

CHAPTER 10  
THE DYNAMICS OF SYSTEM DEVELOPMENT IN A  
COMPARATIVE PERSPECTIVE: INTERACTIVE VIDEOTEX IN  
GERMANY, FRANCE AND BRITAIN

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**1 Interactive videotex as a large technical system**

Interactive videotex belongs to that class of technical systems which are spatially extended and serve to transmit or transport given objects (electrical current, water, passengers, freight, information, etc.) through a network of appropriate channels. Though not a fully independent system since it is normally owned/operated by the telephone agencies and uses their networks for transmission, interactive videotex is more than just another service offered within an already existing technical system<sup>1</sup>. The existence of technical and social components which are specific to videotex make it meaningful to consider it as a large (socio-) technical system and to study its development. Interactive videotex is based on a special set of (linked) computers serving as data banks, it needs special terminal equipment (though *one* alternative is the TV screen connected to the telephone plus decoder), and there are special service providers distinct from the national PTT agency.

For a long time there were only three telecommunication networks: the telegraph and the telephone, both dating back to the last century, and the teletypewriter (Telex in Germany) introduced in the 1930s. This repertoire of telecommunication forms changed significantly only with the advent of microelectronics and the subsequent diffusion of computer technology into the telecommunications domain. Within a short period of time several new telecommunication forms emerged, such as facsimile transmission, data and text transmission systems.

Within this family of new telecommunication media videotex has an important place. It is a form of telecommunications in which not only text and data, but also pictures and graphics can be transmitted<sup>2</sup>. In contrast to the other new telecommunications media, videotex had

been conceived for mass utilization from the very start. It was understood, as Forester has put it, as "the spearhead of the information technology revolution that will transform the living room TV set into some kind of electronic supermarket"<sup>3</sup>. Since the late 1970s a number of industrially advanced countries have introduced videotex systems: The British Post Office introduced *Prestel* as a public telecommunication service in 1979<sup>4</sup>, France followed with her *Teletel* service in 1982<sup>5</sup>, and Germany officially introduced *Bildschirmtext* in the autumn of 1983<sup>6</sup>. These national developments are not only closely parallel, they have also taken place practically under our own eyes, which makes the introduction of videotex a particularly promising case for an internationally comparative study of the development of a large technical system. The research upon which we shall draw in this chapter has been carried out by three different national teams working in cooperation, and may be considered a brief and preliminary version of the full comparative study to be published jointly later on<sup>7</sup>.

## 2 The process of videotex introduction

The introduction of videotex is not only a technological innovation process and a systems development process, it is at the same time a policy process. Quite in contrast to the initial phase of electrical power or railroad system development, videotex has been planned as a nationwide system from the very beginning; a possible counterpart to the process of gradually linking up many smaller, local and/or regional power networks into one big system can therefore only be found at the international level, where attempts are presently made to establish links between various national videotex systems. The reason is obvious: in the three countries considered here, the existing state telephone monopoly offered the central government a focal role in the introduction of this new form of telecommunications from the start, and the existing communication network made the plan of a nationwide extension of the new service feasible. Accordingly, state agents and not private entrepreneurs were the dominant actors in this case of systems development. This might well make an important difference both with respect to features of the process, and to its outcome: In a centrally planned, top-down process of systems development, market

forces - profit motives as well as manifest consumer needs - could be of less importance at least in the initial phase, whereas political considerations should play a more prominent role. One consequence could be that the phase model developed by Thomas Hughes<sup>8</sup> turns out to be of less general applicability than he - and we - imagined at first.

If we look at the comparative chronology of videotex development presented in Table 1, it is possible to distinguish - in spite of all differences in detail - three phases in all countries: conception and formation of a policy, experimentation and consensus building, system consolidation and adaptation to usage trends.

*Phase 1:* Videotex is not a radically new technology, but rather a new combination and elaboration of existing technologies. The new medium emerged not as a technical invention, but as the concept of a new technically based public service, and hence within a policy context. Characteristically, therefore, initial technological development took place in a government laboratory, or the technology was taken over from another country as in the German case. This phase ends with a high-level political decision or even, as in Germany, a series of such decisions (to develop *Bildschirmtext* in 1976, to introduce it nationwide in 1981).

*Phase 2:* Experimentation and consensus building are parallel processes. Field experiments are made but some have served primarily consensus building functions. In no case did the final decision to introduce videotex actually depend on the results of a public trial. Conflict about and opposition to the planned introduction of videotex came to the fore as the field tests demonstrated possible modes of utilization. There is least evidence of opposition in the British case. In the two other countries, opposition died down after some appeasement measures, and even before that it never reached a particularly high intensity. Powerful organized interests such as the labor unions did not appear to be negatively affected to any significant degree, and while the print media did fear negative consequences, they had also good reasons not to oppose this technological development outright. It is interesting to note that videotex has not become a partisan political issue in any of the countries: though in all three cases important government changes took

Table 1: Comparative Chronology of Videotex Development

	France: Teletel	UK: Prestel	FRG: BTX
1971-74	Technological developments at the PTT's major research center CNET.	Technological developments leading to Prestel at the UK Post Office research laboratories; Post Office presents "the world's first videotex system" to the public.	
1975			Government advisory commission KiK recommends attention to videotex; Bundespost decides to develop videotex.
1976			Purchase of licence for the British Prestel by the DBP; BTX is shown at International Fair in Berlin
1977	DGT, the French PTT's telecommunication division, is alerted to telematics progress in other countries; prototype of Minitel is developed.	Prestel trials start; about 100 information providers.	
1978	Nora-Minc report published; Government decides experimental introduction of electronic telephone book and of experimental videotex service on adapted TVs.	Formation of Association of Viewdata Information Providers.	Establishment of a Working Group for BTX at the DBP with producers, IPs and users; non-public testing; controversy about legal status of BTX.
1979		Prestel is launched as a commercial service before the end of its market trial; TV manufacturers welcome the chance of a pre-developed service from the Post Office; Prestel-adapted TVs envisaged as main terminals.	
1980	First test of "annuaire électronique" at Saint Malo; DGT announces plan to introduce Teletel; core service will be annuaire électronique; private service providers may join.	Prestel marketing strategy shifts from "domestic" information services to professional services.	Start of field tests in Berlin and Düsseldorf-Neuß; 2000 private, 1000 professional users participate

France: Teletel	UK: Prestel	FRG: BTX
<p>1981 Opposition to telematics program especially from press; commission is set up to evaluate the telematics experience; DGT orders 300,000 terminals; Second test opens in the Rennes area; Field test is started Vélizy; New minister of PTT announces revised telematics program.</p>	<p>Prestel registers its 10 000th user nationwide; introduction of Prestel's messaging service; access to Prestel from seven countries becomes possible; travel agents become important user group.</p>	<p>Cabinet decides that BTX will be introduced; CEPT standard is adopted; IBM Germany gets commission for BTX systems equipment.</p>
<p>1982 Service starts in Nantes, Grenoble, and Strasbourg; nationwide professional Teletel started; another 300,000 terminals ordered.</p>	<p>British Telecom (BT) separated from the P.O.; creation of BT Enterprises of which Prestel becomes a part; Prestel opens gateway service permitting access to non-Prestel computers; launch of Telecom Gold (a competing service) within another division of BT.</p>	<p>PTT minister announces that DBP wants to develop BTX into a mass service.</p>
<p>1983 Regular service starts in "Picardie" and "Ile de France".</p>	<p>Reorientation of Prestel to the mass market with new transaction services Homelink (telebanking), and Micronet (service for home computer owners); BT reorganized; Prestel and Telecom Gold (a competing service) belong to the same division.</p>	<p>DBP fixes BTX charges; Convention concerning BTX signed by Federal Government and Länder; BTX officially inaugurated; six months late due to delays in system installation. New IBM system put into operation.</p>
<p>1984 Legal regulation of service provision; New tariff system "Kiosque".</p>	<p>Launch of the Prestel Education service; British Rail provides ticket booking service on Prestel.</p>	<p>Siemens' bitel (BTX-telephone) gets licensed; DBP develops new marketing strategy, oriented toward small businesses.</p>
<p>1986 Further simplification of access for service providers.</p>	<p>Telecom Gold has almost as many users as Prestel.</p>	<p>DBP launches program to lease BTX compact terminals (multitels); Electronic telephone book is introduced.</p>

place (Mrs. Thatcher came to office in 1979, Mitterand in 1981 and Kohl in 1982), this did not result in any radical changes with respect to videotex development. In the UK, however, the conservative liberalization policies had far-reaching long-term effects by leading to early and intense competition between *Prestel* and a growing number of similar services.

