotex systems. Since its announcement, Telidon technology has been adopted almost universally in Canada for teletext, videotex and hybrid combinations of the two. This has been achieved despite the fact that, in Canada, there are several independent telephone and cable companies who do not have the leadership of a national PTT. Several different videotex systems employing Telidon technology have been developed in Canada by independent companies, but these developments have been co-ordinated centrally by the Department of Communications. Among these systems the most widely used is Infomart Telidon. Infomart is a wholly owned subsidiary of two Toronto-based newspaper companies (Torstar Inc. and Southam). But Bell's Vista system, which was the subject of a large-scale trial in Toronto, had the largest number of terminals connected to it at the end of 1981.

Telidon technology has also been successfully exported. In particular, it has been embraced by

AT&T, whose Bell System presentation-level protocol is based on the alphageometric principles of Telidon. Infomart Telidon has been sold in the United States and South America, and Telidon technology has been licensed by Siemens in Europe. In addition, the Swiss PTT expects to use Telidon technology as the basis of its own public videotex service.

The rivalry between Prestel, Antiope and Telidon has both stimulated and divided the videotex industry. Much international effort has been expended in attempts to reconcile the different coding and display standards, but progress towards agreeing international technical standards has been slow. (We review the principal standards issues in chapter 4.)

Figure 2 Status of videotex market trials

Country	*Service name*	*System operator*	*Location*	*Start date*	*Terminals connected*	*Comments*
France	Télétel 3V	PTT (DGT)	Velizy (SW Paris)	1981	2,500	
France	Electronic Directory System	PTT (DGT)	Ille-et-Vilaine	1982	250,000	Telephone directory service
Italy	Videotel	SIP	Rome, Padua, Bologna, Turin, Naples	1981	1,000	
Sweden	Datavision	PTT (Televerket)	Stockholm	1981	100	
Switzerland	Videotex	PTT	Geneva, Zurich	1983	2,000	
W. Germany	Bildschirmtext	PTT (Bundespost)	Berlin and Düsseldorf	1980	5,000	
Canada	Telidon	Ontario Education Communications Authority	Toronto	1980	55	Broadcast and telephone
Canada	Ida	Manitoba Tel. System/Infomart	South Headingley, Manitoba	1980	30	Coaxial cable
Canada	Elie	Manitoba Tel. System/Infomart/ DOC	Elie and St. Eustache, Manitoba	1981	150	Optical fibre cable
Canada	Mercury	New Brunswick Telephone	St. John, New Brunswick	1981	45	
Canada	Vista	Bell Canada	Toronto and Quebec City	1981	500	
Canada	AGT/Telidon	Alberta Gov. Telephones	Calgary, Alberta	1981	30	Series of mini trials
Canada	Gateway	British Columbia Telephone	Vancouver	1981	150	
Canada	Telidon 2	Telecable Videotron	Montreal	Spring 1982	250	Coaxial cable
USA	Viewtron	AT&T with Knight Ridder	Miami, Florida	1980	260	Trial completed, next phase to follow in 1983
USA	Indax	Cox Cable	San Diego	1981	50	Cable
USA	Pronto	Chemical Bank	New York	1981	200	Cable
USA	Telidon	Times Mirror Cable	Orange County	1981	200	
USA	Channel 2000	OCLC	Columbus, Ohio	1980	200	Trial completed
Brazil		Telesp	Sao Paulo	1982	1,500	Télétel technology
Venezuela		Central Office of Statistics	Caracas	1982	30	
Japan	Captain phase 2	NTT	Tokyo	1981	2,000	Phase 1 trial completed 1981
Hong Kong	Viewdata	Hong Kong Telephone	Hong Kong	1981	500	
South Africa	Beltel	PTT	Johannesburg	1982	300	

MARKET TRIALS AND COMMERCIAL SERVICES

Videotex has sometimes been called a solution searching for a need. At first sight it appears to be an attractive concept but, as yet, there is no conclusive evidence to prove that it will be accepted by the user community for which it was originally intended. Because of this, most prospective videotex system operators have preferred to conduct market research investigations rather than launch a speculative full-scale service. This section of the report reviews the status of the market trials that have been (or are now being) conducted. It then reviews the status of those market trials that have progressed to a commercial service.

Market trials

Various simple trials, such as focus group tests, have been conducted in different countries. Their purpose has been to obtain a first reaction to the concept of videotex from the public, in both residential and business sectors. In these tests, videotex has been received favourably far more often than not. Such findings have encouraged the system operators to carry out more extensive (and expensive) public market trials, which typically involve several hundred users over a period of months.

A summary of the status of the leading videotex market trials is shown in figure 2. The list of trials in the figure is incomplete, but it serves to emphasise the extent and variety of the trials that are either underway or planned. The common aim of these trials is to evaluate both the problems and benefits of a full-scale commercial service. There are, however, significant differences between the trials in terms of their detailed aims, target market sectors, technology, pricing policies, ranges of applications and services. In general, the results are providing useful answers to fundamental questions about the nature of the market for videotex (for example, the response of different sectors, information preferences, usage frequencies and willingness to pay). In addition, the trials are providing valuable information about the technology and the commercial prospects for the service participants.

Commercial services

In some instances, videotex has progressed beyond the market trial stage and has become a commercial service. Figure 3 lists the commercial services that are, at least in principle, available to the public, including three 'videotex-like' services (The Source, CompuServe's MicroNet, and the Dow Jones News Retrieval Service). In most respects these three services qualify as videotex. They are inexpensive, and they are aimed at users of personal computers that can be plugged into a television which is used as the display device. But in other respects (ease of use, for instance) it is debatable whether they can be classified as videotex.

Apart from those services identified in figure 3 as videotex-like, the largest commercial videotex service (in terms of numbers of subscribers) is undoubtedly British Telecom's Prestel. The Prestel system became a publicly available service towards the end of 1979, even though the Prestel market trial (which had commenced the previous year) was still in progress. Figure 4 shows some key statistics about the Prestel service at the end of 1981 after its first two years of public operation. The figure shows that Prestel could be accessed at local-call rates by more than 60 per cent of the telephone subscribers in Britain. At the end of 1981, 14,000 terminals were connected to the system, and the number was growing at about 500 per month. Although these numbers are substantial, they were a disappointment to British Telecom and to the other service participants

Figure 3 Commercial videotex services

Country	*Service name*	*System operator*	*Location*	*Start date*	*Terminals connected*	*Comments*
Finland	Telset	Teletieto Oy	Helsinki	1980	250	
Netherlands	Viditel	PTT	National in Holland	1981	3,000	
UK	Prestel	British Telecom	National in UK	1979	13,000	
Canada	Novatex	Teleglobe	International	1981	70	
USA	Dow Jones News Retrieval Service	Dow Jones	Users in N. America and Europe	1977	25,000	Videotex-like
USA	The Source	Readers Digest/ Telecomputing	Users in N. America and Europe	1979	12,000	Videotex-like
USA	MicroNet	CompuServe	Users in N. America and Europe	1979	12,000	Videotex-like

Figure 4 Prestel statistics at the end of 1981

Key measure	*Statistics*	*Comments*
Number of registered users	13,000	2,000 residential users and 11,000 business users.
Number of terminals in use	14,000	Some users have more than one terminal.
Service availability	Within local call reach of 62% of telephone subscribers in Britain	Service centres, called retrieval centres, located in major connurbations and connected to a central update centre.
Number of user ports and retrieval centres	1,700 at 18 retrieval centres	12 retrieval centres to be closed by December 1982, and replaced by multiplexed links preserving the local-call service availability.
Number of frames available	193,000	
Number of frame accesses per day	190,000	About 15 frame accesses per user per day.
Number of response frames (transaction frames) per day	2,000	
Average connect-time per user per day	9 minutes	
Number of service providers (called Information Providers)	692	153 registered information providers, and 539 sub-information providers, who use the services of registered 'umbrella' Information Providers.
Number of editing transactions per day	15,000	
Number of editing hours per day	200	
Number of editing ports	85	80 at 75 bit/s, 2 at 300 bit/s and 3 at 1,200 bit/s.

in that they were substantially lower than earlier projections. In 1981, British Telecom alone probably lost as much as £10 million ($20 million) on Prestel.

PRIVATE VIDEOTEX SYSTEMS

Videotex was conceived in Europe as a public service which, in principle, would be available to all subscribers able and willing to pay the price. The PTTs were the first to recognise the potential opportunities of videotex, and they set about establishing themselves as the prospective system operators of nationally available videotex services.

More recently (and particularly in Britain) the concept of private videotex systems has come into prominence. At first the term applied to videotex systems owned and operated independently of the PTTs by private-sector system operators. Private videotex systems were for the exclusive use of a privileged, closed community, such as the staff in an office, or the employees of one company, or a small group of companies sharing a common interest. Thus the Topic system, owned and operated by the London Stock Exchange for its members, is a private videotex system. Another example is the Grass Roots system in Winnipeg, which provides a service for local farmers. This system is owned and operated by Infomart in association with Manitoba Telephone System.

Today, the meaning of the term 'private videotex system' is somewhat broader. It is now possible for privately owned videotex computers to be connected into a public videotex service through links (known as gateway links) at the public enquiry centres. By the end of 1981, about 150 videotex systems falling within the scope of this broader definition were either installed or close to implementation. A representative list of some of these private videotex systems is shown in figure 5.

In the future, more privately operated videotex systems will be available to widely differing user bases. Some privately operated service computers will be available only to narrowly defined and authorised groups of users, such as the employees of a corporation. In such instances the service provider will also be the system operator. Other privately operated service computers will be available to the public, often (though not always) through gateway links from the enquiry centres of national system operators.

As these trends develop, the distinction that is apparent today between public and private videotex systems will blur in the future.

Figure 5 Private videotex systems

System operator	*Business area*	*System type*	*Software product*	*Start date*	*Primary application*
UNITED KINGDOM					
Barclays Bank (1)	Banking	I/M	Rediffusion Viewdata Plus	1981	Staff training
British Leyland (1)	Motor manufacturing	I/M	SDL IVS-3	1981	Stock distribution
Debenhams	Retailing	I/M	Computex	1981	Computex
Howson-Algraphy	Engineering	I/M I/F	Incotel Bulletin	1980 1981	Marketing information Management reports
London Stock Exchange	Stock Exchange	I/M	TOPIC (2)	1980	Stock prices
Olympia Holidays	Tour operator	I/M	SPARTA (2)	1981	Travel reservations
Talbot Motors	Motor manufacturing	I/M	Rediffusion Viewdata Plus	1981	Stock distribution
Thames TV	Television	I/M	Bulletin	1981	Programme information
Thomas Cook (1)	Tour operator	I/M	SDL IVS-3	1981	Travel reservations
Thomson Holidays (1)	Tour operator	I/T	Rediffusion Viewdata Plus	1981	Travel reservations
Whitbread	Brewing	I/M	Daisy (2)	1979	Stock control
WEST GERMANY					
Otto-Versand	Mail order	G/T	IBM/Bildschirmtext	1980	Catalogue ordering
Quelle	Mail order	G/T	IBM/Bildschirmtext	1980	Catalogue ordering
Verbraucher-bank	Banking	G/T	Aregon IVS-3	1980	Home banking
FRANCE					
Viniprix	Retailing	I/M	Steria Videopac	1981	Sales order entry
THE NETHERLANDS					
Tijl Datapress	Publishing	I/M	Bulletin	1981	Share prices
NORWAY					
Bergen Tidende	Publishing	I/M	Aregon IVS-3	1981	Subscription services
SPAIN					
Agenzia Giornalistica	News agency	G/M	Aregon IVS-3	1981	News services

Key:

1 = See also case histories in chapter 5
2 = Bespoke software
I = Independent in-house system
G = Connected through gateway facility
M = Dedicated microprocessor or minicomputer
F = Front-end processor
T = Timeshared mainframe

CHAPTER 2

THE RESIDENTIAL AND BUSINESS MARKETS FOR VIDEOTEX

The two main markets for videotex are the residential market and the business market. It is useful to consider these two markets separately, even though there is some overlap between them. This chapter first reviews the potential of the residential market by examining the benefits and problems of videotex for users at home. It then discusses videotex in the context of the other new home electronic media with which it will have to compete, and next identifies the videotex applications that home users are likely to find most beneficial. The last two sections in the chapter concentrate on the business market, respectively providing a review of videotex's potential in that market and an assessment of the business applications that are likely to be most successful.

THE RESIDENTIAL MARKET POTENTIAL

It is the prospect of widespread use in the home that has generated most interest in videotex. Indeed, without this prospect it is doubtful whether videotex could succeed. The domestic use of videotex presents a huge market opportunity — every household with a television and a telephone is a potential user. The potential residential market in Europe alone is more than one hundred million homes.

In the past there has been both scepticism and enthusiasm about the prospects for the residential use of videotex. Now, however, the climate within the industry is increasingly one of cautious optimism, and several recent market studies have predicted that videotex will penetrate between 5 per cent and 10 per cent of homes by the end of this decade.

Although predictions of market penetration in the field of consumer electronics can be notoriously misleading, we believe that it is probable that a sizeable industry is about to emerge. The two critical issues are the motivation that consumers will have to acquire videotex, and the applications that they will use it for. In this section we examine the perceived benefits and problems of videotex that will shape consumer motivation, and in the section commencing on page 15 we examine residential applications.

Benefits of videotex

The early residential users of videotex have reported the following specific benefits:

— It provided the information they wanted.

— It was quick and easy to use.

— It provided information that was up-to-date.

— It was fun to use.

— It was a source of status.

Responses like these, whilst they are gratifying, are insufficient to attract large-scale and sustained usage of videotex in the future. We believe that the three lasting benefits that consumers will seek through videotex are likely to emerge as cost saving, time saving and convenience.

Problems of videotex

As well as saying what they liked about videotex, the pioneer residential users have also identified several problems. A common complaint was that the information was too limited in scope, and insufficiently up-to-date. The typical user perceives just one or two information services as of paramount importance (sports results, for example), but these critical services vary from user to user. Moreover, users typically demand that a wide range of information should be available, even though in reality they, as individuals, may not make much use of them. But in the early days of a videotex service, when revenues are small, the range of information services inevitably remains somewhat limited, and the service providers will restrict the amount they spend on updating the information. The problem of limited, out-of-date information will not disappear until service providers are prepared to invest heavily in the medium, and they are unlikely to do that until higher revenue levels can be assured. It is a classic vicious circle.

Database searching has also been identified by the pioneer residential users as a common source of difficulty. Videotex permits users to retrieve at any one time a small amount of information from a very large database, and the standard menu-choice method of accessing information can present difficulties in locating what is required. Users either may know that an item of information is in the database, and be unable to find it; or they may not know, and be uncertain whether to persist with the search. The task that confronts the designers of database access methods is how best to strike a balance between the simplicity of menu-choice and the

sophistication of the methods used by specialised information retrieval services. In the future, a range of retrieval options will be developed to satisfy the differing needs of individuals.

The readability of the displayed text has been criticised almost universally by the pioneer residential users. Several factors contribute to the poor quality of videotex displays. The first factor is the severely constrained fonts (character shapes) and spacing of today's videotex systems. A second factor is associated with the stability, brightness and colour of the characters. These two factors are inherent in the current technology of videotex systems and terminals. Another factor concerns the layout of pages, the choice of colours, and the wording of the text and prompt instructions. These aspects are the province of the database designer, and enormous improvements to the readability of videotex pages can be gained by paying attention to 'page design' considerations such as these.

The time taken by a user to reach the desired page (the access time) can also be a source of irritation. Access time depends on the system configuration and its current loading, and there are three main causes of lengthy access times. The first is an inability to connect with the service, either because of equipment failure or because the system is overloaded. The second cause is the time taken by the user to locate the desired page. The third cause is the system response time, which determines how long it will take to retrieve a page from storage and transmit it to the terminal. All three types of access time problem can be overcome — at the price of providing higher performance hardware and software, or improved database design, or faster data communications.

To the uninitiated, videotex is sometimes perceived as somewhat demanding to operate, for two main reasons. First, as a new medium, videotex represents the unknown, and so creates inhibitions that are often unwarranted. Second, the inherent simplicity of the medium can be lost through inattention to human factors in the design of elements such as the keyboard, the database routeing structure and the layout of individual pages. All of these difficulties will be overcome in time.

The use of videotex in the home may conflict with the normal use of the television and the telephone. Such conflicts will diminish in the future as the number of multiple-television households grows, and as local telephone loops acquire the ability to transmit concurrent voice and data calls. The increasing use of cable for videotex distribution will also remove the need to involve the telephone in videotex.

Some users have complained about the lifelessness of videotex compared with normal television transmissions. They see its lack of video quality, animation and audio as being serious drawbacks. These problems will reduce in the future as graphic-display quality improves, and as audio accompaniment is introduced.