*Phase 3:* In this last phase, the planned nationwide system went step by step into routine operation. At this point, commercial service providers, a range of user groups, the associations which both formed, and - in the British case - competing technical systems entered the scene and shaped the growing system. In two of the three countries, expectations of mass utilization were disappointed, which led to the adaptive modification of some systems features and changes in marketing strategy. The process of videotex development is still incomplete; in none of the countries has a "momentum phase" been reached, and it is not even clear that this will generally happen. In fact, the monolithic videotex systems which we can today observe in France and Germany may disappear in an array of overlapping and competing services, as seems already to be happening in Britain.

After this brief introductory description we shall analyze the features of the developing videotex systems and their utilization in more detail. We shall then try to explain the observed differences, and will conclude with some reflections on features of the development process.

### 3 Cross-national differences in systems design and user patterns

The initial idea of videotex was to have low-cost and user-friendly access from user terminals to computer centers via data transmission facilities in telecommunication networks. There are several technical ways in which this idea can be realized. Thus, a videotex system may consist of a distributed network of independent computers, a hierarchy of computers with external data bases, or a mixture of both. A variety of options also exist with respect to the transmission technology and terminal configuration. Table 2 summarizes the major design alternatives,

but it also shows that all videotex systems are composed of certain basic elements: a host computer (or set of host computers), a network to access the host(s), a terminal on which the text is displayed, a display standard used to define the character set and the graphical signs communicated through the system, and a retrieval system facilitating the access to information also for non-specialists.

Table 2: Structural Elements of Videotex Systems and their Combination

Terminal Configur.	Modem	Telecom Networks	Databases	Standards
TV+Decoder PC+Hardware Dec. PC+Software Emul. Profess. Terminal Multifunctional Videotex Telephone	Modem	Telephone network and/or Special data network and/or Packet Switching network	Central and/or regional and/or local Computer centers and Databases	Prestel Antlope Telidon CEPT Captain (ASCII) .. .. etc.
Integrated Compact Terminal (French Minitel)				

An important feature of videotex is that it is not designed for one specific form of utilization only (as is the telegraph, for example). It is rather a communication infrastructure which permits a number of different forms of usage, depending on the terminals, display standards and network architecture which have been chosen. Possible applications range from message systems and information data bases to transaction services such as home banking, home shopping, etc. Applications also differ with respect to the target groups to which they are oriented and by which they are mainly used - private households, professionals or business firms.

In view of this plurality of design options it may not be surprising that the videotex systems developed in Great Britain, France, and Germany differ markedly from each other. This fact *per se* reflects an insight which today need no longer be argued at great length, i.e. that the design specifics of technical systems are shaped by social - economic, legal, political, cultural - factors. But where choice exists, the selection of specific alternatives needs to be explained, and this we set out to do in the following sections. In this section we shall

first describe the three different videotex systems and the - similarly different - utilization patterns which develop in response to the opportunity structures thus created.

### The technical system and its social organization

The technical and social structure of videotex systems may be described by specifying four core elements:

- the videotex actors, i.e. service providers, system operators, communication network providers and producers of hardware and software
- the technical architecture of the system: database arrangements and communication networks; the display standards; the typical user terminals; the methods and procedures of accessing the services and information (retrieval systems) etc.
- the organizational structure: rules and regulations which allocate tasks and responsibilities such as: system operation, hardware and software provision; administrative and control activities including passwords, user access, billing, central indexing, messaging and any form of user monitoring
- the regulatory norms: although sometimes difficult to distinguish from the previous category, the regulatory norms refer to rules related to externalities such as privacy and data protection, consumer protection and other "social control measures" in the innovation process.

### *Actors*

There is no basic difference between the three countries in this respect: In all countries the system operators are the PTTs, which also provide the communication networks. In all three countries there are private information or service providers, and in all three countries private enterprises produce the hardware and software components for the system. So far the actor systems look similar. However, the industrial producers in France come mainly from the telecommunications domain, whereas in Germany and Britain they initially came from the consumer electronics sector.



### *The technical structure*

As outlined above, on a rather simplified level the technical systems can be described by specifying the terminal configuration, communication networks, database arrangements, and display standard. For the communication network there is only a limited room for choice. The existing videotex systems typically involve at least two network linkages: one between the user and the videotex service centers, the other among the service centers. In all three countries the telephone network is used for the first linkage. For the second linkage France chose a special solution because it uses the general public packet switching network for this purpose, while the two other countries use a special data network.

Regarding the data base arrangements, the German and British systems are rather close: both have very centralized network architectures. The *Prestel* system maintains a master database at a centralized update center and replicated databases in a handful of information retrieval centers. The data base is therefore replicated, rather than distributed, across a number of machines. This creates a demand for large storage capacities<sup>9</sup>. In the original version of *Prestel* there was no gateway for connecting remote databases to the system. Consequently it was not possible to implement true interactive applications such as, for instance, telebanking. This facility was created when the *Prestel* system was modified in 1982 and the German "remote database network" concept was applied.

The core of the German system is a highly complex hierarchical system of databases and computer networks which was designed and implemented by IBM. A recent study of an international consulting agency (Butler Cox) called the German system the most complex and sophisticated system in the world<sup>10</sup>. The central strategy of IBM was to create one single big database and network management center together with a stratum of regional databases in which only the most frequently used information pages are stored. This favors updating from one single center and reduces the overall storage capacity required<sup>11</sup>. Another special feature of the German network architecture is the possibility to connect remote databases to the system via the packet switching network. For this connection, however, a very complicated communications protocol is required in addition to the well-known X.25 standard, which makes access rather difficult and costly for information providers.

In contrast to the videotex systems outlined above, the French system has no central database and no specific network infrastructure beyond the already existing public telecommunication networks: The French *Teletel* consists of a large number of autonomous, privately-owned computers (servers) which are interconnected by the public packet switching network and can be accessed by the telephone network. The most striking difference between *Teletel* and the other systems, therefore, is its complete decentralization. Unlike the British and the German systems, *Teletel* has no central database provided by the systems operator. Subscribers are connected via the telephone network to a switching computer which works as an access point of the public packet switching network *Transpac*. This data network then links the subscriber to a remote database, which is chosen by the special code of a service. This systems architecture has far-ranging implications for the flexibility of adapting to the users' changing needs and for the financial access barrier for service providers.

A significant difference between *Bildschirmtext*, *Prestel* and *Teletel* exists also within the (typical) terminal configuration and with respect to the display standard. In Germany and Britain it was initially thought that the television set enhanced with a special decoder should be used as a display device. The television industry was expected to exploit this chance for new markets and to develop cheap decoders which would lead to low financial access barriers into the system. Since in both countries the "rush" of private households has not yet taken place, today's typical terminals are not television sets. The most widely used terminals today seem to be professional terminals, which are manufactured exclusively for using *Prestel* or *Bildschirmtext*, or personal computers - now that relatively inexpensive microcomputers are generally available. The French terminal configuration differs completely from that of the Germans and the British. The typical *Teletel* terminal is the *Minitel* - a very simple compact terminal equipped with a small monochrome monitor, a modem, a decoder and an alphanumeric keyboard.

Further differences between the three systems exist in the display standards. Despite their seemingly marginal importance, these technical aspects have an important impact on the complexity of the hardware and software requirements for the decoder. The basic differences are represented in Table 3. As this table shows, the *Prestel* standard is the lowest - because compatibility with the British broadcast-videotext played an important role in its design when it was developed in the

1970s. However, the impact of the screen standard on speed and storage seemed to be also an important criterion in the British Prestel design.

The most complex display standard was developed at the CEPT level. This standard is used within the German system<sup>1,2</sup>. Although this is a European norm, standardized at the *Conférence européenne des postes et des télécommunications*, it was strongly influenced by the German Bundespost. The functional requirements for the hard- or software which are implied in this standard are so intricate and complex that even a multinational corporation such as Philips was unable for several years to realize these specifications in an Integrated Circuit (IC) without major difficulties.

Table 3: Technical Differences in Display and Transmission

Specifications	Prestel	Teletel	CEPT (Btx)
Resolution	6x10	8x10	12x10
Transmission Speed	1200/75 bit/s	1200/75 bit/s	1200/75 bit/s
Page Format	24x40	25x40	24x40
Characters	95	127	335
Graphic Symbols	64	64	151
DRCS*	-	-	94
Colors	8	8	4096
Coding	7-bit	7-bit	8-bit

\*A DRCS is a character whose shape is freely definable.

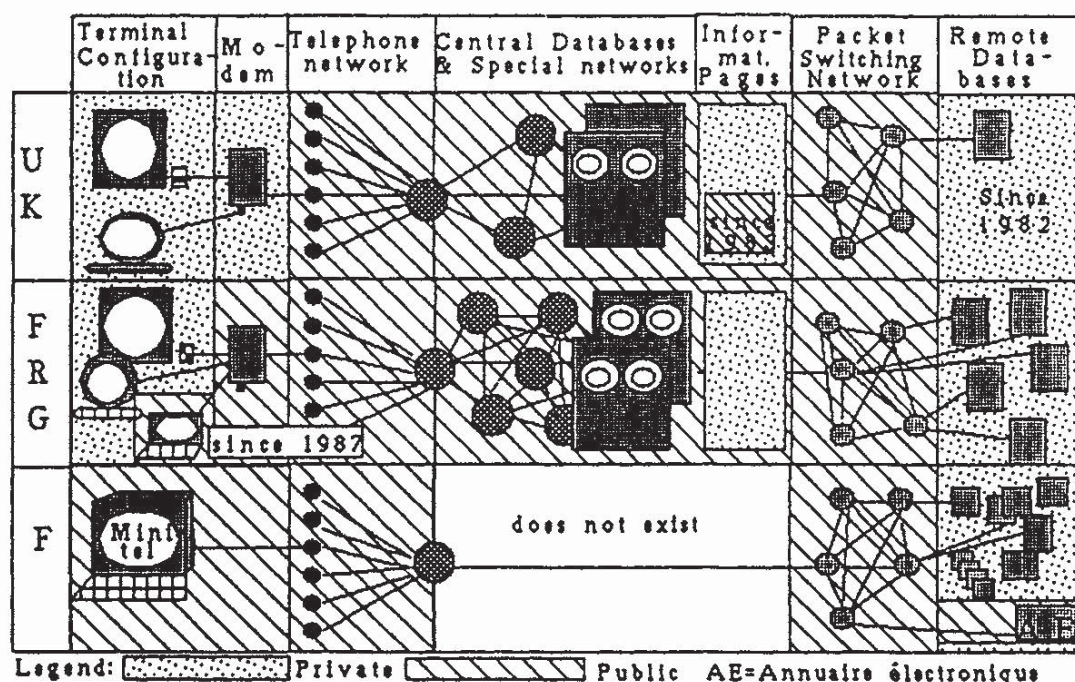
The French system steers a reasonable middle course between "technical performance" or sophistication on the one hand and "financial burden" on the other. The *Minitel* has another great advantage: Its screen resolution is based on 8x10 matrices and the 7-bit coding which are well known in the home and personal computer domain. The French display standard is thus more closely related to common computer technology. As a consequence, it is technically less difficult to implement the ASCII and 24x80 character mode (the normal professional database standard outside the videotex) in the French *Minitel* than in the other systems. The adaptation of *Bildschirmtext* to normal

database standards is technically far more difficult to realize. Although *Prestel* with its 6x10 resolution is also incompatible with the home and personal computer standard, the low complexity of its standard nevertheless renders similar solutions easier. On the British computer software market there are now many terminal emulation and communication programs available in which the *Prestel* facility is implemented together with other communication protocols.

### Organizational structure

One basic organizational feature of videotex is the distribution of the responsibilities for the system's operation among different actors, e.g. are the system's operators private or public - or both? In this respect there are important differences between the three systems.

Figure 1: Technical and Organizational Structures



Because of the telecommunications monopoly which existed during system design in all three countries<sup>13</sup>, the postal organizations generally provide the networks and switching facilities and, thus, the basic infrastructure of videotex. Nevertheless, a major difference between

the French and the other two systems is that, in addition to controlling the telecommunication network, the French state also controls the terminal sector and, with the electronic telephone book service, one important service. Therefore, within the French configuration at least for one application the whole videotex *filière* is controlled by one single actor: the French PTT. This solution could be called a "state solution". However, the service sector beyond the electronic telephone book is a complete market solution in France - a market which quickly passed its critical mass and is currently growing very fast.

The German and the British systems have adopted a different distribution of tasks between private and public actors: in both countries the PTTs are only responsible for the storage and transmission of information, the information providers are responsible for information contents, and the terminal market is under the control of private firms.

A further element of the social organization of videotex systems are the regulations concerning the financial contributions of information providers and users. In Table 4 the user tariffs and user tariff structures of the three systems are outlined. As can be seen, the British and German systems have a similar tariffication policy, whereas the French system is unique in the sense that there are no standing charges at all and all charges are time based. The most important French tariff subsystem is the *kiosque*: its time charges cover at the same time transport *and* service costs.

### *Regulatory norms*

The major regulatory aspects of videotex concern equity of access, consumer protection, and data protection. Comparatively speaking, the German *Bildschirmtext* is the most heavily regulated videotex system. The German terminal market is subject to a dense network of regulatory constraints, especially licensing procedures. To give an example: In the interest of consumer protection, the German system requires the *Bildschirmtext* user who calls an information page for which there is a charge to confirm his intention of looking at the chosen page by typing the corresponding numerical code of "yes". In sharp contrast, data and consumer protection is almost non-existent in France, and access for information providers is practically unconstrained<sup>14</sup>. This may create a number of problems in the future, but it undoubtedly has

Table 4: Tariffs and Tariff Structures in Comparison

	Prestel	Teletel	BTX
Standing Charge	residential users £6.50 per quarter (~6.50 DM/month) business users £18 per quarter (~18 DM/month)	no standing charges	8 DM/month
Time charge	Telephone charges 51p/h during the cheap rate period (~1.50 DM/h) Special Prestel Charge during telephone peak hours £3.60/h (~10.80 DM/h)	all teletel charges are time based - electronic telephone book: the first 3 minutes are free; then for every 2 minutes 0.75 FF; for the other services there are 3 different tariffs: - "3613": 0.75 FF every 6 minutes - "3614": 0.75 FF every 2 minutes the service provider then sets an additional time charge. - "3615" (Kiosque-System): 0.75FF every 45 seconds. This covers transport and service costs (~24 DM/h)*.	telephone charges: every 8 minutes 0.23 DM (during cheap rate periods every 12 minutes 0.23 DM). (~ 1.70 DM p/h)
Frame Charges	frame charges are set by the information providers; most pages are free.	no frame charges; all charges are time based	prices for frames are set by the information providers; however, there is a maximum of 9.99 DM per frame.

\* since the end of 1987 there are several additional, more differentiated tariff categories within the Kiosque

the advantage of facilitating and smoothing the videotex usage both for service providers and for users.

### Evolution dynamics, diffusion and user patterns

The various features of the socio-technical system "videotex" constitute an opportunity structure with incentive and disincentive effects for different groups of potential users, whose reactions in turn constitute an opportunity structure for service providers and hard- and software producers. The interdependence between provision and utilization operates as a positive feedback loop which can generate dynamic growth, but which may also lead to a downward spiral of decreasing utilization and decreasing service quality, unless countermeasures are adopted.

The difference in the growth dynamics of the three videotex systems can be described with the aid of various time series. The development of the number of user terminals may indicate how the systems grow and how the videotex services find acceptance among users. The figures on the growth of information or service providers may give an impression of the development of the new "telematic market" (databases, communication services, transaction services etc.). Table 5 and especially Figure 2 show a striking difference between the French, German and British videotex systems with respect to the number of terminals connected to each system. Whereas the British and German figures with a more or less stable growth rate look rather similar, the diffusion of French videotex terminals has grown exponentially during the last three years. Compared to the British and German "failures" or "flops"<sup>15</sup>, the French, indeed, are "riding a videotex craze"<sup>16</sup>, and French PTT managers are peddling their "success story" internationally<sup>17</sup>. The growth and structure of service providers or information providers in the three countries cannot be compared directly because the systems are differently structured. Their evolution over time, however, may give a rough picture of the different growth dynamics in the three countries, in particular in the service market. Whereas the number of information providers in Germany and Britain is more or less stagnating or even decreasing, the number of services in the French system is growing very fast.