In addition, most users are concerned about the security of videotex systems. One concern is that, because information is paid for on the basis of the pages actually accessed, expensive pages may be viewed inadvertently. Another concern relates to the unauthorised use of identity numbers. With banking applications; for example, there is a very real concern that it may be possible for a third party to penetrate the system. This concern can be overcome by the use of personal identity cards, sophisticated password numbers, and data encryption. A third worry is the threat of an invasion of personal privacy because the computer records individual viewing habits. The national and international laws currently being enacted to protect privacy should alleviate this concern in time.

The perception of the magnitude of the problems that have just been described varies widely between individual users. For some users, the problems are no more than irritants. But there are two main worries about videotex that are shared by virtually all residential users, and both are critical to the medium's ultimate success. They are the perceived value of the service, and the price. Both of these issues are considered in the next section, following a brief survey of the other home electronic media that will emerge in the 1980s to compete with videotex for the consumer's disposable income and attention.

VIDEOTEX AND OTHER HOME ELECTRONIC MEDIA

It is important to consider videotex in the context of other new home electronic media for three main reasons. First, it is necessary to identify the media which will be best suited to satisfy specific demands, and hence to determine the likely uses that will be made of videotex. The second reason is to help predict how much money and time consumers will be prepared to spend on videotex, as opposed to the other new media. The third reason is to help understand how videotex will interwork with the other new media in an environment where the trend will be towards integration, rather than fragmentation, of services.

Home electronic media can be conveniently grouped under the four headings of television and home video, home information and communications, home monitoring and the modular television.

Television and home video

During the 1980s, television will continue to be the focal point for family entertainment, and also the main area of consumer spending on electronics. Although the average number of viewing hours is unlikely to increase very much, the role of television will expand and change. The trend in home video entertainment will be to a much wider choice of programming. There will be strong competition for viewing time, and for disposable income, between the different home video products and media that are described below.

Video cassette recorders will continue their rapid penetration of the consumer market in the 1980s. By the end of 1981, the installed base had risen to about 5 per cent of homes in the United States and West Germany, and to about 7 per cent of homes in Japan and Britain. The annual sales of video cassette recorders will continue to rise steeply in the western world from nine million units in 1981 (mostly from Japan) to as many as thirty million units by 1985. Video cassette recorders will be an increasingly important area of consumer spending on electronics.

Videodisc systems will be launched onto the consumer market in Europe in 1982. At first they will penetrate the market only slowly, reaching less than 1 per cent of television-owning homes in the EEC countries by 1984. Later, their popularity will grow rapidly with the availability of pre-recorded material that best exploits the advantages of the medium.

Solid-state home video cameras will also become a mass consumer item, reaching 5 per cent of homes by the mid-1980s as volume production causes unit prices to drop. Electronic cameras for taking still pictures will also become available. They will be designed to display 'snap-shots' on the television.

Direct broadcasting of television signals into the home from satellites will become widespread in Europe during the second half of this decade. This development will follow the launching of sufficiently powerful broadcasting satellites, and the availability of antennae receivers of one-metre diameter (or less) at unit prices below $150.

Pay-television distributed by cable is likely to begin in earnest in Europe by the middle 1980s, with Britain and France being the leaders. Commercial cable television already reaches more than twenty million homes in the United States, more than half of which subscribe to at least one pay-television channel.

Home information and communications

Electronic information and communications systems for the home will be another important growth industry in the 1980s. This development will be fuelled by conventional information services (such as news printing) becoming relatively more expensive, and by consumers placing a greater emphasis on convenience and time saving.

The use of teletext will grow rapidly in the 1980s. With teletext, an updateable file of information pages is continuously cycled at the broadcasting station. Owners of adapted television sets can select a page at a time from the broadcast stream, and display it on the screen for as long as desired. The teletext signals can be arranged either to slot into unused channel capacity between television frame transmissions, or to use the full bandwidth of a television channel. Teletext is ideal for distributing a limited number of topical pages of information, such as news headlines and sports results. By the mid-1980s, the extra price of providing a new television with teletext capability will be less than $50. Adaptors for existing televisions will also be available at about the same price.

Programmable television games and personal computers will converge into game-computers for use in the home. A growing proportion of these devices already contain a modem that permits the device to be connected to remote service computers that offer information databases, software, interactive services (such as shopping and banking from home), and electronic mail.

Voice messaging services will, in the future, be used by residential users through digital store-and-forward (mailbox) facilities located within telephone exchanges. For informal messages, many home users will prefer voice technology to the keyboard-based technology of videotex.

Home monitoring

Home monitoring services based on the telephone and on cable systems will grow in popularity during the 1980s. Such services will be used mainly for three types of application — remote monitoring of fire, intrusion and medical alarms; remote reading of utility meters (such as gas, electricity and water); and to enable power utilities to manage remotely the consumption of energy, and so smooth out the peaks in the power-generation load.

Home monitoring services using two-way cable will grow in popularity. This will stimulate investment in two-way cable systems, which, in turn, will encourage the development of cable videotex.

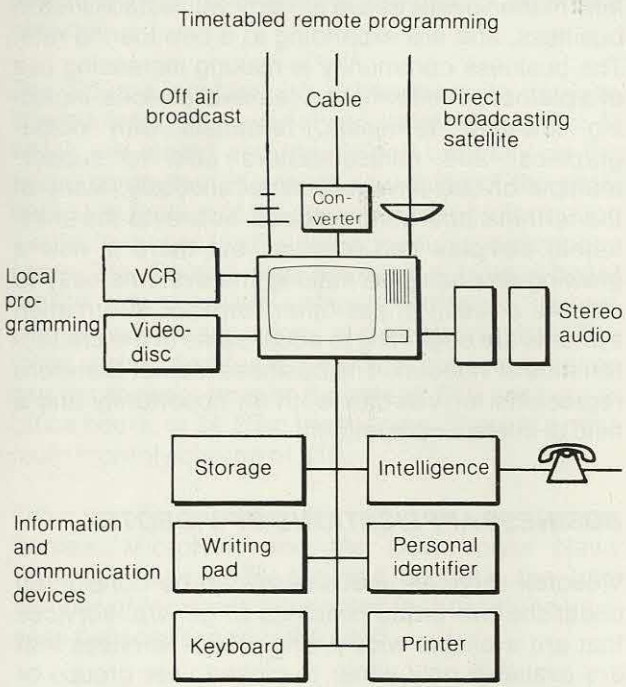
The modular television

Many people have proposed that a range of television-based entertainment, information and com-

munications devices should be brought together in a single unit known as the integrated home terminal. In this proposal, the television becomes the basis of a multifunction terminal, to which a variety of components can be attached. One obvious advantage of such a unit is that it should be possible to achieve economies through the sharing of components.

As yet, it is by no means certain that there is (or will be) a demand for such a terminal. A more plausible alternative is a modular television, in which compact components with standard interfaces can be brought together in a way that is similar to today's racked hi-fi systems. With this alternative, customers purchase only the components they want, and they can extend the system at their leisure. Figure 6 illustrates the range of components that might be included in a modular television system.

Figure 6 The modular multi-purpose television



(Source: Butler Cox Videotex Report Series No. 10, "The Future of Videotex".)

RESIDENTIAL APPLICATIONS OF VIDEOTEX

Videotex will compete for discretionary income and attention with the other new electronic media that have just been described. To succeed, videotex must therefore be desirable and attractively priced. Above all, the services available through videotex must be perceived as beneficial. As with conventional television, the equipment and service capabilities will not be purchased for what they are, but for what they can deliver. In this section we identify the residential applications of videotex that are likely to be successful, and we predict the price levels that residential users will be prepared to pay for videotex.

Successful residential applications

Videotex should obviously cater for the paramount needs of individual users. Nevertheless, few consumers will be able to justify videotex on the basis of just one, or a few applications, and videotex will therefore need to provide a wide range of applications. The most successful applications will be those that offer the benefits of convenience, cost savings and time savings compared with other media. These applications will not be restricted to the provision of information. Transactional uses will also be important, where information has first to be sought, and then acted upon. Three examples of transactional uses of videotex are:

—Comparing prices and then placing an order.

—Checking seat availability and then making a reservation.

—Checking a bank balance and then authorising a transfer of funds.

Videotex will be most successful in applications that combine information-seeking with a follow-up action that depends on the information retrieved. Shopping and banking from home are both examples of this type. Shopping from home through videotex (sometimes called teleshopping) will become important as users come to appreciate the benefits of convenience, cost saving and time saving that it provides.

Banking from home will also become an important videotex activity, although it is likely to follow, rather than precede, shopping-from-home applications because of the security implications. Banking from home will be promoted by the banks (because it will save them money) and it will be welcomed by users, who will appreciate the convenience.

Advertising through videotex will also become important. Indeed, advertising revenue may prove to be vital to the economic viability of videotex. Videotex provides advertisers with a built-in direct-selling link, and built-in feedback, both of which are strong incentives for advertisers to make use of the videotex medium.

Information retrieval will, however, remain an important use of videotex. The type of information that is most appropriate for videotex distribution has three main characteristics:

—It is concise rather than voluminous, to match the constraints imposed by the videotex page.

—It is volatile rather than static, to exploit the

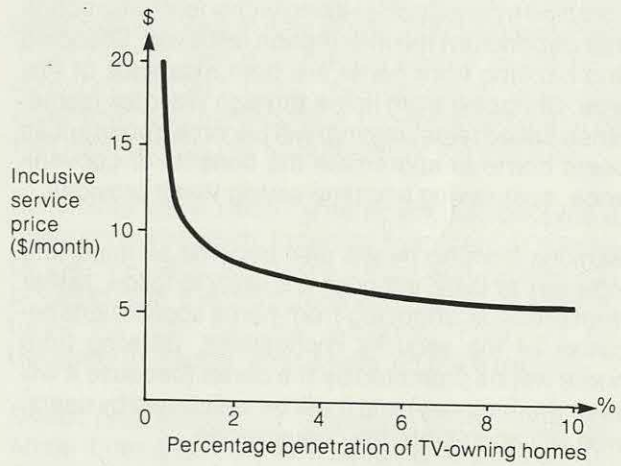
advantage of immediacy that videotex has over printed material.

— It is not general or topical in the way that news headlines are. Teletext is a more appropriate medium for distributing this type of information.

Price levels that users will pay for videotex

There is still little firm evidence to help predict the price levels that consumers might be prepared to pay for videotex when the service becomes widespread and when the applications available match those most in demand. Nevertheless, research findings indicate that the relationship between price and demand will be something like that shown in figure 7. The figure shows that a small proportion of householders (less than a half per cent) might be prepared to pay as much as $20 per month for videotex. But at mass-market levels (equivalent to a household penetration of around 10 per cent) the average monthly price that consumers might be expected to pay is shown in the figure to be around $6 per month. The monthly price shown is fully inclusive of terminal costs, communication charges, and all subscription and access fees.

Figure 7 Consumer price/demand relationship for videotex



(Source: Butler Cox Videotex Report Series No. 10, "The Future of Videotex".)

A fundamental issue in assessing the commercial prospects of videotex is whether a service can be provided economically at the price levels shown in figure 7. Before addressing this issue, it is first necessary to analyse the costs of supplying a videotex service. The economics of service supply and demand is discussed in the next chapter, on page 24.

BUSINESS MARKET POTENTIAL

Business users of videotex are distinguished from their residential counterparts by the fact that their terminals are located in their office or workplace, rather than at home. Business videotex terminals are normally provided by the organisation, and are not paid for by the individuals using them.

The potential of videotex in business is probably recognised more widely now than it was a year or two ago. Most of the market trials listed earlier in figure 2 involve business users as well as domestic consumers, and more than three-quarters of all the subscribers to commercial videotex services are business users. Within the videotex industry (and particularly in Europe) it is now commonly accepted that the business market will prove to be the lead-in market for videotex. Compared with the residential marketplace, the business market has a more clearly defined need for information. Also, business people value information more highly than consumers do, and so are less sensitive to the price they have to pay for it.

On the other hand, other forms of electronic information systems are already well established in business, and are expanding at a bewildering rate. The business community is making increasing use of a plethora of information retrieval devices, including low-cost terminals, terminals with colour graphics, and minicomputers able to support multiple on-line terminals simultaneously. Many of the terminal operating procedures are (to the uninitiated) complex and obscure, but there is now a growing emphasis on making the systems easy to use. As a result, these other forms of information systems are beginning to adopt some of the characteristics of videotex. The business market therefore represents for videotex both an opportunity and a field of intense competition.

BUSINESS APPLICATIONS OF VIDEOTEX

Videotex services in business can be considered under the two broad headings of general services that are available widely, and private services that are available only either to closed user groups or within an individual organisation.

General business services

A variety of general business information services can be provided by videotex, including:

— Company information such as news, performance and stock prices.

— Rates of currency exchange.

— Demographic, statistical and market information.

— Traffic and freight data.

— National and international standards and regulations.

—Communication rates.

—Employment and tax legislation.

—Trade association news.

—Timetables and travel reservations.

—Electronic messages.

—Distribution of software for intelligent terminals and personal computers.

A good example of a general-purpose business videotex service is The Source, which is an on-line database service and information utility that first became publicly available in 1979. Because of its low cost, and the fact that it can be used by subscribers with a personal computer that uses a television as the display device, The Source qualifies as a videotex-like service (as mentioned on page 9). The Source is based on Prime computers located in McLean, Virginia, and is distributed to subscribers in the United States and overseas through the Telenet packet-switching service and the dial-up telephone network.

The Source enables its subscribers to retrieve information from a variety of databases, most of which are stored and maintained centrally on the Prime computers. Keyword searching of the databases is a feature of the system, and the information available ranges from airline schedules to company news. The Source also provides a bulletin-board facility, downloadable computer software, a shopping service, reservations and electronic mail. The initial registration fee is $100, and subscribers then pay for connect time at the rate of $15 per hour in office hours, or $4.25 in the evening. There is a minimum monthly charge of $10.

Other similar videotex-like services are CompuServe's MicroNet, and the Dow Jones News Retrieval Service. By the end of 1981, the total number of terminals connected to these three business services exceeded 40,000.

General business services of the type offered by The Source are attractive and useful, but they are probably insufficient on their own to create widespread business acceptance of videotex. This acceptance will depend also on the kind of catalytic application that can be provided for closed user groups and for private organisations, and which we now describe.

Private services

There is a huge potential in business both for distributing information and for collecting data from its source by using low-cost terminals that are operated only intermittently by unskilled operators. The key characteristic of such operations is that the data is relevant to a specific group of users (a closed user group) or to a private organisation. For many organisations, a private videotex system may be the means of fulfilling that potential. Private videotex systems can be used, for example, for the distribution of internal management information, for internal training programmes and for communication between managers and employees. The potential is illustrated by the many applications that fall in the third of those categories, including newsletters, organisation charts, company financial performance, diaries of events, product prices, targets and achievements, client information, and so forth.

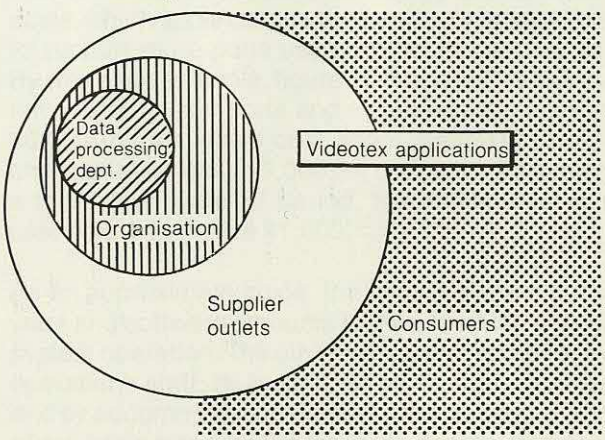
Another way in which private videotex systems can be used — and probably the most significant of all — is for communication between suppliers and customers. Figure 8 illustrates how videotex may be used to extend conventional data processing systems beyond their existing boundaries in order to embrace distributors, agents and retailers at the customer interface. In practice, this extension can be achieved by attaching the videotex terminals either to a mainframe computer that is running videotex software, or to a minicomputer that may be dedicated to videotex (or may front-end the mainframe computer). These alternative configurations are described in more detail in chapter 3 (on page 19).

By taking account of the nature and limitations of videotex, it is possible to list the broad characteristics of videotex applications that are suited to closed user groups and to private organisations (see reference no. 2). Such applications have the following characteristics in common:

—Information retrieval is a prominent requirement.

—Two-way communication (for order entry, for example) is also required.

Figure 8 Extension of conventional data processing through videotex



(Source: IBM (UK) Ltd.)

—Casual and intermittent use is required rather than intensive use. The system therefore must be easy to use, and should not require the users to undergo any special training.

—The information in the database is of interest to a wide audience.

—Videotex applications are seen as an extension to an existing computer system.