Table 5: Diffusion Patterns in Videotex: France, Britain and the FRG

	1982	1983	1984	1985	1986	1987
<b>France: Teletel</b>						
Subscribers (end of year)	-	120,000	530,000	1,300,000	2,200,500	2,791,000*
Services (end of year)	-	-	840	2,070	4,150	5,662*
Hours of connection (mill.)**	-	-	-	1.0	2.5	4.7*
<b>Britain: Prestel</b>						
Subscribers	19,850	38,000	48,000	63,000	70,000	76,000
Information providers	1,003	1,356	1,365	-	-	1,252*
Number of frames	41,050	277,100	330,000	320,000	300,000	310,000
Frame calls per week (mill.)	-	-	3.4	7.6	9.1	9.1
<b>FR Germany: Btx</b>						
Subscribers	-	10,155	21,319	38,894	58,365	83,633
Information providers***	-	2,740	3,099	4,043	3,528	3,416
Remote databases	-	0	37	151	218	248
Number of frames	-	378,000	521,783	762,673	589,330	610,704
Number of calls (mill.)**	-	0.1	0.3	0.5	1.1	1.9

\* Data refer to June 1987

\*\* per month

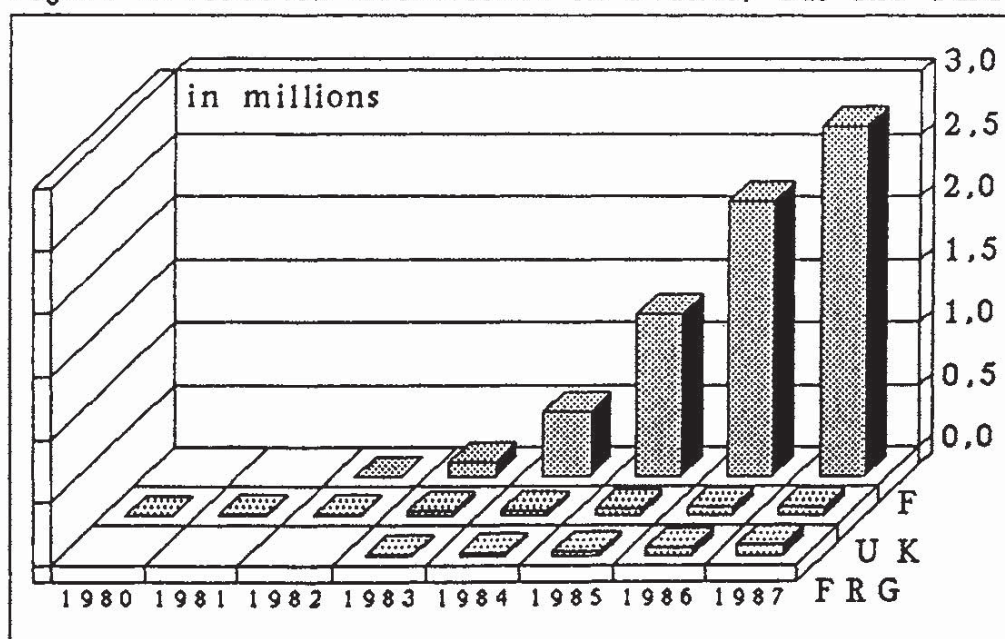
\*\*\* Sub-information providers are included



Against this background it is clear that the French videotex system *Teletel* has had the most spectacular development. By the end of 1987 almost 3 million *Minitels* had been distributed by the French DGT. The number of accessible services tripled in the course of two years, from about 2000 services to about 6000. This growth continues - every day several new services are created. A large part of them are offered within the tariff system called *kiosque* which provides the easiest and most flexible access through its time-based billing system. The services within the *kiosque* are in the greatest demand. From the 3.5 million hours of connection in the year 1986 (not counting the electronic telephone book), about 2.5 million were within this category.<sup>18</sup> The structure of the service providers is quite diversified, but services oriented toward the general public are in the majority.

The overwhelming share of use of the French system is non-professional in nature; professional demand, nevertheless, is also quite strong. There are data which show that of the 1,300,000 Minitel terminals distributed by December 1985, nearly 40% were installed in firms.<sup>19</sup> Other figures similarly suggest that *Teletel* has established a strong foothold in the business community.<sup>20</sup> Contrasting sharply with the French *Teletel*, the terminal diffusion and the applications of British and German videotex are largely limited to professional users - this is evident also with respect to the service structure (cf. Table 6).

Figure 2: Videotex Subscribers in France, UK and FRG



Although for Germany there are no reliable figures about the distribution of terminals among professional and residential users, it has been estimated that only about 20% are privately used.<sup>21</sup> This is more or less also true for Britain's *Prestel*. Although British Telecom as *Prestel's* operator publishes exact figures on the distribution of *Prestel* subscribers between the private and professional sector, (according to these data, in summer 1987 about 39% were used at home<sup>22</sup>), these figures seem to be unreliable. Insiders say that a large share of the terminals which have been classified as private are in fact used for professional purposes<sup>23</sup>.

The slow growth of subscribers and the marked reluctance of private households to use and pay for the services is accompanied by a relative quiescence in the arena of information and service providers. In Britain and in Germany there are only very few services which are profitable. The overwhelming majority of service providers are making losses and are only staying in the system for strategic purposes. It is still expected

Table 6: The Service Structure (in percent)\*

Branches	UK ('82)	FRG ('85)	France ('86)
Press, Media, Communication	14	11	35
Other "general public" services	-	-	29
Tourism	32	4	6
Trade, Electronics	7	18	-
Finance	7	24	12
General industry	-	5	9
Consulting firms	13	15	-
Public institutions	11	14	6
Education	6	-	3
Miscellaneous	10	9	-

\* These figures are only roughly comparable, since the statistics - esp. F compared with FRG and GB - work with different categories; updated figures for the UK are not available.

Sources: Minitel Guide des Services; ISI 1987; Btx Praxis (1985)12; Butler Cox (1981/1982)

that - in the long run - a market for telematic services will evolve.<sup>24</sup> Especially in Germany this has led many business users to use videotex as in-house networks and as cheap data communication facility between firms.

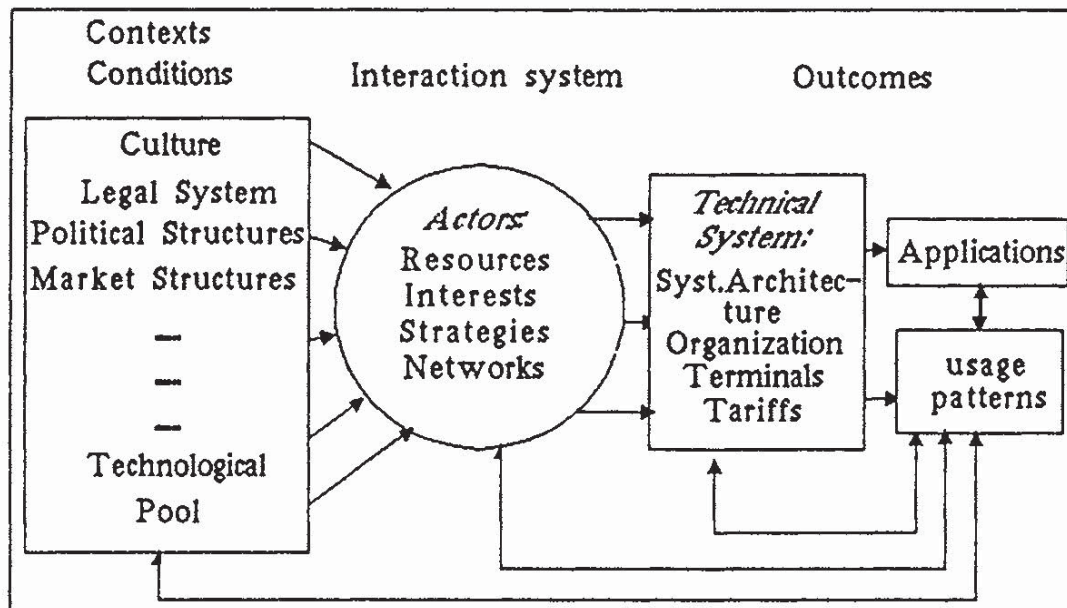
In conclusion, only in France has the evolution, diffusion and usage of videotex fulfilled the optimistic initial expectations. In contrast to Germany and Britain, France has succeeded in penetrating also the private household area with this technology. In doing so, it has created a very dynamic market for telematic services. That this "success" was possible is undoubtedly a function of deliberate choices in the technical and organizational design of the system, but it must also be related to contextual and situational factors which explain why some choices were possible and others were not.

#### **4 Explaining the cross-national differences: actor strategies, technical opportunity structures and institutional arrangements**

In trying to account for the cross-national differences in videotex development outlined in the previous sections, our framework of analysis starts with a structured system of actors who, under given environmental conditions such as institutional and resource constraints, shape a technical system. This system in turn creates an opportunity structure for a set of applications. Realized applications then shape the usage patterns.

A central presupposition of this approach is that differently structured actor systems together with different actor strategies lead to different technical systems configurations. Actor systems and strategies must be explained within the context of particular economic, cultural and legal arrangements which enable some actors to act or "think" in a certain way. The structural constraints under which they operate should not be seen as deterministic effects of external variables, i.e. economic, institutional and cultural factors, nor should these factors be conceived as being static over time. The constraints are transmitted and reproduced in each action situation, and they can vary as the result of voluntaristic utilization and extension of the room for maneuver of the actors involved. Our basic explanatory idea is therefore that country differences in contextual conditions and in the actor systems

Figure 3: Determinants of the Development of Technical Systems



involved in videotex development can explain the different national technical system configurations and the application (usage) patterns of the videotex technology.

Core factors explaining the observed differences between the three videotex systems are found (1) in the general *introduction strategies* (or policies) adopted by the three PTTs, and (2) in a number of *key decisions in the technical and organizational design* of the videotex systems. Whereas the introduction policy refers to procedural decisions, cooperation strategies of the dominant actors and the distribution of competences between private and public actors, the design decisions are more related to the specific attributes of the technical and organizational system configuration itself.

### Introduction strategies

The introduction strategy for *Bildschirmtext* and for *Prestel* follows the logic of an infrastructure policy orientation, mediated by the self-interest of the PTTs. In both countries, the main motivation of the PTTs was to create a new growth field within the telecommunications domain because telephone diffusion had reached its saturation level. In addition, they hoped to stimulate the use of the telephone network,

especially in off-peak times. In Germany the Bundespost was also looking for investment opportunities for its profits, which the Federal Government otherwise might have absorbed into its general budget.

A major determinant in the British and the German introduction strategy was the terminal technology available. As terminal display devices were still expensive during the 1970s and the PTTs were looking for a new mass market, the revolutionary idea was to use the home TV, with which 90% of the private households were already equipped, with a special adapter. This technological strategy implied that the PTTs would have to rely on the consumer electronic industry instead of entering the terminal market themselves. Given the difficulties which this industry had with Japanese imports, it was supposed that the firms would be interested in the new market.

A further element of the introduction policy in Britain and in Germany was the "common carrier" idea, which meant that the PTTs would provide only the technical infrastructure for storage and transmission. Consequently, the development of the videotex service domain was left to be driven by market dynamics. This meant that the growth of such a market depended very much on the number of service subscribers. Both these countries thus faced a critical threshold problem which led to later strategic modifications. British Telecom as *Prestel* operator gave up the "common carrier" concept in 1983/84 and is now offering services, too, while in Germany emphasis was shifted from domestic to professional users.

The French strategy of videotex introduction differed from that of Germany and Britain in two important respects. First, the introduction policy was not based on a mere telecommunications infrastructure policy primarily oriented toward assumed societal needs, but on a voluntaristic sector-specific industrial policy which aimed to create new markets in order to develop industry. Secondly, videotex was not primarily introduced to create a new telecommunication service, but was "sold" as an internal postal rationalization project, in which the rather costly operator-assisted telephone information and the printed telephone book was supposed to be replaced by the *annuaire électronique*. This justified, in fact even required the distribution of *Teletel* terminals free of charge. In following this strategy, France had learned especially from the British mistakes. It is striking how clearly these lessons were spelled out by Roy D. Bright, a *Teletel* manager who was a former *Prestel* manager, in 1982. Under the subtitle "the videotex

learning curve", Bright spelled out the following points, that could be learned from the British experience: "(i) The reluctance of the mass market user to bear a major proportion of the cost of the service. (ii) The lack of commitment from TV manufacturers while the market is still in its infancy resulting in high terminal costs. (iii) The danger in creating a centralized system which cannot readily adapt to the various needs of different 'service providers'."<sup>25</sup>

Based on these insights, the French PTT decided to assure a fast diffusion of videotex terminals, and the easiest way to do this was their provision by the state free of charge. In connection with this, the French PTT offered with the very smoothly functioning electronic directory service at least one strong user incentive. Private operators were then free to create additional, independent services. Following this strategy, *Minitels* were distributed from 1982 on in all French departments. The assumption was that these investments would be written off within 7 years merely by the increase of traffic within the telecommunication networks. This strategy succeeded at least in one respect: with a huge investive advance, the French obviously passed the critical threshold and, in the meantime, created a very dynamic market for communications services and information.

The French videotex introduction strategy resembled very much the traditional French mercantilistic orientation where the control of industry is used for the achievement of political goals.<sup>26</sup> In fact, within the tradition of the French "grands projets" the *annuaire électronique* was used as an instrument of a general industrial policy, which was geared to challenge the American hegemony in the field of information technology<sup>27</sup>. In this connection the French policy makers even have developed the strategic concept of the *filière électronique*, which essentially tries to identify strategic sectors within the system of technological and sectoral interdependencies. The key idea there is to develop weak sectors with the aid of closely connected strong sectors.<sup>28</sup>

### Choices in systems design

The introduction strategy of the French planners goes a long way toward explaining the current success of *Teletel*. Nevertheless, there are also some technical and organizational decisions which, although

sometimes tightly coupled with the overall French introduction strategy, can be treated as separate choices. In the technical and organizational systems design the French government made several strategic decisions which had important consequences for videotex utilization:

- The first was the technological choice to produce a very simple terminal which would be easy to handle, and cheap.
- The second choice was to establish a highly decentralized and flexible network structure, which could easily be adapted to changing user needs.
- The third choice was to create a very unbureaucratic billing system, which, on the one hand, unburdened the service providers from costly administrative work and, on the other hand, enabled a free user access without any formal administrative entrance barriers.

The French choice of a simple terminal may have been dictated primarily by financial considerations, as terminals were to be paid for by the state itself. But it is not only the low financial access barrier to the user which promoted videotex growth in France. With its simple and commonly used communication procedures (X.25) and its simple display standard, the French system also made it easier (and less expensive) to develop truly interactive services.

The decentralized French network concept reinforces these effects. The absence of a central database in France stimulated the development of transaction services as service providers and users interacted directly in any case. In Britain it took years before it became possible to connect external computers to *Prestel*. In Germany, the possibility to do so existed from the beginning, but it is still an expensive and complicated alternative to the use of the central databases with their limited interactivity.

The flexibility of the French decentralized system also facilitates service innovations. An example for this is the invention and development of interpersonal communication services. What today is called a *messagerie* was invented as a result of a system failure in a videotex field trial in Strasbourg. Once the technical possibility of anonymous communication was discovered, the idea was taken up by some service providers, who were able to implement this development in their own host computer. The readiness of the French PTT to permit this new form of communication then led to applications which the system builder had not thought of.

The French decentralized technostructure also much better fits the requirements of updating. A number of field trials and many market research studies have shown that the strength of electronic communication lies in providing *up-to-date information* - and being continuously up-to-date depends on a direct and easy access of service providers to the host. It is interesting that only the French system really supports applications where up-dating is no important financial and technical problem, whereas in *Bildschirmtext* and *Prestel* such applications are technically much more cumbersome. In consequence, the majority of information providers use the support of consulting agencies specialized in such services. This makes updating in *Bildschirmtext* relatively expensive in terms of time and money. As a result, only a very small group of information providers update their pages continuously, which lowers their attractiveness in many cases<sup>29</sup>.

Given the intentions to create a mass service, the German and British choice of a centralized solution seems paradoxical - but the choice is understandable within the context in which it was made. It was a time in which microcomputers did not exist and electronic data processing still had high financial entrance barriers. Especially interested groups representing small business therefore supported the Bundespost in the establishment of a centralized public database. It was thought that if a public storage facility did not exist, only big firms could establish remote databases and small business would be excluded from the information market. But as the central database turns out to be a major hindrance for the provision of truly interactive services and to be too costly with respect to updating procedures, it is now in effect the centralized system which excludes the small information providers from key applications of videotex.

Many observers consider the French *kiosque*-billing system the most important decision in French videotex system design. It is generally believed that the dramatic increase in videotex traffic was due to the introduction of the *kiosque* facility for general public-oriented services in 1984<sup>30</sup>. The completely decentralized French network structure originally implied that each information provider would have to create his own billing system. Except for the free services the user would then have been constrained to subscribe to each individual service separately. But with the *kiosque* system a general time-based billing system was introduced which saved information providers these administrative efforts. In the *kiosque* system each service is accessible without pass-



word and costs the user about 1 franc per minute. The French PTT collects the charges with the normal telephone bill, keeps 3/8 of the total charge for transport, and sends 5/8 to the service provider. Interestingly, many users prefer to access services via *kiosque*, even if the same services are cheaper to access by subscription. The success of this billing system may largely be explained by the fact that it responds to new trends in consumer behavior: the aversion to constraints which are created by formalities of subscription and the interest in freely passing from one application to another.<sup>31</sup>

The design of the German and British billing systems are very much determined by the "paging concept" coupled with the common carrier idea. The basic idea there is that the costs of operating the system should be covered by standing charges for users and storage charges for information providers. The users then have to pay the information providers separately - page for page - unless a service is offered free. In this system, the user is constrained to consider the "price-for-service relation" continuously as he uses different videotex services.