—The users are geographically dispersed.

—The chosen application justifies the use of videotex.

These characteristics can be found in applications in a wide range of industries, although some industry sectors (such as retailing, agriculture, medicine, and travel) have particularly suitable applications. The five case histories described in chapter 5 are typical of private videotex applications in these industry sectors, and they illustrate the seven characteristics listed above. Before considering these case histories, it is helpful to examine the economics and technology of videotex in more detail. We do this in chapter 3, which is about videotex system components and costs, and in chapter 4, which is about technology, standards and networking.

CHAPTER 3

VIDEOTEX SYSTEM COMPONENTS AND COSTS

In this chapter the main components of a videotex system are discussed under four section headings — system hardware and software, database maintenance, terminals, and communications. In the fifth and last section, the separate components are brought together in a discussion of the economics of service supply and demand.

SYSTEM HARDWARE AND SOFTWARE

Although the videotex industry is relatively new, a wide range of proprietary videotex system products (both hardware and software) is already available, and these products are competing in what is today a narrow market. This section first gives an overview of alternative videotex system configurations. It then provides a summary of the proprietary software products that are available and, finally, it sets out a brief analysis of the total hardware and software costs of a videotex system.

Alternative system configurations

There are three main ways of configuring a videotex system:

- —The system can be based on a dedicated microcomputer or minicomputer that is designed to operate independently of other computer systems. The important characteristic of this configuration is that the information database is an integral component of the system.
- —The system can be based on a front-end processor to a conventional mainframe computer. In this configuration, the information database is maintained on the mainframe computer. The front-end processor responds to terminal requests for individual information pages by accessing the appropriate database records and reformatting them for transmission back to the terminals.
- —The system can be based on a time-shared application program that is run on a mainframe computer.

Proprietary software products

The range of proprietary videotex software products is already extensive, and a comprehensive list of those available is given in figure 9 overleaf.

The specifications of the different products vary widely, particularly in terms of the number of simultaneous users that can be supported and of the size of the database that can be accommodated. Even so, there are some common features. All the products listed in figure 9 can, for example, handle data coded in accordance with one or more videotex display standards. They all allow users to retrieve information pages either by selecting from displayed menus, or by specifying the required page numbers. They all provide a basic level of security against unauthorised access, and they have facilities for logging user enquiries and for database editing. Nevertheless, there are also some extensive differences in the features offered. Some systems provide keyword searching, for example, some provide mailbox services, and some support communication with other computer systems.

System costs

It is useful to evaluate the hardware and software costs of a videotex system in terms of the cost per user port. But such an evaluation should be treated with caution: the total cost will clearly be affected also by other factors (the size of the database, for example, and the nature of the features provided). Nevertheless, it is possible to produce general guidelines of the type shown in figure 10 (on page 21). The figure shows how the purchase price for a videotex system based on a dedicated minicomputer varies with the number of user ports. The curves indicate that, for a given database capacity, the cost per port falls as the number of ports increases. This fall in cost is caused by economies of scale, which apply despite the fact that systems able to support more ports usually offer more features. By way of an example, figure 10 indicates that a system with 100 user ports and a database capacity of 40,000 frames would cost about $300,000 to purchase (that is, about $3,000 per user port). Assuming a three-year write-off period, the annual cost per user port is therefore $1,000.

As an approximate guide, the cost of system hardware and software amounts to about half the cost of system operation. The other half is accounted for by operations staff, by maintenance, by consumables and by accommodation costs. The total annual cost of providing a port is thus twice the depreciated cost of hardware and software (that is $2,000 per year in the above example). This amount excludes the cost

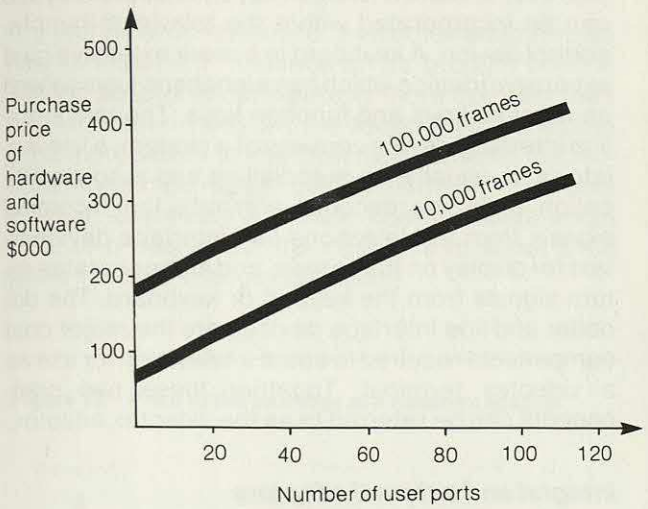
Figure 9 Proprietary videotex system products

Supplier	*Name of software product*	*Configuration class*	*Type of hardware*	*Maximum number of simultaneous users*	*Approximate cost $000*	*Remarks*
Aregon International and Systems Designers Ltd. (SDL)	IVS-3	a	DEC PDP-11 VAX	250	60-400	Aregon sells outside UK, SDL within UK
AU-System (Sweden)	Datavision	a	DG Nova/Eclipse	200	100-900	Marketed in UK by Butel
British Telecom	Prestel	a	GEC 406X/408X	200 +	1,000	Mostly sold for public services
CAP-Sogeti France	Multitel	n/k	Honeywell Level 6	n/k	n/k	
Computer Automation	Syfatel	n/k	CA Syfa	24	14	
Computex Systems Ltd.	Computex	a, b, c	DEC PDP-11 Systime	32	70 +	
GEC Viewdata Systems Ltd.	Viewdata 4000	a	GEC 408X	100	100-500	
ICL	Bulletin	a, b	ICL ME 29 ICL 29XX	n/k	100-200	
IBM	VTF + VTM	b	370/3705			Front-end only
IBM	SVS/1	a, b	Series 1	24	64-140	
Incoterm	Incotel	a	Incoterm 20/20	35	35-70	
Infomart	Telidon	a	DEC PDP-11	n/k	n/k	
Mars Group Services	PVS 990	a	Texas Instruments DS 990	n/k	16	
Metrotech	Metrotel	a	VMZ or Z2H	8	14-20	
Modcomp	Viewmax	a	Modcomp Classic 78XX	256 +	70-500	French version available
Nova (Netherlands)	Viewdata Flush 3000	a	HP 3000	n/k	25	
Oy Softplan (Finland)	Mistel	a	DEC PDP-11 or VAX or Honeywell Level 6	100 +	40-300 +	Also sold in UK by AVS Intext
Radio Rentals Contracting	Thorntel	c	ICL 1900/2900	n/k	n/k	On trial only
Rediffusion Computers	Viewdata Plus	b	Rediffusion R1800/30 or R1800/50	64	60-200	
Siemens (W. Germany)	Telidon	a	n/k	n/k	n/k	
Steria (France)	Videopac	a, b	Honeywell Level 6	100	n/k	Range of products
Technologics	TECS T7	a	6809 micro	32	100	
Télésystèmes (France)	TS'L XXX	a, b				
Univac	n/k	a	Univac V77	16 +	28 +	Marketing policy unclear

Notes: n/k = not known

Configuration classes: a = dedicated micro or minicomputer
b = front-end processor
c = shared mainframe

Figure 10 Videotex system purchase cost



of maintaining information on the database, and it excludes the cost of terminals and of communications. These last three cost elements are discussed in the following three sections.

DATABASE MAINTENANCE

The cost of creating and maintaining a database for a videotex system varies widely, and will depend to a large extent on whether or not the database is already in existence.

Database already in existence

A company maintaining a database for another purpose may want to make it available through a videotex service. The usual method of transferring the database is to have a computer program rearrange the database records into formatted and indexed videotex pages. Such a program may be provided as part of a proprietary videotex system product, as it normally is with mainframe system configurations. On the other hand, the program may be a separate product, as it usually is when the videotex system is configured on dedicated minicomputers. The most widely used proprietary software product for rearranging existing database records into a videotex page format is the Preview package, available from Langton Information Systems (see reference no. 3).

The Preview package was designed originally to convert existing computer files into the Prestel database format. According to Langton, Preview has been used widely for this purpose in Britain, and also in continental Europe (notably in Holland and West Germany) and in North America. Today, Preview can be used on IBM and other popular computers, and it can format files for videotex systems compatible with Antiope and Telidon as well as for Prestel.

Users of Preview define a series of parameters that specify the precise format of the input and output files. Another set of parameters defines the tree-structured hierarchical relationships between the videotex records that are generated, the indexing links, the frame numbers, and additional information such as frame prices.

Figure 11 Annual cost of frame maintenance

Type of change	*$ cost per frame change*	*$ annual cost of maintenance for different change frequencies*			
		Daily change	*Weekly change*	*Monthly change*	*Yearly change*
Minimal change	0.75	190	40	9	0.75
Small change	1.5	375	75	18	1.5
Significant change	3	750	150	36	3
Complete change (limited graphics)	15	3,750	750	180	15
Complete change (extensive graphics)	50	12,500	2,500	600	50

The shaded area denotes the most likely combination of type of change and change frequency.

(Source: Butler Cox Videotex Report Series No. 3, "The Economic Realities of Videotex".)

A licence to use the Preview package costs about $25,000. Alternatively, the package can be used on a bureau basis at a charge of approximately ten to twenty cents for each videotex frame prepared.

Databases created specially

Some businesses can make use of existing databases for videotex services, but others have chosen to create and maintain new databases for videotex. The advantage of special databases is that they can be tailored precisely to the needs of the market; the disadvantage is that they are expensive. Experienced service providers have found that a typical annual cost of maintaining a videotex information frame is between $50 and $200. This cost includes all the charges (labour, equipment and overheads) for collecting the data, creating the copy, designing the frame, entering the data, proof reading the entry and documenting it. Figure 11 on the previous page shows the annual cost of maintaining different types of frames at different change frequencies. The figure indicates that the wide range of annual costs is caused primarily by differences in frame complexity and in the frequency of frame updates.

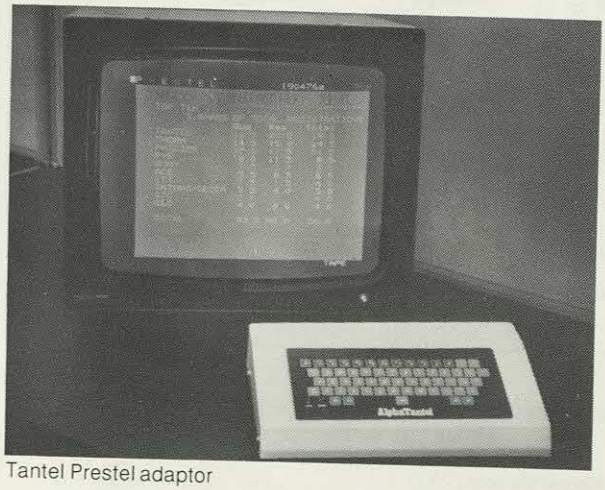
TERMINALS

Videotex has been designed to use adapted domestic televisions as terminals, but that does not preclude the use of other types of terminal. In this section we discuss the technology and the costs of terminals based on adapted televisions, and on other terminal designs.

Adapted television terminals

Adapting a television for use as a videotex terminal requires the addition of three main components — a keypad or keyboard, a device for interfacing with the telephone line, and a decoder. In its simplest form the keypad is like an electronic calculator, with ten digit keys and a few function keys. A videotex keypad can be incorporated within the television remote-control device. A keyboard is a more extensive (and expensive) device which has alphabetic keys as well as numeric keys and function keys. The telephone line interface device consists of a modem, a line isolator and, usually, an autodialling and auto-identification unit. The decoder converts the incoming signals from the telephone line interface device to text for display on the screen, and also generates return signals from the keypad or keyboard. The decoder and line interface devices are the major cost components required to adapt a television for use as a videotex terminal. Together these two components can be referred to as the videotex adaptor.

Figure 12 Television fitted with external adaptor



Tantel Prestel adaptor

Integral and external adaptors

A videotex adaptor can be located either inside or outside the television.

Integral adaptors are built into the electronics of the television, and the output from the decoder can be used to drive directly the television video guns (the RGB guns). With such adaptors, videotex displays can benefit from the full quality of the television CRT in terms of colour and clarity. The disadvantages of integral adaptors are that they cannot be fitted to existing televisions, and the sales costs are high.

External adaptors (or set-top adaptors) are fitted outside the television, as illustrated in figure 12. External adaptors are usually plugged into the television antenna socket, except in France, where modern televisions are fitted with a special socket (called a SCART socket) which is wired directly to the RGB guns. It is an easy matter to fit an external adaptor, and the sales costs are lower than for integral adaptors. However, external adaptors cost more to produce than their internal counterparts, because they require additional components such as a power supply, a radio-frequency generator and a case. A further disadvantage with most external adaptors is that the signal produced by the adaptor enters the television as a radio frequency signal through the antenna socket. The antenna socket imposes bandwidth limitations on the adaptor signal, which in turn limits the number of character positions that can be displayed on a row without loss of colour saturation.

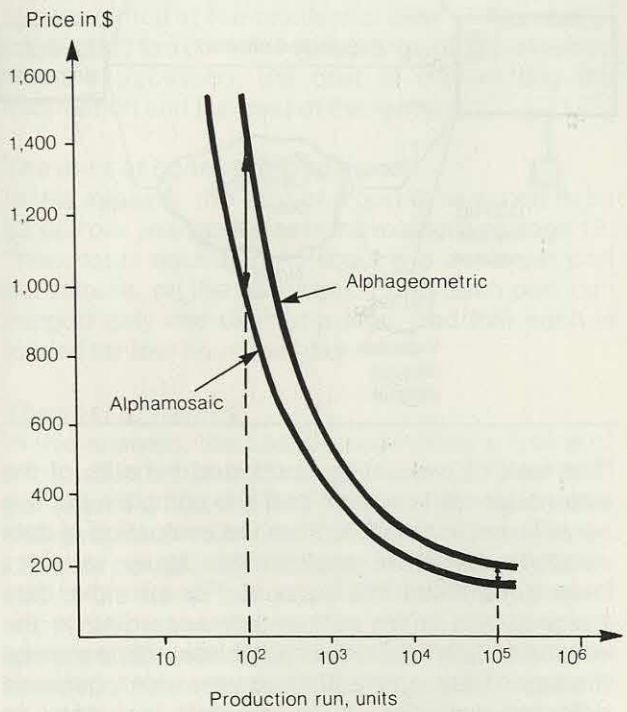
Cost of an adaptor

The manufacturing cost of an adaptor, in common with other electronic equipment, is highly dependent on production volume. For example, it has been estimated that the production cost of a simple alpha-mosaic adaptor, built in quantities of tens or hun-

dreds, is about $560, but that the same adaptor, when built in quantities of hundreds of thousands, costs only about $115 (see reference no. 4).

The technical complexity of a videotex adaptor also has an important influence on its product cost. A Telidon adaptor is considerably more complex than one for Prestel, because the decoder contains both a microprocessor to interpret the geometric instructions, and a much larger display memory. When built in small quantities, a Telidon adaptor costs about $770 to produce, but the cost falls to about $135 when it is built in large quantities.

Figure 13 Price to the end user of a videotex adaptor



The arrowed lines on the figure show that the price difference between alphamosaic and alphageometric adaptors is considerably smaller at large production quantities than it is at smaller production quantities.

The price of a videotex adaptor is inflated before it reaches the end user by sales and distribution costs, and by profit margins. These extra costs can vary widely depending on circumstances and quantities but, in general, they are greater for integral adaptors than for external adaptors. Nevertheless, the end-user prices of both types of adaptors are not significantly different, because the lower sales costs associated with external adaptors just about compensate for their higher production cost. The end-user price of a typical videotex adaptor is shown in figure 13. The price curves in the figure are for two types of videotex technology — alphamosaic and alphageometric. The curves are only approximate, but they illustrate clearly that adaptors become cheaper as production quantities increase. They also illustrate that alphamosaic technology is cheaper than alphageometric technology, but that the difference is not large when the adaptors are produced in quantities of tens of thousands or more.

Other terminals

In addition to the adapted domestic television, several other types of terminal can be used as a videotex display device. We now discuss five of these.

Purpose-designed terminals

Purpose-designed videotex terminals do not use a conventional television as the display device. They are designed to be used in a specific working environment, such as on the top of a desk or on the kitchen counter. The Antiope-compatible French electronic directory terminals are probably the best-known of these purpose-designed videotex terminals. (A typical electronic directory terminal is illustrated in figure 14.) The electronic directory terminals have small monochrome screens (typically between 15cm and 20cm diagonal) and full alphanumeric keyboards, and do not contain a television tuner. Designs from CIT Alcatel and Matra have been ordered in quantities of hundreds of thousands. Built in such large quantities, these purpose-designed terminals can have an ex-factory price as low as $150 to $200 each. (The price to the end user is, of course, higher than the ex-factory price.)