A factor which is related to the organization of the system and which hindered the dynamic growth of innovative applications in the German system has been the regulatory overprotection of *Bildschirmtext*. Although this was not a deliberate choice of a single actor but the joint result of the actions of a set of actors, it has to be considered a strategic decision, too. As the Bundespost initially relied on the TV as the display terminal, *Bildschirmtext* was conceived by the public as a new electronic mass medium. This triggered the intervention of media policy actors who wanted to incorporate this service into their domain of regulatory responsibility. *Bildschirmtext* thus became the most intensely regulated videotex service. The relatively low regulation of the French system is an important factor which should not be underestimated when explaining the dynamic growth of the French service market and the rapid diffusion in the private sector.

### Environmental conditions and institutional contexts

We have shown that success and failure of the different videotex systems have to be explained to a large extent by strategic decisions of the core actors on the one hand, and by the resulting technologic of each system on the other hand. These explanations, however, are

incomplete. The strategic actors' decisions cannot be taken for granted. Strategies themselves are embedded in a structural and institutional environment. It is necessary therefore to understand under which circumstances and in which context these decisions were feasible, and which other options were systematically ruled out. It is therefore necessary to look at the particular institutional and cultural background of each decision.

The most important question would be why the Germans and British did not apply the same introduction strategy as the French when they launched their videotex systems. Here the built-in restriction in the concept to use the existing TV terminal is very important. The result was that the British and the Germans from the very beginning relied on the consumer electronics industry, an industry in which public purchasing played only a marginal role. The French strategy, in contrast, was dominantly based on the telecommunications industry. Since the telecommunications monopoly in this domain implied a long tradition in public purchasing with a well established network of "court suppliers", the *Minitel* strategy was just the continuation of traditional business.

Further pressure against a telecommunications based introduction strategy existed in Germany because since the late 1970s there was a growing resistance on industry's part (especially by the computer industry) with regard to the PTT monopoly in the terminal market. It would have been unthinkable that the PTT would have been allowed to provide the *Bildschirmtext* terminals following the old telephone strategy where markets had been reserved for some court suppliers.

The choice between telecommunications industry and electronics industry had important consequences. Both sectors have completely different market structures and are organized in different ways. In all three countries - at least until 1984 - the telecommunications industry was highly concentrated and protected from external pressure; procurement relationships were stable and restricted to a small set of traditional court suppliers. The telecommunications market showed a "clientelistic structure". The consumer electronics industry in contrast is very dynamic and open to foreign competition. Even though this sector is also relatively concentrated and penetrated by conglomerate corporate structures, the international openness creates a highly competitive market. In contrast to Britain and Germany, whose PTTs had to negotiate with more than a dozen TV manufacturers, the French administration was able to procure its *Minitels* from a small group of

traditional telecommunications firms and was therefore able to exploit large "economies of scale". The Germans and the British also had to deal with the fact that the TV manufacturers were less interested in producing "external decoders" to adapt existing TV sets to videotex than in fostering the TV replacement cycle with videotex, understandably so in a saturated color TV market<sup>32</sup>. British and German TV manufacturers consequently were doing little research and development<sup>33</sup>. Also, too many competitors in a sunrise market prohibited the expected price decrease for terminal equipment. This is still considered to be the major hindrance to the videotex boom. This "crowding effect" is further increased by the merging of home telematics with conventional office information and communication systems. One consequence is that computer firms are becoming more and more interested in the terminal market. The intrusion of the dynamism inherent in the computer sectors increased the openness and competition in the German and British terminal markets even more. In such a context, it was hardly possible to apply the traditional telecommunications terminal provision strategy. But situations and contexts can change. The fact that the German PTT, in a strategic reorientation with its "Multitel Program", is now trying to follow the French strategy, and that industry is not protesting is tacit recognition that it has failed to produce a functioning market. Interestingly, even the deregulated British Telecom now intends to "go Minitel"<sup>34</sup>.

The French videotex strategy is closely linked to its deliberate reliance on the telecommunications industry. At the same time, the French strategy is also very much related to the French historical tradition and institutional framework. The governmental planning system, headed by the *Commissariat Général du Plan*, has long been a key instrument for channelling large capital investment into selected economic sectors.<sup>35</sup> Especially in telecommunications, this is supported by close links between the Ministry of PTT and the telecommunications and electronics industries. In addition, there are also close organizational links between the French PTT and the *Ministère de l'industrie*. The PTT has an office of industrial policy which can be used for coordination with the more general industrial policy of the government<sup>36</sup>.

Important for the explanation of the French strategy is also the special situation of the French electronics industry in the 1970s. Beginning in the late 1960s, France tried to bridge the "technological gap" to US computer industry. But the great *Plan Calcul* ended unsuccessfully

in 1974. The French telecommunications sector, in contrast, was remarkably successful during the 1970s. Thanks to public procurement policies guaranteeing long-term orders and adequate research funds, the French telecommunications industry has been able to develop very advanced technologies and modernize the French telephone network in a very short period. In the course of one decade, the French PTT quadrupled the number of telephones from 5 million in 1970 to 20 million in 1980 and succeeded in developing the world's first fully-digital exchange and packet switching network. With the *plan télématique* the French government tried to repeat this success in the new domain of "telematics". The aim was to use the telecommunications industry as a "lever" to create a telematic sunrise industry.

In Britain and Germany, where state intervention has always been a rather contentious issue, PTT procurement policies certainly shape industrial decisions as well. But in both countries the PTTs have never been used as policy instruments in order to pursue general industrial policy objectives. In Germany there is no political infrastructure for instrumentalizing the Bundespost for industrial policy. Institutionally and financially, the Bundespost is an almost completely autonomous organization, and its investment strategies and goals are derived from its own preferences and objectives. Key decisions made when *Bildschirmtext* was introduced are good illustrations of this general orientation. The first decision was to buy the *Prestel* system for field trials. At this time, the German military firm Dornier, with the aid of the German Ministry of Research and Technology, was developing its own videotex prototype. Surprisingly, the Bundespost did not even take this national videotex project into account and bought the foreign *Prestel* system. The other decision was to charge IBM with developing and implementing the public service centers. IBM won a public tender, although SEL, a traditional German "court supplier", had also made an offer. Within the French industrial policy orientation, such a decision would hardly have been possible.

Compared with France, there is certainly nothing like the French "industrial planning system" in Germany and Britain. Industrial development in both countries is much more an effect of market forces and the strategic decisions of the big firms than of state policies. Although there are some sporadic examples of high-tech industrial policy (e.g. the British teletext initiative<sup>37</sup>) and there is much governmental rhetoric in this domain<sup>38</sup>, consistent sector-oriented state intervention in

Germany and Britain exists only in "sunset" sectors. But even in the German steel sector this interventionism is currently hotly debated. Such restrictions for consistent and strategic state interventionism follow from the hegemony of a "liberal market ideology" in both countries. Closely related to this is the "balanced budget" philosophy, which meant for *Bildschirmtext* and *Prestel* that both systems were designed to be financially self-supporting.

Another strategic decision which has to be explained is why the Germans have chosen such a complex display standard. Although in the face of a primary orientation toward the home market the preference for high graphic capabilities seems understandable, it is still hard to explain why the Bundespost pushed for such an overcomplex standard. Foreign observers do so by reference to German techno-perfectionism. There seems to exist a techno-culture in Germany which emphasizes "functional sophistication", technical finesse and "over-engineering" regardless of the technical and financial burden which this involves. The French and the British seem to be much more pragmatic in this respect.

The overregulation in the German case finally is linked to the federal institutional structure, which distributes regulative jurisdictions among different actors. In Germany, mass communication or "distributed communication" (radio and TV) - as opposed to individual communication such as the telephone, etc. - falls under the jurisdiction of the federal states (the *Länder*). Individual communication, in contrast, is subject to central government control. Since from its early beginnings *Bildschirmtext* had been thought of as an electronic newspaper, the regulatory arena in Germany quickly widened to include the *Länder*. It is this arena extension which involved the media policy makers, who then proceeded to use their regulatory powers extensively. In the convention finally concluded between the federal government and the *Länder*, the issue of regulatory jurisdiction found a compromise solution, but it is quite likely that more extensive regulation of *Bildschirmtext* than might have resulted from a more centralized institutional structure has been the price.