Figure 14 Purpose-designed electronic directory terminal

Videotex terminal designed by Radiotechnique and TRT for use with the French electronic directory system.

Combined telephone and videotex terminals

Some videotex terminals incorporate a conventional telephone instrument as well. These terminals save

both space and costs, because they are able to share components that would normally be present in both the telephone and the terminal. Plessey, GEC and Thomson-CSF have models in this category that are available to end users at prices in the range $400 to $700, depending on their features and quantities. The Plessey Vutel is illustrated in figure 15.

Figure 15 Plessey Vutel terminal

Personal computers

Some personal computers already provide an optional device that enables them to be linked to a videotex system, and the number offering this feature will increase in the future. Prestel and Telidon-compatible options are available for Apple computers, for example, and Tandy and Commodore computers also have videotex options.

Multi-standard terminals

Some terminals have the ability to work in different modes. The Belgian company Barco builds terminals that can function either as conventional data processing terminals or as videotex terminals, for instance, and Prestel-compatible versions of Wordplex word processor terminals are also available. The range of dual-function and multi-function terminals will increase in the future.

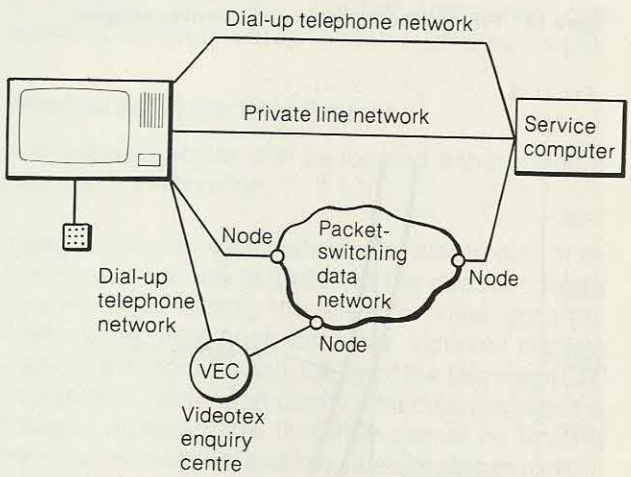
Editing terminals

Videotex editing terminals have alphanumeric keyboards designed for intensive use, and their range of functions (often similar to word processing functions) is designed to help editors create and maintain videotex frames and indexing structures. These terminals can also include features (such as graphic input tablets and photo-digitising devices) to ease the preparation of graphic designs for videotex. Many editing terminals have their own processor and their own disc storage units, so that they can be used as a stand-alone system. Indeed, there is little to distinguish a multi-terminal editing system from a small-scale dedicated videotex system.

COMMUNICATIONS

Videotex terminals are usually connected at the subscribers' premises to the dial-up voice telephone network, but there are several possible transmission paths to the service computer, as figure 16 illustrates. The path may be through the public dial-up telephone network, it may make use of private circuits, it may use a public data network, or it may pass through a gateway at the local enquiry centre. The transmission path may use a combination of these various alternatives.

Figure 16 Alternative communication paths between terminal and service computer



The task of evaluating costs and benefits of the alternative transmission paths is complex, but it is no different in principle from the evaluation of data networks for other applications. Many variables have to be taken into account. For example, data transmission tariffs vary widely according to the volume of data traffic, the transmission distance and the time of day, and tariffs also vary widely between different countries. It is therefore not easy to generalise about the cost advantages and disadvantages of the various methods of communicating between videotex terminals and service computers. One aspect of a comparative evaluation that is particularly pertinent at present, however, is the question of how a terminal connection through a gateway at a service centre compares with a direct connection to a service computer. This question is considered in chapter 4. (Reference no. 5 contains some cost comparisons for different methods of communications — including gateway in the case of Prestel.)

ECONOMICS OF SERVICE SUPPLY AND DEMAND

The earlier sections in this chapter have described the main components of a videotex system, and

commented on their costs. This section is concerned with the overall cost of providing a service to users.

As with conventional computer systems, it is difficult to generalise about costs, while a detailed analysis would be out of place in this report. Accordingly, we now provide a much-simplified analysis which illustrates the overall costs. The analysis is based on a large-scale videotex system aimed at the residential marketplace. This choice is pertinent, because it helps to throw some light on the question raised in chapter 1 of whether such a service can be supplied economically at prices that the market might be prepared to pay

Service cost components

There are four main cost components of a videotex service aimed at the residential user — the cost of connecting to a port, the cost of providing the frames that are accessed, the cost of transmitting the information and the cost of the terminal.

The cost of connecting to a port

In this analysis, the cost of a port is assumed to be $2,000 per year, as it was in the example on page 19. This cost is equivalent to about two cents per port per minute, on the assumption that each port can support only one user at a time, and that each is loaded for four hours per day.

The cost of frames

In this analysis, the cost of maintaining a frame of information on the database is assumed to be $100 per year. To recover that cost from frame access charges, the service provider would have to charge one cent per access, assuming ten thousand accesses to the frame per year. Whether ten thousand accesses per year is a realistic estimate depends on factors such as the size of the user population, the number of frames in the database and the popularity of individual frames. Assuming that each user accesses forty frames per week, and that there are one hundred thousand frames in the database, then a population of about half a million users is required to generate an average of ten thousand accesses per frame in a year.

The cost of transmission

In this analysis, the cost of transmitting data between the service computer and the user's terminal is assumed to be two cents per minute, which is about the same as the average local call charge rate in Britain at off-peak times of the day.

The cost of the terminal

In this analysis, the user is assumed to have purchased an external adaptor for a television at a cost of $250. The equivalent depreciated annual cost is about $70. Assuming that the television is used in videotex mode for about twenty minutes per week, the cost per minute works out at about six cents.

Overall service cost

The four service cost components identified above add up to 14 cents per minute (2 cents for port connection, 4 cents for frame accesses, 2 cents for transmission and 6 cents for the terminal). It is reasonable to assume that the average residential user will connect with a videotex service for about twenty minutes per week. Twenty minutes per week at 14 cents per minute is $2.80, or about $12 per month.

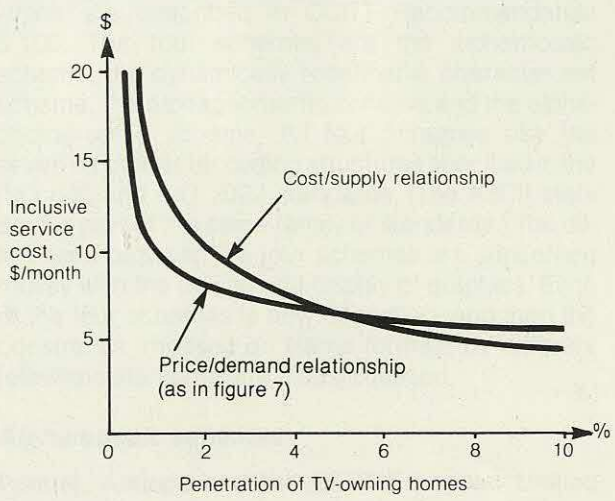
This cost of $12 per month is more than the average residential user can be expected to spend on a simple videotex information retrieval service. The point is not that this is an unaffordable cost — ten million cable television subscribers in the United States are already paying $20 per month for a basic cable service and a single pay-television channel. Rather, for the average residential user, $12 per month is likely to exceed the perceived value of a videotex service.

This analysis highlights two important findings:

— The residential community on its own will not be prepared to pay the full recovery cost of a videotex service that simply offers information retrieval services.

— A proportion of the total costs will have to be borne by business users. Alternatively, and in many cases additionally, the service providers will have to support the costs of residential videotex. This can be done through advertising on videotex, and through cost displacement services such as shopping from home and banking from home. Simple information retrieval services

Figure 17 Videotex supply and demand



on videotex that are supported by direct subscriber payment will be viable only when they are offered as additional services at marginal cost.

The foregoing analysis can be modified to include the assumption that business users and service providers bear part of the cost. As a result, the service cost to a residential user would drop significantly. Indeed, it can be shown that, beyond a critical mass of users, the cost of providing a videotex service should fall below the price that the users might reasonably be expected to pay. This is a particularly important point because it demonstrates that, ultimately, there is a sound commercial basis for large-scale videotex.

Figure 17 brings together videotex cost/supply and price/demand relationships. It shows that, to be economically viable in the residential market, videotex will require large numbers of users. To achieve these large numbers will require large financial investments by the participants, however.

CHAPTER 4

STANDARDS, NETWORK ARCHITECTURES AND INTERWORKING

This chapter begins with a section that describes the four main schemes for videotex coding and display, and continues by placing these four schemes in the context of a full network architecture for videotex. The following section examines in more detail one such network configuration where distributed service computers are connected to a videotex network by gateway links. The next section then considers the advantages and disadvantages of connecting distributed service computers to a videotex network by direct links or by gateway links, and the final section examines the prospects for interconnecting videotex networks with other types of networks.

CODING AND DISPLAY STANDARDS

Many videotex industry participants and observers have suggested that several important advantages would result if a common world videotex standard could be agreed. In particular, they have suggested that:

- —Large production volumes would lead to lower prices, because of the economies of scale.
- —Service providers would have an international market.
- —Subscribers would have access to worldwide services.
- —The growth potential of the industry would be greater.

The prospect of these benefits has prompted a considerable international effort in recent years to define a worldwide videotex standard. But, despite the effort, progress has been slow, and at times the atmosphere in which the discussions have been held has been acrimonious. In November 1980, at the end of its most recent four-year plenary session, the CCITT issued two key documents (Recommendations S.100 and F.300). These recommendations in effect endorse all three technologies, reflecting the fact that the CCITT had been unable to resolve the conflict between the incompatible technologies of Prestel, Antiope and Telidon.

Since these documents were issued, the videotex standards scene has changed yet again. In May 1981, the CEPT (Conference of European PTTs) announced that its representatives had finally agreed on a videotex standard for Europe that was upwards-compatible both with basic Prestel and basic Antiope. The plan was that the CEPT standard would be implemented in 1983. At virtually the same time that the CEPT announced its European standard, AT&T announced its own Bell System presentation-level protocol in the United States. This product is based on Telidon, and the Canadians exploited this endorsement of their technology by announcing that Telidon would be brought into line with the Bell protocol. Europe and North America seemed to be settling on two distinct and incompatible standards for videotex. Not surprisingly, recent efforts regarding videotex standards have been aimed primarily at reconciling these two factions.

One way of considering the present position of videotex standards is to relate them to a complete network architecture. This is best accomplished by considering the seven-layer reference model recommended by the International Standards Organisation for open systems interconnection (known as the ISO reference model, and described in reference no. 6). Most of the videotex standards discussions to date have focused on coding schemes and on display presentation schemes — equivalent to layer 6 (the presentation layer) of the reference model. Accordingly, we first consider the issues of videotex coding schemes and display presentation schemes before discussing a full network architecture for videotex in terms of the seven layers of the ISO reference model.

Four distinct schemes for the coding and display of videotex information are generally recognised, all of which are described in CCITT Recommendation S.100. The four schemes are the alphamosaic scheme, the dynamically redefinable character set scheme, the alphageometric scheme and the alphaphotographic scheme. All four schemes use the seven-bit character coding structures specified in the ISO 646 and ISO 2022 standards. (The ASCII standard is part of the same family of standards.) The differences between the four schemes are concerned mostly with the coding and display of graphics. Each of the four schemes is now described, and then the constraints imposed on frame formats by different television standards are also discussed.

Alphamosaic schemes

Prestel, Antiope and the CEPT European Unified Standard are the main representatives of alpha-

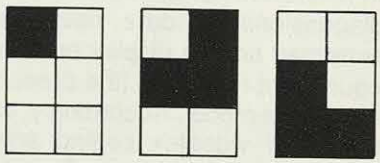
mosaic videotex character coding and display schemes. With alphamosaic schemes, the display area is divided into a fixed grid of cells. A character generator can display in each cell in the grid either an alphanumeric character, or a mosaic graphic element selected from a fixed repertoire. The frame format, in terms of the number of characters in a row and the number of rows in a frame, is determined by the dimensions of the grid. The grid dimensions that are chosen are influenced by several factors, such as the readability of frames displayed on the grid, the resolution characteristics of standard colour television tubes, and the size of the character memory. In Europe, a grid dimension of 40 characters per row and 24 rows per frame (40 x 24) is widely, though not universally, accepted. In North America, several different grid dimensions are in common use, although 40 x 20 is an increasingly popular choice.

Prestel and Antiope

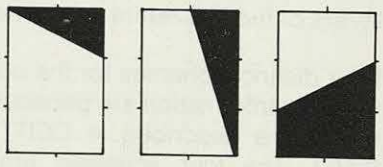
In their basic forms, both Prestel and Antiope are alphamosaic schemes and so are broadly similar. Nevertheless, there are sufficient differences between the two to make them incompatible with each other. Both technologies use similar display grids, but Prestel uses a 40 x 24 grid whereas Antiope uses a 40 x 25 grid. Both use similar dot matrix character generators, although Prestel characters are displayed in a 7 x 10 dot matrix, whereas the Antiope matrix is 8 x 10. Both use similar character sets and codes based on the standards for seven-bit coding contained in ISO 646 and ISO 2022, although there are some important differences in the way in which alternative character sets are used. Both use a repertoire of mosaic elements that are created by subdividing each character cell into three vertical sub-cells and two horizontal sub-cells. Each of the six sub-cells can be blocked in or not to form 64 different mosaic shapes ($2^6 = 64$), as illustrated in figure 18. Figure 19 shows a typical alphamosaic display.

Figure 18 Graphic elements

a. Examples of mosaic sub-cell combinations (64 possible arrangements)



b. Examples of diagonal shapes (48 possible arrangements having one diagonal each).



Typically, each character cell is divided into six sub-cells, as indicated in *a.* above. The sub-cells can be combined in 64 different ways.

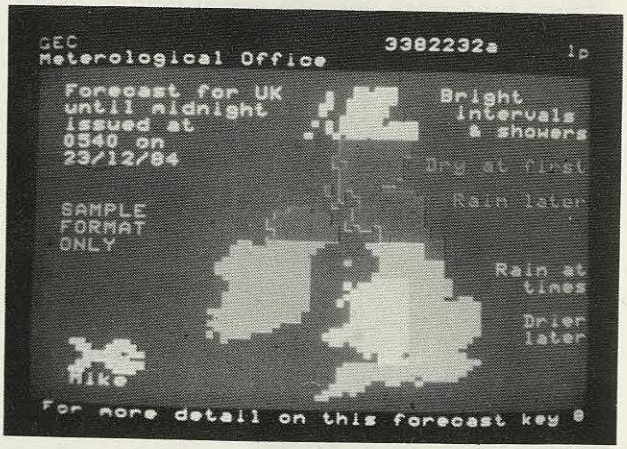
An alternative arrangement that yields 48 combinations is indicated in *b.* above.

The main difference between Prestel and Antiope (at least, in their basic forms) concerns the way in which the character attributes are coded. Character attributes determine the precise way in which a character is displayed, such as its colour and whether it is flashing or steady. Prestel employs a serial-coding technique to specify these attributes, with attribute control codes occupying a space in the display memory, just as characters and mosaic shapes do. The result is a display that has some limitations, but which uses a minimum amount of memory. Prestel terminals require only 960 eight-bit memory positions.

Antiope uses a parallel-coding technique to specify character attributes, where the memory space for storing the attribute control codes is separate to that used for storing the displayed characters. Antiope terminals therefore require more memory than Prestel terminals.

By the time Recommendation S.100 was published in November 1980, the CCITT had not been able to resolve the differences between the serial and parallel-coding techniques in a way that would create a single, unified standard. Consequently, the recommendation gave equal prominence to both schemes. Subsequent (and prolonged) debates amongst representatives of the European PTTs within CEPT culminated in the announcement in May 1981 of the CEPT European Unified Standard.

Figure 19 Alphamosaic display



CEPT European Unified Standard

The European Unified Standard is upwards-compatible from both Prestel and Antiope in their basic forms. At present, a terminal built for use with

Prestel in its basic form cannot be used with Antiope in its basic form, and vice-versa. Both types of terminal will, however, be able to access databases that adhere to the European Unified Standard, and the information will be displayed with virtually no loss of content. Such databases could be established using either serial attribute coding or parallel attribute coding (or both), depending on the preference of individual service providers.