## 5 Conclusion: Planned system development and the role of demand

The preceding comparison of videotex development in three countries has shown how the legal, political, and economic context shapes the strategies of major actors, who jointly determine the design of the evolving socio-technical system. In this concluding section we want to draw attention to some aspects of systems development considered as a collective decision process unfolding over time.

Videotex development in the three countries studied has dominantly been a top-down process: it emerged not "spontaneously", but was - in the three countries to a different degree - centrally planned.

This has a number of important implications. To begin with, large, spatially extended videotex systems do not seem to emerge where the state (or a national telecommunications monopoly) does not assume the role of system builder; this is shown by the lack of videotex development in the US<sup>39</sup>. This is, however, not a technical problem: Given the present state of technological development, videotex is not a "natural monopoly" and hence a collective good that *must* be centrally provided. If existing transmission networks can be used (leased, rented), videotex provision is not even prohibitively expensive. But from the very beginning there seemed to be no widespread demand among potential users for this particular service (or rather, bundle of information, transaction, and communication services). Some critics have even called videotex "a solution looking for a problem".<sup>40</sup> In any case, "market pull" has played only a minor role in this technological innovation process. This, however, does not mean that "technology push" can explain videotex development - the explanation rather has to be sought in the political field.

If the political or state actors did not initially *respond* to a perceived public demand, they still needed to *create* it for the new system to be viable. It is essentially the way in which the system has been set up and the way in which the demand has been created that explains the difference between France and the other countries. Whereas Germany and Britain used an incentive concept, France used a voluntaristic Trojan horse strategy, attempting to create an initial imperative need by introducing *Teletel* as a substitute for an earlier and essential product, the telephone directory. For this purpose France established a system which was fully integrated vertically and in which the French PTT controlled each component - from the terminal to the directory

service. In Germany and Britain only the networks and databases were provided centrally - the growth of the terminal market and the information market has been left to market forces. So far, these forces have not been strong enough to overcome by themselves the critical threshold in the growth process. Certainly, in France the market of additional telematic services around the *annuaire électronique* is guided by the invisible hand, too, but on the basis of an already existing terminal park (beyond the threshold level) and a flexible and smoothly functioning computer network. In Britain and Germany the users still seem to show no vivid demand. But demand depends also on the quality of the services offered. The quality of services - hence indirectly the investment in services - depends in turn on the existing terminal park which defines the boundaries of this new market. Following the German and British introduction strategy, the users in these countries have to buy their terminals on a market where the costs are still high since the small volume and the large number of competitors prevent economies of scale. In Germany and in Britain there is, in fact, a double "chicken-egg dilemma" by which the service market *and* the terminal market are blocked and both blockages are closely related.

All three governments started from similar assumptions regarding the latent demands that might be stimulated by the new service. It is fascinating to observe how these "expectations of latent demand" were formed, partly disappointed, and revised. Initially, videotex was perceived primarily as a cheap and easy means of access to a large variety of useful information - information that could be highly specialized, detailed, and was always up to date. This functional image is reflected in the terminal configuration which was initially designed for accessing databanks with simple numeric keyboards. In addition, videotex was seen to provide small users with access to data-processing facilities - at a time when access to large computer centers was prohibitively expensive and difficult for small business users and non-computer specialists. Finally, it was thought that videotex might save time by making teleshopping, telebanking, and similar transactions possible. Thus, videotex appeared as a "cold" medium, an instrument of rationalization. This functional image reflects the logic of engineers, but also the logic of producers who are in the information and service market (e. g. newspapers, banks, travel agents, and mail order houses), and want to give "value for money" to their exacting clients.

Correspondingly, private households as well as professionals and firms were addressed as target groups because each of them was perceived as potentially having some of these information and transaction needs. Nobody seems to have doubted that professionals and small firms would quickly avail themselves of the new service. It appeared more difficult to open up the mass market of private households. Therefore the system builders in all three countries paid attention to this particular target group in their campaigns, field tests, and demonstrations of the new service. But only in France did the decision makers adopt a strategy based on a realistic assessment of the obstacles to a speedy diffusion in the private household sector. In Britain and Germany, on the other hand, we observe redefinitions of videotex as a medium for professional and business use as initial expectations of domestic utilization were disappointed.

The process of videotex development has not yet run its full course. Accordingly it is too early yet to tell whether existing differences among the three national videotex systems will persist or will rather be attenuated and disappear in the future. One reason for the latter to happen might be cross-national learning, where Britain and Germany could try to imitate the more successful French model. But at least in Britain, this is not what seems to be happening. The gradual shift of the German and British videotex systems toward professional applications is probably supporting a trend for videotex to lose its distinct identity. Initially seen as the prelude of the "home information society", videotex is today merging with conventional office information and communication systems. In the context of an ever growing number of competing services the distinct identity of *Prestel* is presently eroded and it becomes just one more brand among many offering comparable products. This process is largely the consequence of British deregulation and privatization policy, a road which France actually began to follow and Germany might eventually follow - even if with less determination.

An important factor facilitating the development in Britain is the growing diversification in the terminal field, where the spread of relatively cheap personal computers not only in offices, but also in the home makes recourse to the adapted TV set less and less necessary for using videotex. This holds equally for Germany and may soon even supersede not only the simple specialized videotex terminal but also the relatively "unintelligent" compact terminals as the French *Minitel* and the German *Bitel* or *Multitel*. More is at stake than the



disappearance of a difference in the videotex terminals used in France on the one hand, and Britain and Germany on the other. The multi-functional home computer should facilitate access to many different information, transaction, and communication services (as it evidently does in Britain). It might in fact ease the growth of competing services so that in the end the bundle of functions that videotex is today might either be untied, or integrated into an even more comprehensive interactive telecommunications system.

#### Notes

- 1 This would be true for broadcast videotext. This text information service is offered and transmitted by TV stations and generally received on the (adapted) TV screen.
- 2 In view of the existing design alternatives, a general definition of videotex is rather difficult. One definition was elaborated within the "International Telegraph and Telephone Consultative Committee" (CCITT). According to this organization, a videotex system should have the following essential characteristics: "1) information is generally in an alphanumeric and/or pictorial form; 2) information is stored in a data base; 3) information is transmitted between the data base and users by telecommunication networks; 4) displayable information is presented on a suitably modified television receiver or other visual display device; 5) access is under the user's direct or indirect control; 6) the service provides facilities for users to create and modify information in the data bases; 8) the service provides data base management facilities which allow information providers to create, maintain and manage data bases and to manage closed user group facilities." CCITT, *Telematic Services: Operations and Quality of Service (Recommendations F.160-F.350)*. Geneva: CCITT 1985, p. 88.
- 3 Tom Forester, *High Tech Society: The Story of the Information Technology Revolution*. Oxford: Blackwell, 1987, p. 126; Sam Fedida and Rex Malik, *The Viewdata Revolution*. London: Associated Business Press, 1979, p. 7: "Viewdata (...) will be one of the key systems of the 'silicon revolution', which in turn is one of the cornerstones of 'The Information Society'".
- 4 For some descriptions of viewdata see: James Martin, *Viewdata and the Information Society*. Englewood Cliffs/N.J.: Prentice-Hall, 1982. Margaret Bruce, *British Telecom's Prestel. Material for Open University Course T362 (Design and Innovation)*. Milton Keynes: Open University Press, 1986. Rex Winsbury (ed.), *Viewdata in Action: A Comparative Study of Prestel*. London: McGraw-Hill, 1981.
- 5 For descriptions of Teletel see Claire Ancelin and Marie Marchand, *Le Videotex: Contribution aux débats sur la télématique*. Paris: Masson, 1984. *La télématique grand public: rapports de la commission de la télématique au ministre des PTT*.