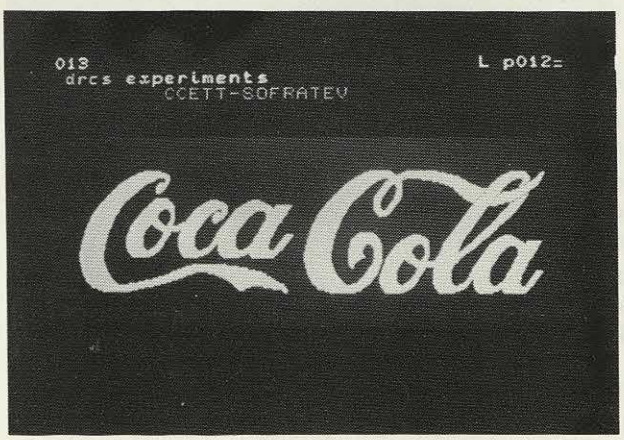
The key element of the European Unified Standard is the precedence it allocates to serial and parallel attribute codes when they both apply to the same character positions on the screen. The approach agreed depends on the sequence in which attributes are specified, with precedence being given to the latest attribute. Each character position affected by attributes is marked with a single-bit flag, and the attributes themselves are stored in a separate memory of 40 bytes per display row.

In effect, the European Unified Standard requires a terminal to have sixteen bits per character position in the display grid — in other words, nearly two kilobytes of memory for a 40 x 24 display (see reference no. 7).

Dynamically redefinable character sets (DRCSs)

The DRCS technique is a way of improving the display capability of alphamosaic schemes. The fixed repertoire of pre-defined character shapes and elemental graphic shapes may be extended with an additional repertoire, called a dynamically redefinable character set, that is downloaded to the terminal as required. Figure 20 shows how the DRCS technique can be used to simulate high-resolution graphics. Different dynamically redefinable character sets may be downloaded for use on different pages, so giving a very flexible approach.

Figure 20 DRCS display



The DRCS technique has several disadvantages, however. It is not easy to define and use DRCSs during frame editing, and a DRCS repertoire must be available continually at the database. Downloading a DRCS to the terminal requires additional transmission time, and extra storage is also needed at the terminal to accommodate the DRCS. Each character in a DRCS is defined as a cell matrix and this demands that a standard be agreed. The currently proposed standard is for a 10 x 12 matrix, which would require a random access memory of 5,760 characters in the terminal to store a forty-eight character DRCS.

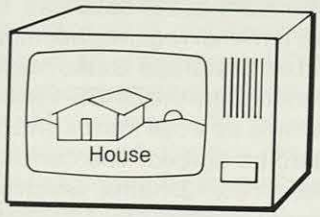
The CEPT European Unified Standard also provides for the use of dynamically redefinable character sets, but not all the details had been defined when the standard was announced.

Alphageometric schemes

The two main examples of alphageometric videotex schemes are Telidon and the Bell System presentation-level protocol. In such schemes, the display area is not divided into a fixed grid as it is with alphamosaic schemes. Instead, it consists of a continuous array of picture elements (called pixels), and each pixel has terminal memory positions allocated to it. Alphanumeric characters are coded and transmitted in much the same way as they are with alphamosaic schemes, but the difference between the two schemes emerges in the way in which graphics are transmitted and displayed. With alphageometric schemes, basic graphic commands such as point, line, arc, rectangle and polygon are stored at the database and transmitted to the terminal. The graphic commands are transmitted in the form of picture description instructions (called PDIs), together with their corresponding display co-ordinate positions. (The use of PDIs is described in reference no. 8.) Geometric graphic displays are constructed from these PDIs by a microprocessor within each terminal. A typical sequence of PDIs is illustrated in figure 21 overleaf.

The resolution of the graphics display is determined by the number of pixels. Similarly, the range of colour shades that can be associated with each pixel is determined by the number of memory bits allocated to each pixel. The display memory itself consists of a stack of memory planes, with each plane having one bit for every pixel in the array. A typical array consists of 240 x 200 pixels, so one typical memory plane contains 48,000 bits, or 6,000 eight-bit bytes. A stack of four memory planes (giving four bits per pixel) contains 24k bytes of display memory. These four bits are sufficient to code sixteen different colour combinations — for example, the six colours formed by combining the RGB guns, black, white and eight shades of grey.

Figure 21 Example of telidon PDI sequence



The simple drawing shown above can be described with 137 bytes of information using PDIs:

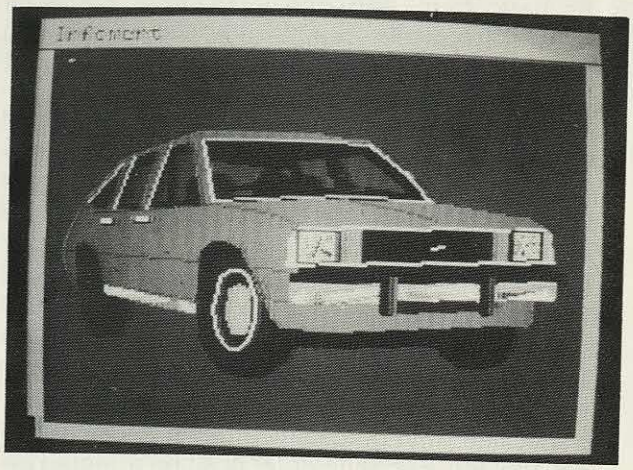
Shift Out (SO) to graphics mode.
Draw a blue background covering entire display area.
Draw a green foreground using a filled 8-sided polygon instruction.
Draw the walls of the house in red using a filled 6-sided polygon instruction.
Draw a green line to define the edge of the roof.
Proceeding from the present beam position draw the remainder of the roof using a filled 4-sided polygon instruction.
Draw a yellow sun using the arc instruction. Fill in the area between the chord and the end points of the arc.
Draw a yellow door.
Set the colour to white and reposition the beam ready for text.
Shift In (SI) to alphanumeric mode and write "House".

(Source: Communications Research Centre, Ottawa, Canada.)

240 x 200 pixels are sufficient to construct character shapes with about the same level of detail as with alphamosaic schemes. But the pixels are available also for constructing graphic displays that have an effective resolution greater than that of alphamosaic systems. With alphageometric schemes each of the 240 x 200 pixels can be defined, compared with the 80 x 72 sub-cells of a Prestel-like alphamosaic display. Alphageometric images can therefore be drawn in the style of a cartoon (as illustrated in figure 22), rather than being coarse and granular as alphamosaic graphics are. Alphageometric systems have the further advantage that the display resolution is independent of the database. An alphageometric terminal with many pixels will create a display of higher resolution than a terminal with few pixels, even though identical PDIs are transmitted to both terminals.

Compared with alphamosaic schemes, the main disadvantage of alphageometric schemes is the additional cost of the terminal. This additional cost results mainly from the larger display memory that is required, and from the microprocessor (with its own associated memory) that is needed to interpret the PDIs. A further minor disadvantage is that, for complex graphics, a lengthy database record may be required (5k bytes or more per page). In addition, it will take a correspondingly longer time to transmit such pages.

Figure 22 Alphageometric display



Telidon is the best known, though by no means the only, example of an alphageometric coding and display scheme. The Bell System presentation-level protocol that AT&T announced in May 1981 (see reference no. 9) was based on Telidon, but it extended and improved it. The Bell protocol permits a wide range of colours to be used through a technique known as colour mapping. It also has features such as continuous text scaling, variable stroke widths and simple animation. Seven-bit and eight-bit character coding can both be accommodated in the Bell protocol.

Following AT&T's announcement, the Department of Communications in Canada announced that it would enhance the Telidon specification to bring the two schemes into line. We believe that most North American videotex systems will now conform to the Telidon/Bell System presentation-level protocol. Telidon terminals that meet the new specification should be available from the spring of 1982.

Alphaphotographic schemes

Alphaphotographic schemes can create high-resolution images by defining uniquely each point (pixel) on the display. In addition they can generate alphanumeric characters from conventionally coded information. The alphaphotographic method is appropriate where the accurate display of illustrations is important, and in applications which require signatures and logos to be displayed.

To display an alphaphotographic image, facsimile-like point-by-point information (typically in the form of colour and brightness signals) has to be recorded

at the database. The information is then transmitted to the terminal and stored in its memory for subsequent display. Ultimately, videotex colour pictures, equivalent in quality to a still television picture, could be shown in this way. However, there are about 250,000 pixels on the screen of a large television and, even with only four bits per pixel, more than 100k bytes of terminal memory would be needed for a full screen display. That number can be reduced, of course, if the photographic picture covers less than the full screen area. Nevertheless, the amount of database storage required, and the time taken to transmit the information to the terminal, still remain as significant problems that have to be resolved before the alphaphotographic approach can become a commercial reality. One possible solution lies in the development of data compression techniques.

In the future, alphaphotographic schemes will become more prominent as mass storage costs reduce further, and as integrated services digital networks become widespread. Such networks will permit data to be transmitted on the public switched telephone network at 64k bit/s.

Different alphaphotographic techniques have already been demonstrated by enhanced versions of Prestel and Antiope, and also by Telidon (using the 'point' PDI command). Figure 23 shows a display from the alphaphotographic version of Telidon. During 1981 a great deal of activity within CCITT was aimed at agreeing world standards for alphaphotographic videotex during the next four-year plenary session, from 1981 to 1984.

Frame formats

Apart from the four alternative approaches to character coding and display that have just been described, another important distinction at the presentation layer (layer 6) concerns the frame format.

Figure 23 Alphaphotographic display

In Europe, where the 625-line raster PAL and SECAM colour television standards are in use, a frame format of 40 characters per row and 24 rows has been widely adopted (in accordance with CCITT Recommendation S.100). This format is exactly half of the 80 x 24 format used with conventional data processing terminals.

In North America, the colour television standard is NTSC. The bandwidth of NTSC is smaller than the two European systems, and the NTSC raster contains only 525 lines. These restrictions mean that a videotex frame format of 40 x 24 cannot easily be displayed on a television using the NTSC standard. The difficulty is greater with external adaptors than with integral television adaptors — and in North America external adaptors are probably the more important factor in establishing a videotex market. Most experts in North America would prefer a frame format of 40 characters per row and 20 rows, despite the problems of incompatibility with Europe that this would imply.

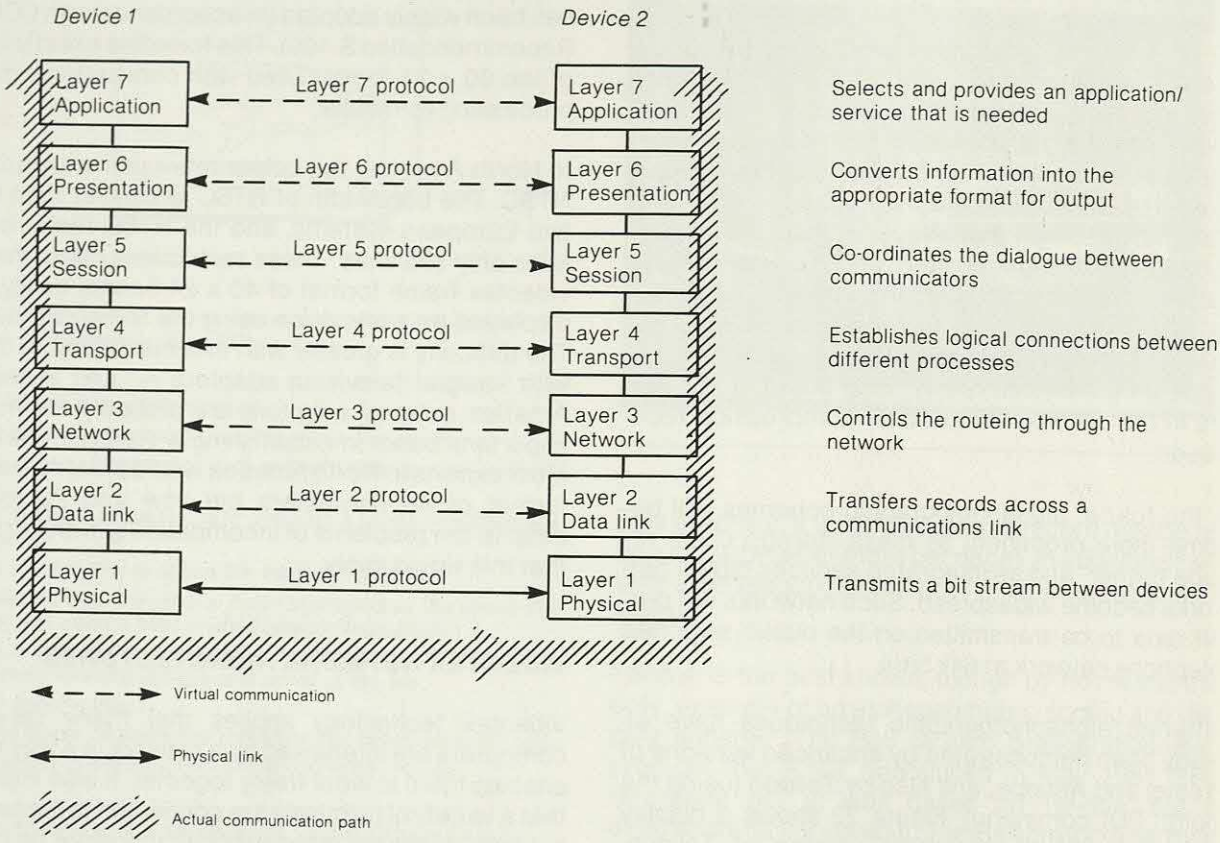
VIDEOTEX NETWORK ARCHITECTURES

Videotex technology implies that many service computers are interlinked by a network in a way that enables them to work freely together. It also implies that a variety of terminals are connected to the same network. Videotex standards can therefore be considered by relating them to a complete network architecture, and in this section we do that by considering the ISO reference model for open systems interconnection. The ISO reference model is designed to help to overcome the problems created by differences in the specifications and communications protocols of today's computers and terminals. These differences prevent different computers and terminals from interconnecting freely with each other.

One solution to this problem would be to specify (and then enforce) a universal network architecture, but that is an ideal which will be difficult to achieve in practice. An alternative solution is to use protocol converters, which can act as interpreters between the different components of a videotex service (service computers, terminals and networks) which may be operating according to different standards. Protocol converters able to handle several different protocols are, however, complex and expensive. In practice, open systems interconnection in videotex networks will be achieved through a combination of protocol converters and network architectures that approximate to the ISO reference model.

The complexity of network architectures is simplified by considering them as a series of layers. Most of the major computer equipment suppliers

Figure 24 The ISO reference model of open systems interconnection



have announced their own proprietary layered network architecture, but unfortunately these architectures are different and incompatible. The purpose of the ISO reference model is to provide a frame of reference within which suppliers can define their own network architecture. The seven-layer structure of the ISO reference model is illustrated in figure 24. The computer industry is unlikely to adopt a single universal specification for a network architecture based on the ISO reference model. Nevertheless, this model is likely to lead eventually to a family of standards that will all have a common base.

Discussions about videotex standards are conducted increasingly with the ISO model as a frame of reference. This reflects both the broadening scope of the standards debate and the growing acceptance of the relevance and importance of network architectures. In the remainder of this section, the current status of videotex standards is discussed in the context of each of the seven layers of the ISO reference model.

Layers 1 to 3 — the physical, data link and network layers

The CCITT X.25 protocol seems certain to be accepted as the standard for connecting videotex service centres and service computers to packet-switching networks. X.25 is a collective term, because it covers the first three layers (layers 1 to 3) of the reference model. The protocol for layer 1 (the physical layer) is X.21, which is also the CCITT's interface for circuit-switching networks. The protocol for layer 2 (the data link layer), is borrowed from the International Standards Organisations's HDLC (High-Level Data Link Control), which is similar to IBM's SDLC (Synchronous Data Link Control) as used in SNA. The protocol for layer 3 (the network layer) is called the packet-level protocol.

Layers 4 to 5 — the transport and session layers

Videotex network planners have not yet defined universal videotex standards that correspond to layers 4 and 5 (the transport layer and the session layer) of the ISO reference model. For example, the West German Bundespost has developed its own special protocol (called EHKP) for layers 4 and 5 (see reference no. 10). The Bundespost is using EHKP for the Bildschirmtext market trial, and intends to use it at the outset of the Bildschirmtext commercial service which is due to start at the end of 1983. The Bundespost will continue to use EHKP until international agreement can be reached on an alternative standard.

When AT&T announced the Bell System presentation-level protocol (corresponding to layer 6) in May 1981, the company made it clear that protocols for other layers would follow. We are confident that Bell System protocols for layers 4 and 5 will be announced during 1982.

Layer 6 — the presentation level

We have already described the alphamosaic CEPT European Unified Standard and the alphageometric Telidon/Bell System presentation-level protocol. Both of these standards correspond to layer 6 of the ISO reference model and, for the immediate future, it is likely that both standards will coexist. The European Unified Standard (which is upwards-compatible from the early basic Prestel and Antiope standards) has been embraced overtly by the European PTTs, but has been greeted with less enthusiasm by hardware and software providers. Nonetheless, the European videotex system operators intend to adopt the standard widely in Europe from 1983. The Telidon/Bell System presentation-level protocol is likely to be adopted widely in North America. In the United States, the announcement of that protocol by AT&T has done much to make videotex respectable, and has introduced a measure of stability to the videotex industry. And in Canada there is virtually total allegiance to Telidon.

Even in Europe, there is growing pressure to adopt North American alphageometric videotex technology. Siemens of West Germany will market Telidon-compatible terminals in Europe, following an agreement announced in October 1981 with the Infomart and Norpak companies of Canada. In addition the Swiss PTT has said it will use dual-standard terminals able to handle both the European and North American standards for its forthcoming market trial.

The rivalry between alphamosaic and alphageometric systems may only be resolved when the next generation of alphaphotographic systems become a practical proposition. Such a move can be expected towards the middle of the 1980s, when higher data transmission speeds will be possible following the introduction of integrated services digital networks.

Layer 7 — the application layer

In the context of videotex, application-layer standards embrace items such as log-on and log-off procedures, the use of function keys, and database searching methods. For example, the most basic Prestel subscriber terminal requires twelve function keys (the ten digits 0 to 9 plus ★ and #) in addition to an on/off key and an autodial key. Subscribers have to use these keys in a specific (though simple) way, and this usage constitutes the Prestel application-layer protocol. The function keys of other videotex systems, such as Teletel and Vista, have to be used somewhat differently. In other words, different videotex systems have different application-level protocols.

Another important difference between today's videotex systems concerns database searching methods. Early videotex systems have featured tree-structured databases, which are searched by menu selection. Trial users have found that menu selection is easy to operate if the prompts are carefully designed. But even if the prompts are carefully designed the method can be tedious to use and can create uncertainty in the user.

The menu selection method is sometimes regarded as an essential characteristic of videotex, but this is not so. Various forms of keyword searching, mostly requiring a full alphanumeric keyboard, have also been proposed. Sometimes a keyboard searching method is designed for use in conjunction with menu selection. In the future, subscribers are likely to require a choice of database searching methods, ranging from the simple to the sophisticated, from which they can make a selection. Subscriber terminals in the future may well include a set of basic keys, whose functions are recognised internationally, together with sets of supplementary keys whose use is optional. International discussions of these issues have only just begun.

DISTRIBUTED SERVICE COMPUTERS AND GATEWAY LINKS

In the simplest videotex configuration, terminals are connected to a single centralised computer and database. For a widespread, publicly available service, the logical extension to this simple configuration is to arrange for several replicated copies of the database to be distributed geographically, with each replicated database being kept in line with a central master database. This arrangement is illustrated in figure 25 overleaf.

The advantage of using replicated databases is that a publicly available service can be brought within local telephone call reach of subscribers. The main disadvantage is that storage replication is inherently inefficient. In addition, this arrangement introduces severe maintenance complexities, and is unsuitable for transactional services.

In the future, videotex networks will consist of multiple independent host computers, linked together by a general-purpose data network (typically a packet-switching data network) as illustrated in figure 26. In this arrangement, subscribers' terminals connect to the network at videotex enquiry centres. Each enquiry centre directs subscriber

Figure 25 Replicated database network

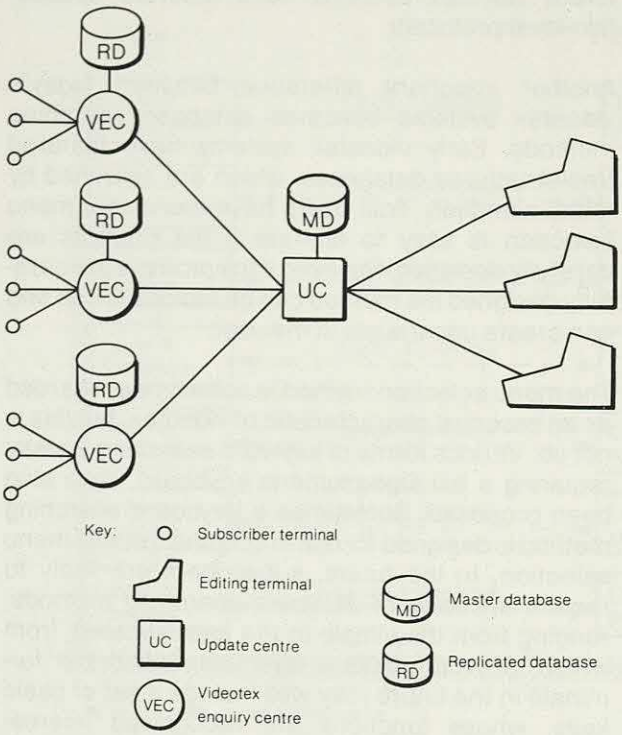
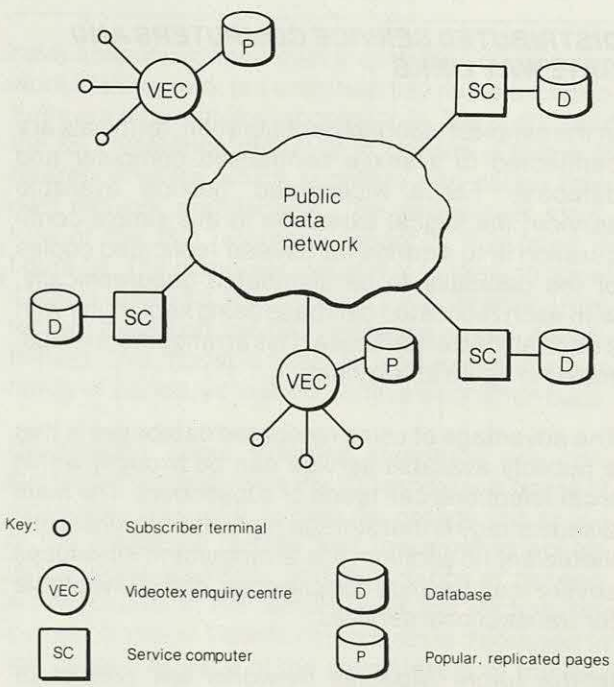


Figure 26 Distributed service computers in a videotex network



requests to the appropriate service computers by performing the roles of transmission concentration, protocol conversion and transmission switching. (Two useful introductions to the subject of videotex networks are contained in references 11 and 12.)

The basic functions typically carried out at the enquiry centres include terminal identification and validation, signal echoing, the collection of usage and billing statistics, and high-level indexing. An additional function of great significance for the future is the gateway facility, where the indexing frames stored at each enquiry centre include specific gateway frames. By accessing a gateway frame, the user may invoke a software-based switching procedure that establishes a connection with the host computer associated with that gateway frame. The dialogue between the user and the host computer is then conducted through the enquiry centre, with frames being transferred backwards and forwards across the packet-switching network. In effect, the enquiry centre acts as a front-end processor between a user's terminal and the host computers. The enquiry centre acts, therefore, as a switch, a protocol converter, and a packet assembler and disassembler.

As well as performing basic functions and providing gateway facilities, some enquiry centres may also store some information frames. This is the plan, for instance, both for Prestel and Bildschirmtext.

Popular information frames that are in constant demand by local users may be duplicated at the enquiry centres, so that it is not necessary to transmit the frames through the packet-switching network each time they are required. The frames associated with transactional services however, are likely to be stored only on independent host computers. In this way, the host computer operator can exercise closer control over access authorisation, and over data such as stock balances. Thus, records of the availability of seats on an aircraft (for example) will be maintained on the host computer. Reservations entered through videotex terminals can then be processed in the same way as reservations entered directly through conventional on-line reservation terminals.

DIRECT VERSUS GATEWAY ACCESS TO SERVICE COMPUTERS

In a typical publicly available videotex network of the future, independent host computers will be accessible to terminal users through gateway frames at the videotex centres. But to the host computer operator, gateway is just one way of connecting videotex terminals to his computer. Terminals can be connected also by direct links to the host computer.

There are several disadvantages with direct terminal connection, however. The first is that long-

distance connections over the dial-up telephone network will incur trunk call charges. Moreover, videotex terminal modems are in general not designed to the high standards required for long-haul connections. An alternative way of connecting videotex terminals direct to a service computer is through a private network, if one is available. In the absence of a private network, the use of a public packet-switching network presents another way of achieving this direct connection. As public packet-switching networks become more widely available, this alternative will become increasingly important.

Character terminals, such as videotex terminals, may be connected direct to an X.25 packet-switching network through a packet assembler/disassembler facility known as a PAD. (The function of a PAD is defined in CCITT's Recommendation X.3.) In essence, a PAD provides the character terminal with an analogue interface (called X.21 bis) to the packet-switching network. X.21 bis extends the familiar RS 232 C (CCITT V.24) interface. A PAD may be installed at a node in a packet-switching network or, alternatively, it may be installed on a customer's premises and connected to a packet-switching network node through a leased line.

In practice, host computer operators will often support both direct connection and gateway connection of videotex terminals. Both methods will offer advantages to the terminal user, and the final choice will depend on the user's particular circumstances. Figure 27 illustrates the two methods of connection, and summarises the advantages of each. By the end of 1981, several host computer operators that supported direct videotex terminal access were already able (or were planning) to support gateway terminal connection as well.

NETWORK INTERCONNECTION

In the future, videotex networks will interwork with other systems networks. In this section, we first describe the ways in which videotex networks may be interlinked with non-videotex services. We then describe the ways in which national videotex services may be accessed through international network links and, finally, we describe the way in which videotex networks could be linked with other data networks and with coaxial cable networks to form an information distribution utility.

Connection to non-videotex services

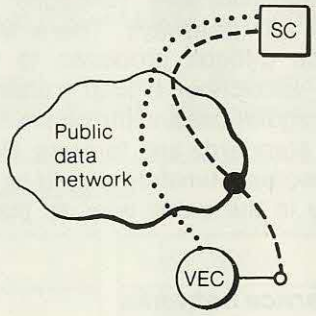
In all the leading countries of Europe there is a commitment to develop public packet-switching data networks. These networks will be used to distribute digital information for a wide variety of services. In addition to videotex, these services will include on-line retrieval of database information, facsimile transmission, electronic mail services and electronic funds transfer. Also it is probable that most national packet-switching networks will be connected to the public switched telephone network, the telex network and, where it exists, to the national circuit-switching data network.

The main implication of this development is that videotex services could be extended to other types of terminals connected to the network — provided, of course, that the protocols were compatible. Moreover, non-videotex services could become available to videotex terminal subscribers — again provided that the protocols were compatible. A consequence of this is that multifunction terminals (able to access not only videotex but other services as well) will be developed.

International interconnection

Accessing videotex services across national frontiers has become commonplace for demonstration purposes in Europe. Prestel-compatible terminals have been able to access the different national services based on Prestel. The value of international

Figure 27 Direct and gateway terminal connection to a videotex service computer



Key: ○ Subscriber terminal; SC Service computer; ● PAD; – – – Direct connection; (VEC) Videotex enquiry centre; • • • • • Gateway connection

Advantages of direct terminal connection via a PAD

- — Avoids the delay of entering the videotex enquiry centre and searching for the gateway
- — Eliminates the videotex cost overhead
- — Can be more efficient by reducing the number of packets transferred across the network

Advantages of terminal connection via a videotex centre gateway

- — Simple videotex access procedure, including autodial, avoiding the relatively unfriendly protocols of packet networks
- — Access to any external computer in the network from one videotex centre
- — Local call connection to the videotex centre
- — Centralised billing

access has also been demonstrated in a real sense by the Prestel International service, which has enabled subscribers in seven different countries to access the Prestel database in Britain. Other database services are also available internationally to subscribers with videotex terminals. In Europe, for example, the European Space Agency service and the Questel database service were both available to videotex terminal users in 1981.

The European PTTs are planning to interconnect their public packet-switching networks, and this interconnection of national networks will do much to encourage international videotex services. Networks will be interconnected at national frontier gateways called node transit internationals (NTIs). By the end of 1981, France, West Germany and Britain had already completed trials that interconnected the Transpac, Datex-P and PSS packet-switching networks. Ultimately, Euronet (the international packet-switching network built primarily to provide database services to Community member countries) will be superseded by interconnected national packet-switching networks.

British Telecom and the West German Bundespost both intend to commence international videotex services on a trial basis by 1983, with protocol conversion and other administrative functions being carried out at the NTI gateways. There will undoubtedly be some difficult problems to solve, including those of subscriber billing, transborder data flow, national regulations and the conversion of different technical standards and formats. But the intention is that videotex ultimately should be available internationally in the same way as the telephone is today.

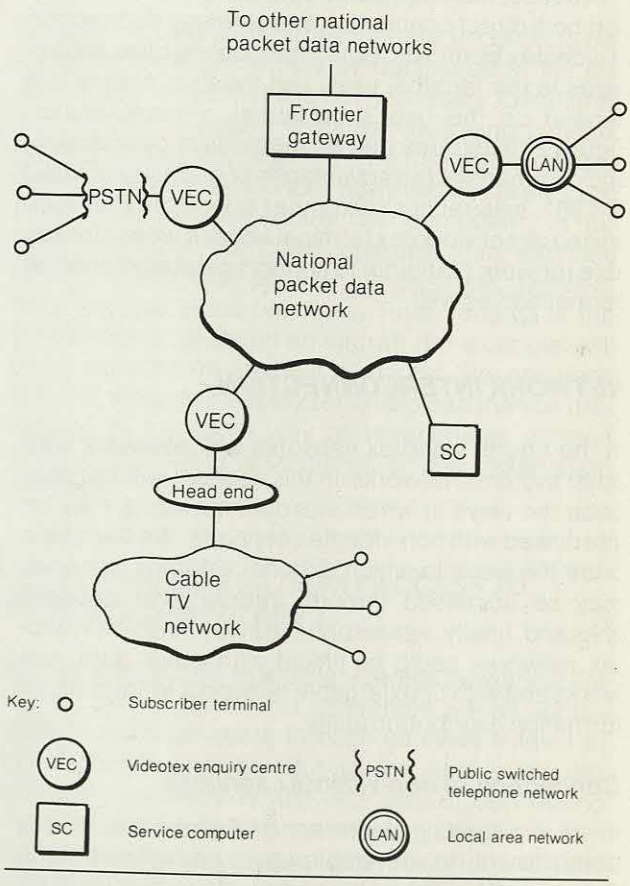
Integrated multiservice networks

An alternative medium to the telephone for local videotex delivery is coaxial cable. Because coaxial cable has been designed for carrying television signals, it has the advantages of high bandwidth and low error rate. Its disadvantages are that it does not switch the signals, it is not two-way (although there are some exceptions to this), and its market penetration is substantially lower than that of the telephone. Nonetheless, coaxial cable is a viable alternative to the telephone for videotex delivery. It is now the norm, rather than the exception, for cable operators in the United States to offer two-way services (including videotex) when they bid for franchises. New cable plant is specifically designed for two-way operation, and switching can be performed through a form of packetised terminal addressing. Moreover, a captive market of residential customers is assured for coaxial cable services. In some instances, one-way cable can be used to deliver videotex services, with the telephone being used as the return channel.

In the future, coaxial cable networks, data networks and the telephone network could all be linked together to form an information distribution utility — a comprehensive delivery network for a variety of information services. This concept is illustrated in figure 28. Subscribers could dial a local videotex enquiry centre through the public switched telephone network, or they could connect through a local two-way broadband cable network. In figure 28 the videotex enquiry centres are linked to host service computers through a wide-area packet-switching data network. The figure also shows an international gateway connection.

So far in this report we have described what videotex is, what it can do, and what its likely markets are. In the remaining two chapters, we turn to the use of videotex in a business environment.

Figure 28 Integrated telephone, packet and cable network for videotex delivery



CHAPTER 5

EXPERIENCE WITH PRIVATE VIDEOTEX SYSTEMS

The primary purpose of this chapter is to recount the experience of some pioneer users of private videotex systems — systems owned and operated by independent businesses for their own benefit. In 1978, only three private videotex systems had been installed. By 1979, the number had grown to 12, and one year later it had reached about 40. By the end of 1981, about 100 private videotex systems had been installed, and at least another 50 systems were close to implementation.

Figure 29 shows how these private videotex systems are distributed between countries, application categories and industry sectors. The figure underlines the predominance of private installations in Britain, due mainly to that country's pioneering interest in videotex.

The remainder of this chapter consists of five sections, each describing a representative case history of a practical private videotex system. The main implications for the data processing manager of the spread of private videotex systems are considered in chapter 6.

CASE HISTORY 1 — COMMUNICATION WITH DISTRIBUTORS

British Leyland manufactures about 300,000 cars each year for distribution to the home market through about 1,800 distributors, called dealers, dispersed throughout the United Kingdom. These dealers range in size from large organisations each selling hundreds of cars per week, to small family-run operations. The range of British Leyland models is extensive, and individual specifications vary widely. There are some 3,000 main model variants, and many other minor variants.