- Paris: La Documentation Française, 1986. Marie Marchand (ed.), *Le paradis informationnels: Du minitel aux services de communication du futur*. Paris: Masson, 1987. Marie Marchand, *La grande aventure du minitel*. Paris: Larousse, 1987. For a rather technical description of Teletel see Arun Ray-Barman, *L'ère du videotex: Les outils de l'entreprise*. Paris: Editests, 1985.
- 6 For a general description Dieter Lazak, *Bildschirmtext: Technische Leistung und wirtschaftliche Anwendung neuer Kommunikationstechnik*. München: CW-Publikationen, 1984.
  - 7 The joint project, which began in the early part of 1986, is scheduled to last three years, and is being carried out by research teams based at the Max-Planck-Institut für Gesellschaftsforschung (MPI), the Centre Nationale de la Recherche Scientifique (CNRS) and the Science Policy Research Unit (SPRU). The teams are being financed by, respectively, the Deutsche Forschungsgemeinschaft and the Max-Planck-Gesellschaft, the French Administration, and the Leverhulme Trust. In France the work is carried out by Jean-Marie Charon and Thierry Vedel; in Britain by Ian Miles and Graham Thomas. We thank our colleagues for providing us with valuable information and research papers. The present paper profited from unpublished papers from and discussions with them: Jean-Marie Charon, *Les acteurs du videotex français (1976-1986)*, Unpublished manuscript (ADI/Cristal:86/C03650), Paris, 1987. Graham Thomas, *Configuration, Regulation and Outline of Strategies*, Unpublished working paper, Cologne, October 1986. Thierry Vedel, *Le programme télématique français: l'apparition d'un nouveau medium*, Unpublished working paper, March 1987.
  - 8 Thomas Hughes, *Networks of Power: Electrification in Western Society 1880-1930*. Baltimore/Md., London: Johns Hopkins University Press, 1983.
  - 9 A large part of this capacity is wasted because only a small part of information pages account for the overall use of the system. In PRESTEL only 100 pages account for about 25% of all information calls; 1,000 pages for 45% and 30,000 pages for 90%.
  - 10 For Butler Cox cf. *BTX-Aktuell* (1987)7, p. 32-33.
  - 11 The regional data bases have to store only a part of the total pages, and data transmission between regional centers is only necessary for pages which are seldom called. For a description of the IBM system, see: Ekhard Ording and Hans Hölsken, "Die neue BTX-Zentralentechnik: Das Konzept der IBM Deutschland GmbH und seine Realisierung", *Fernmeldepraxis* 12(1984), p. 480-488; see also Lazak 1984, op. cit.
  - 12 For a detailed description of the German standard see Lazak 1984, op. cit.
  - 13 British Telecom was privatized in 1984; at this time all relevant facets of the British Prestel had been decided.
  - 14 Thierry Vedel (1987 op. cit.) writes about French regulation: "Depuis le 1er janvier 1986, l'offre de services télématiques sur le réseau de télécommunication est libre. La seule contrainte à laquelle est soumise une société prestataire de services télématiques est une déclaration préalable permettant d'identifier ses responsables légaux et la vocation du service. En outre une consultation télématique est considérée comme une communication privée et son contenu ne peut être censuré. Ce libéralisme - inspiré du modèle réglementaire de la presse écrite - a permis la création d'une multitude de sociétés de services télématiques ...".
  - 15 See for example Eric Arnold, "Information Technology in the Home: The Failure of Prestel", in Niels Bjorn-Anderson, Michael Earl, Olav Holst and Enid Mumford (eds.), *Information Society: For Richer, For Poorer*. Amsterdam: North-Holland Publishing Company, 1982. For a comparative view see also: Eric Arnold and

- Godefroy Dang-Nguyen, "Videotex: much noise about nothing?" in Margaret Sharp (ed.), *Europe and the New Technologies*. London: Frances Pinter, 1983.
- 16 Tom Forester 1987, op. cit.
  - 17 See Luc Brunet, "Minitel: A Success Story" in W. Kaiser (ed.), *Telematik (Telematica Kongreßband II)*. München: Fischer, 1986.
  - 18 Cf. *Lettre de Teletel*, hors serie (1986)3; *Listel: Repertoire des services Teletel*, (January 1987)5.
  - 19 Cf. *Bureau et Informatique* (April 1986)104.
  - 20 From the use patterns of Teletel tariff system Teletel 1, which is used almost exclusively for professional services, one can conclude that Teletel has established itself in the professional world: from 226,000 hours of connection in Teletel 1 in January 1986 to 284,000 hours in December 1986 (cf. *Lettres de Teletel* 1986, op. cit.).
  - 21 A market research study conducted at the end of 1985 concluded that 8,000 of the 30,000 users at that time were private. This figure, however, does not seem to be very reliable (cf. *Btx Praxis* (1986)1). A very recent survey indicates that only 20% of BTX terminals are privately used, 57% are professionally used and 23% are used for professional and private purposes. (*BTX-Praxis* (1988)5).
  - 22 The figures are from the Prestel frame 65659a of July-September 1986.
  - 23 This is undoubtedly supported by the tariff structure of Prestel, where business users have to pay more standing charges than private users.
  - 24 According to a research study conducted by the Fraunhofer-Institut für Systemtechnik und Innovation, almost 80% of all service providers say that there would be no application which is economically profitable: ISI (Fraunhofer-Institut für Systemtechnik und Innovationsforschung), "Sozialhumane Auswirkungen von Bildschirmtext in ausgewählten Branchen". Bericht an das WIK. Karlsruhe, 1987.
  - 25 Roy D. Bright, "Videotex - What Comes Next" in Diebold (ed.), *Bildschirmtext-Kongreß 1982 - Proceedings*. Frankfurt/M.: Diebold, 1982.
  - 26 As Zysman put it: ".. the French are pursuing political goals in industrial development" and the French state is "accustomed to imposing its will on the marketplace." John Zysman, "Between the market and the state: dilemmas of French policy for the electronics industry", *Research Policy* 3(1975), pp. 312-336.
  - 27 In the design of this strategy the report of Simon Nora and Alain Minc (*L'informatisation de la société. Rapport à M. le Président de la République*. Paris: Édition du Seuil, 1978) played an important role.
  - 28 Lorenzi describes this basic idea as follows: "L'idée, héritée du rapport Nora-Minc, est simple. En électronique, il y a trois secteurs de base qui de plus en plus s'interpénètrent. Et il y a donc trois axes pour attaquer un même objectif: la société informationnelle de demain. La France est mal située sur deux d'entre eux: l'informatique (suprématie américaine) et les biens audio-visuels (suprématie japonaise); restent les télécommunications, c'est-à-dire les réseaux de transmission des informations." Jean-Hervé Lorenzi "Analyse d'un plan industriel au travers du concept de filière", *Annales des Mines* (January 1980), p. 80.
  - 29 See ISI 1987, op. cit., p. 413 f.
  - 30 See for example Jerome Aumente, *New Electronic Pathways: Videotex, Teletext and Online Databases*. Newbury Park/Calif.: Sage, 1987, p. 35.
  - 31 For this argument see Bernard Corbineau, *Espace politique et nouvelles technologies de l'information*, Paper presented to the ECPR Joint Session of Workshops, Amsterdam, April 10-15, 1987, p. 3.
  - 32 For the strategy of the UK TV industry see Colin Tipping, "Viewdata and the television industry" in Winsbury 1981, op. cit.

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- 33 In Britain and in Germany, the consumer electronics industry seemed to be interested only in passive protection. For an active development policy the market seemed to be too insecure. The behavior of the British TV industry may also be explained by the fact that this industry funnelled its research and development funds in the development of the broadcast videotex TV terminals (Teletext) and Prestel consequently was given only subordinate priority.
  - 34 Cf. the title of an article in *Btx Praxis* (1988)2, p. 41: "British Telecom schreibt Billig-Terminal aus: UK goes Minitel".
  - 35 For a comparative view of the French industrial policy see Diana Green, "Promoting the Industries of the Future: The Search for an Industrial Strategy in Britain and France", *Journal of Public Policy* 1(1981)3, pp. 333-51. Diana Green, "Strategic Management and the State" in Kenneth Dyson and Stephen Wilks (eds.), *Industrial Crisis: A Comparative Study of the State and Industry*. London: Blackwell, 1983. Christian Stoffaës, "French Industrial Strategy in Sunrise Sectors" in Alexis Jacquemin (ed.), *European Industry: Public Policy and Corporate Strategy*. Clarendon Press: Oxford, 1984.
  - 36 See Zysman 1975, *op. cit.*, p. 320. See also: Rex Malik, "The French keep to their grand strategie", *Intermedia* 11(1982)3, p. 12.
  - 37 See Alan Cawson, *The Teletext Initiative in Britain: The Anatomy of Successful Neo-Corporatist Policy-Making*, Paper presented at the ECPR workshop on Meso-Corporatism, Amsterdam, April 1987.
  - 38 For a comparative view of governmental programs in the communications domain, see Peter Humphreys, "Legitimizing the Communications Revolution: Governments, Parties and Trade Unions in Britain, France and West Germany" in Kenneth Dyson and Peter Humphreys (eds.), *The Politics of the Communications Revolution in Western Europe*. London: Frank Cass, 1986, pp. 163-194.
  - 39 For a recent overview on the U.S. videotex development see James Miller and Thierry Vedel, *The Introduction of Videotex: The Role of the State in Canada, France and the U.S.*, Unpublished paper, 1987. See also John Tydeman et. al., *Teletext and Videotex in the United States: Market Potential, Technology, Public Policy Issues*. New York: McGraw-Hill, 1982.
  - 40 See Forester 1987, *op. cit.*, p. 126.