The problem facing BL Systems Limited, the wholly owned computer system subsidiary of British Leyland, was the small probability of a customer finding just the model and specification that he or she required amongst a particular dealer's stocks. What was needed was an easy, accurate way for dealers to find out about each others' stocks.

For some years, BL Systems has maintained records of dealers' stock levels on a central IBM

Figure 29 Private videotex systems by country, by application and by industry sector

Country	*No.*	*%*
UK and Ireland	66	44
West Germany	26	17
France	20	14
Other countries of Western Europe	17	12
Eastern Europe	10	6
North America	6	4
Australia	5	3
Total	150	100

Application	*%*	
Transactions		
— banking and EFT	12	
— orders from customers and agents	14	
— reservations and bookings	7	
— other forms of data entry	1	34
Information retrieval		
— operational information	8	
— technical and professional information	16	24
Bureau		20
Training		4
Administration		18
Total		100

Industry sector	*%*
Finance	19
Travel	6
Publishing	14
Bureau	13
Manufacturing	29
Distribution	6
Social services	13
Total	100

The tables include information for private videotex systems either implemented or committed by November 1981.

mainframe computer. But the larger dealer organisations had developed their own teleprocessing networks, and were unwilling to change them so that they could access BL Systems' central computer. Also, the smaller distributors were unwilling to pay for the expensive on-line terminals and specialist operators required by a conventional computer system.

BL Systems' solution to the problem was a private videotex system known as Stock Locator. The aim of the system is to enable dealers to improve their customer service by providing the dealers with access to the central files in a way which is easy and inexpensive, and does not require special training. Stock Locator enables dealers to match the requirements of individual customers with the specifications of models already held in stock somewhere within the dealer network.

The British Leyland Stock Locator system

The Stock Locator private videotex system is based on a dedicated PDP 11/70 minicomputer, which runs the IVS-3 software (referred to in figure 3 on page 9). Information about dealers' stocks is still maintained on the central IBM mainframe computer and, twice a week, it is transferred to the PDP 11/70. Langton's Preview software package (described on page 21) is used on the mainframe computer to generate videotex records as the information is transferred.

The dealers use their videotex terminals to access records that describe all the British Leyland vehicles in stock anywhere in the country. Some of the videotex terminals connect to the minicomputer entirely over the dial-up telephone network, and others connect via concentrators in BL Systems' existing high-speed (9,600 bit/s) private line network. BL Systems is also developing its own X.25-based private packet-switching network, which might be used by the Stock Locator system in the future. In this arrangement videotex terminals would connect to the network concentrators and X.3 PADs (see reference no. 13).

Progress to date and future plans

The Stock Locator system was first implemented in 30 selected dealers as a pilot system at the end of 1980. The pilot trial was a success, and a commercial service began in the late spring of 1981. By the end of 1981, about 400 dealers were connected to the service. Dealers rent their videotex terminals from BL Systems for £280 (about $560) per terminal per annum, and they are also charged a service fee of £240 (about $480) per annum. In addition, the dealers pay for their own telecommunication charges.

The reaction of dealers to Stock Locator has been enthusiastic. Those using the system have said that their sales have improved, as the time and cost of locating a vehicle have dropped. They have claimed that the system is easy to use, and that it has required no special training other than an initial day-or-two for familiarisation. They have even suggested several additional applications, such as vehicle price schedules, standard prices for vehicle servicing, and a sales order-entry system that would help to keep stock records more up-to-date. Some of these suggested applications may be developed by BL Systems Limited.

Those dealers not yet connected to Stock Locator have pressed for the service to be extended. As many as 1,000 dealers may be connected to the system during 1982, and some of them may be from outside Britain. BL Systems Limited has also considered connecting its videotex system to the Prestel gateway service. This step would be justified only if a large number of users apart from dealers were to use the Stock Locator service.

CASE HISTORY 2 — INTERNAL TRAINING IN CORPORATE PROCEDURES

Barclays Bank has implemented a private videotex system to enable staff at branch offices to train themselves in corporate procedures. Barclays is one of the largest banks in the world. It has 3,000 branches in the United Kingdom, and is expanding aggressively in other European countries as well as in North America. In common with other banks, Barclays faces a continuing need to train its branch staff in a variety of banking procedures. The training programmes are vital to ensure that the bank's rigorous standards are maintained, and most of the training is carried out at Barclays' own specially equipped residential training centre.

These training programmes are expensive, however, in terms of instructors' and trainees' time, in travel and accommodation expenses, and in the cost of covering staff absences in the branches. To help reduce the expense and inconvenience of the current methods, the bank has launched an experimental training programme based on a private videotex system that can be accessed by trainees directly from the branches. The aim is to provide a computerised programmed learning aid that can be used by employees without the need to attend courses at the residential training centre.

Barclays Bank's internal training system

The bank considered several approaches, including both mainframe-based and minicomputer-based conventional systems, before it decided on a videotex system. The main attractions of videotex were that it was cheaper than other methods, and could

be implemented earlier than any conventional system. The colour displays and easy use were also significant factors in the decision.

A specially created programmed training package consisting of about 1,000 frames was ready for the initial trials, held at the training centre in the summer of 1980. This package, concerned mainly with procedures for raising standing-order forms, consisted of step-by-step instructions followed by self-test questions. The package also contained routines to monitor the performance of individual trainees. The software was written by Barclays Bank staff, and was based on videotex operating software supplied by Rediffusion Limited.

Progress with the system

By the spring of 1981, the programmed training package was sufficiently well developed to be used by trainees in the branches. A trial training programme began in 33 branches, all within local telephone call reach of the training centre. The training staff were careful to evaluate the progress of these trainees, and to compare their results with those achieved with conventional training methods.

The results of the trial have been sufficiently positive to encourage Barclays to consider extending the system to other branches. Eventually all the larger branches (of which there are more than 1,000) could be included in the system. Further training applications are also being planned, as are non-training uses that are designed to assist staff in their daily work. Mortgage calculations, rates of exchange and currency exchange calculations are among the non-training applications that have been suggested.

For the future, Barclays Bank is considering the possible integration of videotex and videodisc systems for training purposes. It is also evaluating the use of videotex as a basis for home-banking services.

CASE HISTORY 3 — CATALOGUE SALES TO THE GENERAL PUBLIC

The Bildschirmtext market trial in West Germany includes a facility that enables the private mainframe computers of several mail order companies to be accessed by participants in the trial. In this case history, we describe the experience of one of those companies (Neckermann-Versand) in making its information available via a Bildschirmtext gateway link.

The mail order business in West Germany

The mail order business is more highly developed in West Germany than anywhere else in the world. The total value of sales in 1980 reached around eight billion dollars (that is about $150 per head of population, compared with about $120 per head in the United States). Two-thirds of the nation's mail order business is shared by the three largest companies — Quelle, Otto-Versand and Neckermann-Versand. Their sales in 1980 were around three billion dollars, two billion dollars and one billion dollars respectively.

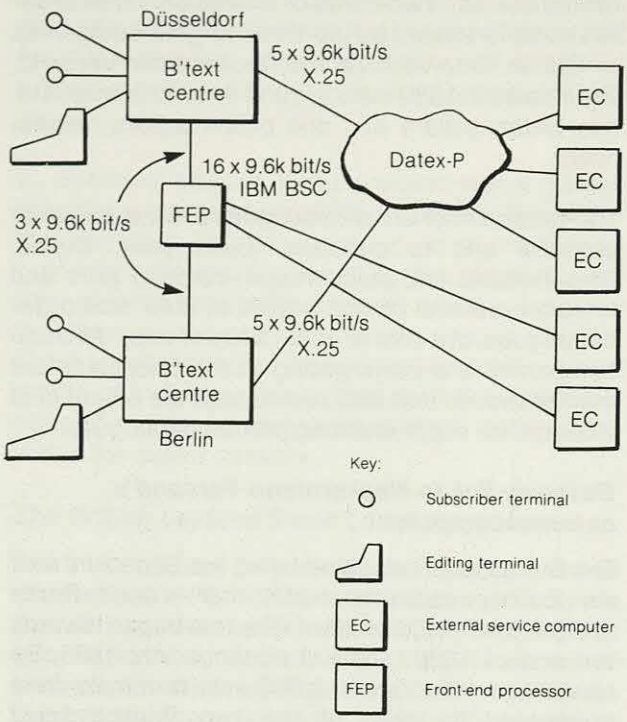
The printed mail order catalogues are expensive to produce and to circulate. Each year, Quelle, Otto-Versand and Neckermann-Versand print and circulate several million copies of their mail order catalogues, at a cost of about $10 per copy. All three companies are participating in the Bildschirmtext market trial so that they can assess the potential of videotex for supplementing printed catalogues.

Gateway link to Neckermann-Versand's external computer

The Bundespost has established two Bildschirmtext service centres for the market trial — one in Berlin and the other in Düsseldorf. The trial began towards the end of 1980, and will continue into 1983. By November 1981, about 3,000 user terminals were connected to each of the two Bildschirmtext centres, and about 100,000 pages of information were being maintained by several hundred independent service providers at each centre. In addition, there were gateway links from each Bildschirmtext centre to 17 private service computers (known as external computers). The overall configuration is illustrated in figure 30 overleaf.

The gateway connections between the external computers and the Bildschirmtext centres can use either the binary synchronous control (BSC) protocol, or the X.25 protocol. X.25 connections are made via the Datex-P packet-switching data network. Eleven of the 17 external computers connected at the end of 1981 used a BSC link, and the other six used the X.25 link. The Bildschirmtext network architecture is based on the X.25 protocol, and external computer operators using the X.25 link are responsible for providing their own X.25-compatible software. For external computers using the BSC link, the Bundespost has installed a dedicated GEC 4080 minicomputer in Düsseldorf to act as a common front-end processor to the dual GEC 4080 computers at both Bildschirmtext centres. The front-end processor provides 512 permanent virtual circuits, which can support a maximum of 16 external computers and up to 32 simultaneous users at each external computer. Each of the two Bildschirmtext centres can connect 256 permanent virtual circuits to the front-end processor, which emulates a 3271 cluster controller and converts IBM EBCDIC to ASCII. (The method is described in more detail in reference no. 14.)

Figure 30 Bildschirmtext market trial configuration



The Neckermann-Versand IBM mainframe uses the BSC connection to the front-end processor. Neckermann-Versand believes that the limit of 32 simultaneous users is adequate for the purposes of the trial (see reference 15).

Catalogue ordering procedure

Those participants in the Bildschirmtext market trial who wish to connect with the Neckermann-Versand external computer can do so by following a simple, clearly defined procedure. Once they have established a telephone connection with their Bildschirmtext centre, participants find their way to the Neckermann-Versand gateway frame either by direct keying, or by working their way through the index. Neckermann-Versand maintains several hundred information frames at each centre, and these frames contain information about the company's mail order business, highlighting particular features of the catalogue. The frames also outline the procedures for using Bildschirmtext and the gateway. Participants invoke the gateway connection procedure by depressing the # key whilst the gateway frame is displayed. The software at the Bildschirmtext centre then establishes the connection, and Neckermann-Versand's computer responds by transmitting a welcome frame.

Participants key-in their account number, and may then select an ordering frame from the external computer database. The frame corresponds to the catalogue item they wish to purchase. The external computer transmits prompts that guide the participants in entering the order details, such as the identification number of the item required; its colour, size and quantity; and the preferred method of payment. Finally, the completed frame is transmitted back to the external computer, where the order is processed and the items are despatched in the normal way.

Progress with the system

Neckermann-Versand's current link with the Bildschirmtext system provides trial participants with a convenient means of ordering catalogue items on a twenty-four hour basis. By the end of 1981, the application was generating about DM 18,000 ($8,000) of mail order sales per day. Most of the sales were generated from 70 terminals installed free of charge by Neckermann-Versand amongst its most active customers.

Neckermann-Versand intends to continue its involvement with Bildschirmtext when the current market trial is superseded by a full commercial service at the end of 1983. At that stage, the company will convert its external computer communications protocol from BSC to X.25 and will then use the Datex-P network to link to Bildschirmtext. The two main benefits that are expected from this change are faster access times and the ability to connect up to 4,096 simultaneous users.

At present, Neckermann-Versand's Bildschirmtext system does not replace the company's printed mail order catalogues, but it does complement them. The limited quality of the Bildschirmtext mosaic graphics means that the system is not suitable for displaying accurate pictorial representations of the goods for sale. Ideally, video-quality graphics are required, and one way of achieving that quality is by using photographic videotex display technology (as described on page 30). An alternative way is to combine videotex with videodisc technology. Neckermann-Versand is experimenting with this latter arrangement, using equipment supplied by Dornier and based on LaserVision videodisc technology (see reference no. 16). Participants equipped with the Dornier system can select catalogue items on the Neckermann-Versand external computer database and then display video-quality still (or moving) pictures of the items on their televisions.

The video-quality pictures are generated by the LaserVision equipment installed in the participant's home, and the videodisc frame indexing is carried out automatically and remotely by the external computer. Participants who select items on the basis of the videodisc display may then proceed to order them through Bildschirmtext in the normal way.

CASE HISTORY 4 — CONTACT WITH FIELD MAINTENANCE STAFF

ICL, Britain's largest computer manufacturer, has been distributing software fault warnings (together with instructions for corrective action) to its field maintenance staff through a private videotex system. ICL manufactures equipment ranging from minicomputers to large mainframes, and has several thousand customers around the world for whom it provides a continuing after-sales support service. An important part of this service is the maintenance of ICL-supported software. Warnings about software faults, together with corrective measures, are distributed to maintenance staff at the operating sites from a reporting centre in Britain. At present, the information is distributed on microfiche cards, which are despatched by post or by courier. Delays are inevitable, and ICL has sought to improve the distribution by linking videotex terminals at the operating sites to a private closed user group service on the Prestel International system based in London.

The software fault reporting system

ICL chose to base its experimental software fault reporting system on the Prestel International trial because it needed a low-cost international distribution network. The system has been in operation since the beginning of the Prestel International trial in 1980.

Details of the most recent software faults are extracted from a master computer file maintained at the software fault-reporting centre. These details are loaded once a week onto the Prestel International closed user group service. The fault details are then distributed to Western Europe through the public switched telephone network, and to the United States and Australia through Tymnet. The distribution speed of videotex has proved to be an immense advantage over the conventional microfiche card method. Moreover, maintenance staff can respond to the videotex displays by sending messages back to the Prestel International centre. Such messages can be retrieved later by the ICL central staff.

Progress with videotex

In addition to the software fault reporting system, ICL has been developing two other private videotex systems (known as Axis and Iris) for its own internal use.

Axis provides ICL company staff (mainly sales staff in the United Kingdom Division) with product and marketing information. It uses the ICL Bulletin software, implemented on an ICL 2904 computer which is dedicated to internal corporate applications.

Iris provides ICL company staff (in the United Kingdom and overseas) with information about internal training courses, company news bulletins, and information about standard application software. (This last service is aimed primarily at the sales force.) Iris is implemented on a dedicated ICL ME 29 minicomputer (which also uses the Bulletin software) and is operated by ICL's Baric service bureau. At the end of 1981, the Iris system had 32 ports, supporting about 200 terminals. The software fault reporting application described above may be transferred from Prestel International to Axis, provided that sufficient cost savings will result. Alternatively, Axis may be connected to the Prestel gateway service, if that proves to be a cost-effective method of providing international access to the system.

CASE HISTORY 5 — TOUR SALES THROUGH TRAVEL AGENTS

In Britain the travel industry has responded very favourably to videotex. At the end of 1981, about 2,300 videotex terminals had been placed in travel agents' offices. Most of these terminals had been sponsored by travel companies and tour operators. At that time, the Prestel database offered a comprehensive selection of travel information. In addition, several private videotex systems were available to some travel industry terminal users. These systems offered information that was specific to the needs of travel agents.

The experience with private videotex systems of two competing tour operators — Thomson Travel and Thomas Cook — is particularly interesting. Both companies are well established, and are highly regarded by the travel industry. Each company has its own associated airline and hotels, and each offers a wide range of tour options and holiday choices to the public through selected travel agents.

Thomson Travel's Computerised Agent Reservation Service

Thomson Travel runs a comprehensive reservation system — called Thomson Reservation and Administration Control System (TRACS) — on its IBM mainframe computers. Specially trained Thomson Travel operators, situated in regional offices, use visual display terminals to access the mainframes through a private network. Travel agents can contact the operators over the telephone, and the operators act as intermediaries to make bookings on behalf of the agents.

Thomson Travel has been experimenting with a pilot version of its private videotex system, called the Computerised Agent Reservation Service (CARS). The aim of the CARS system is to enable travel agents to by-pass the Thomson Travel operators and have direct contact with the mainframe computers. CARS has been implemented on two Rediffusion minicomputers, which front-end the IBM mainframe computers.

The pilot system has been available for use since May 1981. At the end of 1981 it was being used by 66 travel agents in the south of Britain. These formed a representative sample of large and small agents, located in ten towns.

At the time of writing this report, several basic functions were available on the pilot CARS system. Agents could reserve option bookings, and make definite bookings (for up to six passengers at a time) for holidays having a reference number in the Thomson brochure. In addition, the agents could retrieve records so that the status of bookings could be confirmed — they could ensure that invoices or tickets had been despatched, for example, or that a holiday had been cancelled.

The CARS pilot system has been well received by the participating travel agents. The colour terminals are a positive selling aid, and staff training and familiarisation has not proved to be a problem. The participating agents now use CARS to make more than 40 per cent of their Thomson holiday bookings. There have been a few problems, however. Some agents have criticised the slow response times, and some staff have been slow to learn how to use the system. There have also been complaints that CARS is too simplistic and too limited compared with TRACS. Nevertheless, Thomson Travel has ambitious plans to develop the CARS system, and as many as 2,000 agents could be connected to it by 1984. By then, the videotex software may have been rewritten to run on the mainframe computers, and a Prestel gateway connection may also have been implemented.

Thomson Travel believes that one of the more significant benefits of the use of colour television terminals by travel agents may well turn out to be the ability to display full video-quality images from input devices such as videodisc players.

Thomas Cook's Holidaymaker

Thomas Cook's Holidaymaker private videotex system for travel agents (described in reference no. 17) has several features in common with Thomson Travel's CARS system. Like CARS, it began a pilot trial in 1981. Travel agents with videotex terminals can access the Thomas Cook IBM mainframe computers through a dedicated front-end minicomputer in a similar way to the CARS system. The travel agents use their videotex terminals to access information about Thomas Cook's holidays and tours, including details of resort features, flight timetables and hotel room availability. As with the CARS system, travel agents and their clients can use the Holidaymaker system together, paging their way through the options and reviewing the alternatives. As a result, Thomas Cook's clients have become more involved with the selection process. If they wish, clients can make their own holiday selections by using the videotex terminals that are often positioned on the service counters in the agents' offices.

The facilities provided by Holidaymaker are rather more comprehensive than those provided by CARS. Alternative hotels and flight details can be more easily displayed with Holidaymaker, for example, and the reservation procedure is more sophisticated. The Holidaymaker videotex terminals are connected to a PDP 11/70 minicomputer that front-ends the IBM 4341 mainframe. The PDP 11/70 runs the IVS-3 software.

By the end of 1981, nearly 100 agents were connected to the system, and the number of terminals in use was approaching 300. Most of the terminals were compact monochrome devices (unlike those of Thomson Travel, who had adopted colour displays for the CARS system).

Like Thomson Travel, Thomas Cook also has ambitious plans to develop its private videotex system. The range of services available via the system may be extended, the main purpose of new services being to eliminate some of the paperwork that currently flows between client, travel agent and tour operator. In addition, a gateway connection to Prestel will probably be tested. Thomas Cook estimates that there could be as many as 2,000 terminals connected to the Holidaymaker system by the end of 1982.

CHAPTER 6

VIDEOTEX INDUSTRY TRENDS

In this final chapter of the report we identify the main trends in the videotex industry. The first section of the chapter predicts the key evolutionary trends of videotex. The second section suggests that videotex may penetrate the European market in four distinct stages during the 1980s. The third, and final, section reviews the main implications of videotex from the standpoint of the corporate data processing department, and suggests ways in which such departments might equip themselves to monitor videotex developments during the short-term future.

EVOLUTIONARY TRENDS

The nature of videotex has already changed in several significant ways since its beginnings in the 1970s, and there will be further changes in the future. From the evidence that is now available, it is possible to predict some of the more significant trends, and these are summarised below:

- —In Europe, the business community, not the residential community, will be the lead-in market for videotex. Specific business sectors will recognise the benefits of videotex, and will justify the price of using it before the general residential marketplace for videotex develops.
- —As the cost of microprocessors and memory continues to fall, the early unintelligent videotex terminals will be supplemented by a widening range of intelligent terminals. This trend is already apparent today, and is illustrated by the availability of videotex interfaces on a growing number of personal computers.
- —Single-function videotex terminals will be supplemented by a growing proportion of multi-function terminals. Dual-standard visual display terminals that can be used both for videotex and data processing applications will become increasingly commonplace in business, as will personal computers and multifunction devices with videotex interfaces.
- —The trend in publicly available videotex services will be away from central databases under the control of a national system operator, and towards distributed databases held on privately operated service computers. These service computers will be connected to the public data networks, and will be accessible through service centre gateways in an open systems interconnection environment.
- —The distinction between public and private videotex systems that is apparent today will blur in the future. Most service computers will be privately owned. Some of them will be publicly available to any videotex subscriber through the national network. Others will be available only to authorised users.
- —The ad hoc network architectures of the early videotex systems will give way to architectures that are based more closely on the International Standards Organisation's reference model for open systems interconnection. However, complete standardisation of network architectures will not be achieved in the foreseeable future. Rather, by working towards a common standard, system designers will find it easier than hitherto to interlink the equipment and systems of different suppliers through gateway and protocol converters.
- —Eventually, consumers will overtake the business community as the major users of videotex. By the second half of this decade, the benefits of videotex to the consumer will increasingly justify its price. By then, the number of regular residential users will be around 2 per cent or 3 per cent of homes — approaching the critical mass needed for service participants to make money from their investments. These residential users will be from the upper income groups, so that the relatively low penetration will represent a much higher proportion of total disposable income.
- —The early emphasis on information retrieval will give way to transactional applications in which information has first to be retrieved, and then acted upon. Three examples of this type of application are the use of videotex to compare prices and then to place an order; to check seat availability and then to make a reservation; and to check a bank balance and then to authorise an account transfer. In each of these illustrations the information-seeking component is important, but only as a means to an end.
- —Basic alphamosaic systems will be superseded by higher-resolution systems as the residential market for videotex becomes well-established. The residential community will be prepared to pay more for graphics displays that are more pleasing

to the eye, and that are more useful for applications such as shopping from home. The extra price of high-resolution terminals will become less significant as terminals are built in larger quantities.

— In time, today's narrowband local communication channels will give way to wider bandwidth channels. The analogue telephone network restricts data transmission to speeds of about 1,200 bit/s, but eventually it will be supplanted by integrated services digital networks. Such all-digital networks will permit data to be transmitted even on local loops at much higher speeds. Also, high-bandwidth cable used for the distribution of television signals will provide an additional medium for the high-speed transmission of digital data, including videotex.

— As it evolves, videotex will become less distinctive and less-readily recognisable. Videotex services will be accessed by a variety of terminal designs, many of which will not be based on conventional televisions. Independent videotex systems, conceived and operated in isolation, will give way to more integrated systems. The packet-switching data networks used for transporting videotex data will form common digital highways that connect subscribers to a variety of different computers. These computers will offer a wide selection of services, varying from database access to electronic mail, and will provide links to other established networks such as telex.

— In the public service domain, videotex will change from a technology-driven industry to one that is market-driven. This will occur as the technology stabilises, as the understanding of the needs of the marketplace grows, and as the service participants become more determined to make a profitable return on their investments. Videotex will also change from a money-losing to a money-earning industry. In its formative years, few participants (with the exception, it is said, of some conference organisers and some consultancies) have made money from videotex. Later, as the market grows beyond a critical mass, this position will change. By the end of the decade, videotex will have become a multi-billion dollar business in Europe. Although still small by the standards of the television entertainment and video industries of the time, videotex will not be an insignificant industry.

— The blind enthusiasm prevalent amongst many of the early public service participants will give way to a climate of more cautious realism. This change will occur in the light of commercial good sense and increasing competition. As a result, everyone involved in the industry will benefit.

STAGE-BY-STAGE PENETRATION OF THE MARKET

The penetration of videotex into the business and residential markets of Europe can be envisaged as occurring in four broad stages. The stages described below are based on those suggested by Campbell and Thomas in reference no. 18. In practice, there is likely to be a good deal of overlap between the four stages. Nevertheless, they serve as a useful indication of the ways in which videotex will develop.

Stage 1 — Specific business sectors

In stage 1, videotex services are paid for by the business community, and videotex terminals are used mainly by business sectors such as travel agents, real estate agents, motor car distributors, insurance agents and employment agents. These sectors use videotex mainly for distributing information and for collecting data. Typically, the terminals are unintelligent adapted televisions, and they are located at sites that are geographically dispersed. The terminals are used fairly infrequently by unskilled staff, and are often used to display and demonstrate information pages to the public. Some videotex databases are maintained on computers provided by PTT system operators, but others are maintained on private service computers that are accessible either directly or through gateways at the enquiry centres.

Stage 1 is already underway (or beginning) in some European countries — notably Britain, France, West Germany, and Holland.

Stage 2 — Public service information systems

In stage 2, videotex terminals are used mainly for disseminating information in public places such as department stores, hotel lobbies, railway stations, airports, bank branches, post offices and libraries. For example, a department store might make information available about discounts, bargains and stocks levels. Railways and airlines could provide information about timetables, fares and local attractions. Bank branches could provide information about rates of interest, currency exchange rates, loan schemes, mortgages and other general banking services. The terminals themselves are similar to those in stage 1, and they are connected to videotex systems in a similar way. The difference compared with stage 1 is that the terminals are used mostly by members of the general public, in much the same way as they use cash dispensers.

Stage 2 begins shortly after stage 1 has commenced.

Stage 3 — Widespread use in businesses

In stage 3, videotex terminals penetrate into a wide variety of businesses, both large and small. The terminals are used by staff who do not require any special training for a range of applications within the four general service categories of information retrieval, transactions, messaging and problem solving. Some terminals are dedicated videotex devices based both on monochrome and colour televisions, whereas others are adapted versions of conventional visual display terminals. Others are multifunction data processing and word processing terminals, and some are teletex terminals fitted with videotex adaptors.

A common characteristic in stage 3 is that the terminals are not used heavily for videotex. Instead, they are used casually and intermittently in the videotex mode. Those users who need to access several different service computers usually do so through gateways at the videotex enquiry centres, whereas those who need to access just one or a few service computers do so directly, by-passing the gateways. Either way, the accesses are sometimes to files maintained in page mode, and sometimes to conventional computer files which are re-formatted into videotex pages as the information is retrieved.

Stage 3 will begin in Europe in about 1983 to 1984.

Stage 4 — Widespread use in homes

In stage 4, the penetration of videotex into the residential market becomes widespread, beginning in the upper income groups. A typical early stage 4 user is a young, affluent executive or professional in the 30 to 45 age range with children at home, and with a considerable existing investment in hi-fi and home video equipment. These early users have encountered videotex frequently in their business environments, or have made use of terminals in public places. In other words, they have already experienced videotex during stages 1 to 3. From this beginning, the penetration of videotex extends downwards through the social strata, in contrast to the development of the colour television market, where the lead-in market was often in the lower social strata.

The applications of videotex in the home include shopping from home, banking from home, and information and software distribution. The motivating factors driving the adoption of videotex are convenience, time saving and cost saving. These benefits become increasingly apparent as alternative, conventional services deteriorate. Some users, such as field sales forces, have their home terminals provided free of charge by their employers so that they can stay in touch with their regional offices. At first, the terminals are conventional televisions with either an integral or an external adaptor. Later, as stage 4 progresses, the trend towards intelligent terminals becomes more pronounced. Intelligent terminals are then used both to retrieve information from the videotex database, and to manipulate it locally. This development heralds the advent of the modular television.

Stage 4 will begin in Europe in about 1984 to 1985.

Penetration profile

Five years from now, at the start of 1987, we expect several countries in Europe to be well into stages 3 and 4. By this time, the number of videotex subscribers should be approaching the critical mass required for service providers to move into profitable operation.

It is likely that the penetration of videotex will follow the familiar S-shaped curve, with a period of relatively slow acceptance followed by one of rapid development. The number of videotex subscribers should grow rapidly in the second half of this decade. A recent report prepared by the Butler Cox Videotex Research Unit (reference no. 19) predicts that in Europe by 1990 the installed base of videotex terminals will have reached three million in businesses, and eight million in homes. Other forecasts that have been made recently are not too dissimilar. For example:

- "Our optimistic, although realistic, estimate is that 7 per cent of all (US) households is achieveable by the end of this decade." (D. J. Sullivan, AT&T; see reference no. 20.)
- "In a relatively free market, we can expect to see between 15 per cent and 25 per cent of homes equipped with videotex terminals by the end of the decade." (G. Haslam, Southam; see reference no. 21.)
- "The installed residential base of videotex terminals (including electronic directory terminals in French homes) in Western Europe will reach twenty million — about 14 per cent of households — by the end of the decade." (Frost & Sullivan Report on the Videotex Market in Western Europe, December 1980; see reference no. 22.)

VIDEOTEX AND CORPORATE DATA PROCESSING

It should be clear from this report that, despite the current problems, the long term prospects for videotex are encouraging. Videotex is clearly not going to be merely a passing fad. We therefore conclude this report by reviewing briefly the main implications of videotex from the standpoint of the corporate data

processing department. Videotex can provide four main benefits to many businesses:

—Compared with conventional data processing systems, videotex systems can be quick to install and easy to use. Also, videotex is potentially much cheaper than conventional data processing, in particular because terminal prices will fall with large-volume production.

—Videotex appeals to the casual user whose job does not demand the use of a terminal. For such users, the training required to use conventional terminals is often irksome or impractical.

—Once justified and installed for one application, the videotex terminals can be used for further applications at marginal cost. For example, they can be used to access external computer services, such as on-line information databases and electronic mail services.

—Because they can use television technology, videotex terminals can display video pictures as well as text and graphics — a feature that is important for certain applications.

Nonetheless, the corporate data processing department would be foolish to ignore the problems of videotex:

—Because videotex is simple and relatively cheap, it is also limited in what it can do. Many business applications are highly specialised, and require the support of highly specialised information systems.

—Videotex introduces new formats and new standards into the computer field, which is already beset by a host of incompatible equipment and systems.

—There is an acute danger of today's videotex equipment becoming obsolete in the not too distant future. It is by no means certain that today's videotex standard will persist unaltered for more than a few years.

It is against this background of benefits and problems that a corporate data processing department has to decide what it should do about videotex. We believe that the manager of such a department should do the following three things:

—First, stay abreast of videotex developments, and include videotex in the department's range of systems on offer to corporate users. But recognise that there are differences between videotex and other more conventional computer systems, and recognise that videotex systems appeal to a different type of user. Be prepared to implement pilot videotex systems.

—Second, ensure that the data processing department is involved with any corporate videotex initiatives that may occur, in the same way that it should be involved with any other information processing technologies. There are several reasons for this involvement. Corporate data processing departments have the knowledge and the experience to select systems that meet user needs at minimum cost. Corporate data processing departments have the ability to integrate videotex into the business by arranging for the mainframe computer files to be accessible through videotex terminals. Also, the data processing manager can ensure that videotex initiatives are kept firmly within the overall umbrella of a corporate information systems plan.

—Third, be aware of how rapidly videotex systems are developing and changing. Make sure that justifications for videotex systems are based on short payback periods — two or three years at the most. Recognise that videotex standards are likely to alter, and that the development of videotex will be influenced by other new media developments occurring around it.

Many people have suggested that videotex will, in the future, merge with another information technology. One technology that has been proposed is computer graphics, which is enjoying a rapid growth in the business environment following the introduction of new designs of raster-scan terminals (see reference no. 23). Another technology that videotex might merge with, according to some experts, is teletex. Certainly the CCITT has made considerable efforts to promote common coding systems for teletex and videotex (see reference no. 24). A third suggestion is that, following the advent of photographic coding systems, videotex might merge with facsimile and slow-scan television (see reference no. 25).

In reality, it is too early to predict the other technologies (if any) that videotex might merge with in the future. What is clear, however, is that videotex will continue to develop. A Foundation report on the subject of videotex in 1985 may be as different from this report as this one is from its predecessor of 1978.

CONCLUSION

The main purpose of this report has been to provide Foundation members with advice about the role of videotex in relation to an organisation's information processing strategy. In attempting to meet that aim, the report has provided a review of the status of videotex in Europe and elsewhere in the world. It has explored the response to videotex from the residential and business communities, and it has placed that response in the context of alternative electronic media. In addition, the report has examined videotex system technologies, components and costs. Finally, it has presented the experiences of some pioneering business users of videotex, and has attempted to forecast the significant trends in the videotex industry during the decade of the 1980s.

The research team who prepared this report was drawn from the Butler Cox Videotex Research Unit. The report may well have provoked several questions, both strategic and detailed. Foundation members who wish to discuss any of the issues raised by this report, or who require further information about videotex, are invited to contact members of the research team.

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