

The Dynamics of Videotex Development in Britain, France and Germany: A Cross-national Comparison

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The paper shows why the three major European videotex programs (Prestel in the UK, Télétel in France and Bildschirmtext in the FRG), although similar in their initial objectives, have led to markedly contrasting results. Each country, based on its particular macro context (technological environment, government-industry relations, political structures, etc.), pursued a different 'implantation strategy', made up of specific clusters of technical and organizational choices. These decisions structured the subsequent development and produced different dynamics: critical mass problems, specific technical frictions and particular political issues. Three strategic choices have been made of particular importance: (1) the technical design and mode of terminal diffusion; (2) the systems architecture; and (3) the mode of service supply.

Introduction

Only one decade ago videotex — the access to computers via telephone networks by means of user-friendly terminals — was a central topic on the policy of agenda of telecommunications. Many countries started pilot projects and planned the introduction of such services.¹ At international conferences and exhibitions videotex systems seemed to be the showpieces of national PTTs. Some authors — among them the leading theoretician of the information society, Daniel Bell (1979) — even conceived this technology as being revolutionary as the steam engine in the industrial revolution (Fedida and Malik, 1979: 1) as a 'spearhead' of the information society. Today, however, it is rather quiet around videotex, and after a number of national 'trial and errors' the initial enthusiasts have been disenchanted. Only France, with its famous Télétel, provides the big exception. Although the

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British Prestel and German Bildschirmtext occupy the second and third position in the international rank order, they are considered to be commercial failures. It is the goal of this paper to describe this extremely uneven development and to identify the key factors explaining the different outcomes.

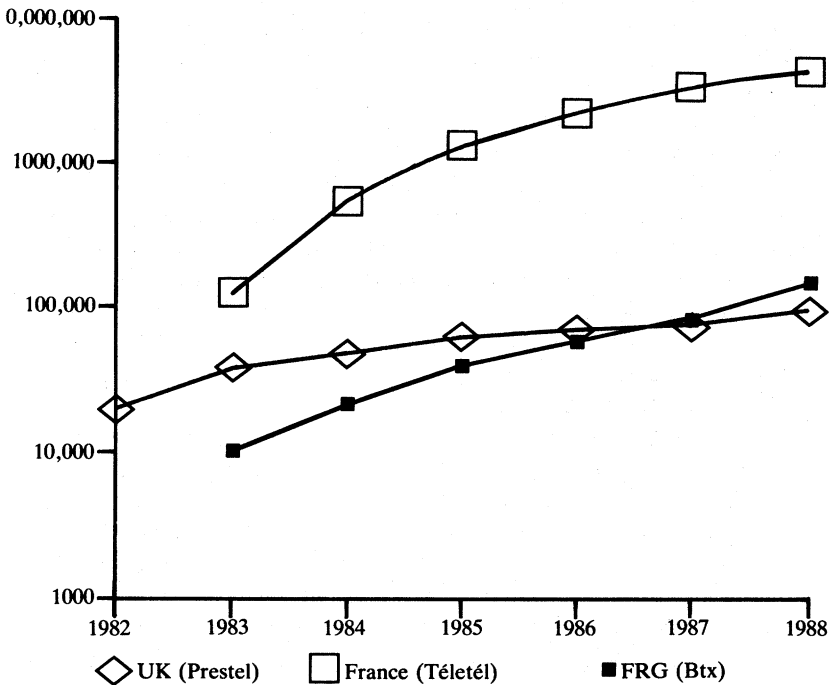
Prestel, Télétel, Bildschirmtext: Similar Objectives and Different Results

The most striking difference between Bildschirmtext, Prestel and Télétel lies in the overall growth in the numbers of users connected to the systems. France has now more than 5 million subscribers and has penetrated widely the residential sphere. In Germany with its 250,000 and Britain with about 150,000 subscribers,² videotex is still restricted to special user communities. Also the explosive growth of the French videotex services leaves the others far behind. In contrast, the videotex information business in Germany and Britain is stagnating or even declining.³ The size of the user community is still below the critical mass necessary for most residential services to be profitable. In Germany and Britain only very specialized business services pay — the majority of information providers are suffering losses and are only staying in the system for strategic purposes: to gain experience, to advertise, or because they expect that — in the long run — a market for telematic services will emerge.

These enormous differences are surprising — since there were no crucial differences between the technical⁴ and financial capabilities of the three countries during the start-up phase of the three systems. Nor did the demand side show any crucial differences between the three countries. Nowhere did the new technology emerge as a fulfilment of existing needs; it was seen rather as a new opportunity to be created by combining existing technologies for which 'needs' still had to be invented. In all three countries the programmes were initiated and promoted by the national PTTs which were in no way reacting to a 'market pull'. On the contrary, they had to mobilize the various 'functional partners' necessary for this undertaking. In France and Germany conflicts over the possible harmful effects of these technologies even forced the PTTs to justify the videotex programs before the public.

If variations in *latent demand* for new communications services were to explain this extremely uneven development then Britain, not France, being the most advanced country with respect to all

FIGURE 1
Videotex Subscribers in Germany, France and the UK



indicators measuring the 'information society', would have had the head start. Its service sector had a bigger weight within the overall economy, and its technical communications infrastructure measured in telephone and TV density was more encompassing than in the other two countries.⁵ At the end of the 1970s the British were also more advanced in the technical development of computer data transmission, and when the PC revolution emerged, the British were much more quickly penetrated than France and Germany.

The French success and the British and German failures cannot be attributed to variations in revealed or latent demand but rather in the differing abilities of the three videotex promoters to *create demand through specific strategies in technical design and coordinated market penetration*. In this article we argue that the different results cannot be explained unless videotex development

is considered as the result of technical *and* social processes, shaped by specific socio-political environments specific to each country. Through these processes, the initial technological capacities and policy orientations were translated and organized in particular socio-technical configurations which, in the end, left more or less room for a demand to appear (Vedel, 1989).

At the end of the 1970s the three countries had similar goals or motivations for getting involved in interactive videotex. The national PTTs, representing the old model in telecommunications (Noam, 1987; Dang Nguyen, 1985), were looking for new services to increase the traffic in their existing telecommunication networks and for new follow-up products for the time when the telephone expansion would reach its saturation point. A further concern was — but not necessarily always within the PTTs — the support of domestic industry, either in the field of consumer electronics, or in the field of telecommunications.

The objective in all three countries was *to reach the mass market*. The systems should thus be user-friendly and easy to integrate into homes. Early advertising showed Prestel and Bildschirmtext as being used by the whole family and the Minitel was displayed in a family home next to the telephone and a newspaper. It was assumed that there would be a huge latent demand. These expectations, however, were not based upon profound marketing surveys or scientific investigations. Field trials were oriented more toward technical tests or to the legitimization of programs which were already underway. Despite these similarities, Britain and Germany on the one hand, and France on the other, followed quite different paths and yielded very different outcomes.

Britain was the first country to introduce videotex as a new telecom service.⁶ Its basic idea was developed in the early 1970s by researchers at the BPO research centre. The first public presentation took place in 1975. A field trial began in 1978 with about 1400 participants, and the official service started as 'Prestel' in autumn 1979 in London. Nationwide operation was established in March 1980. However, the expected market pull did not materialize; at the end of 1981 Prestel had only a tenth of the users predicted for that time. The major reasons for this failure were generally seen in late delivery and high prices of TV terminals, unco-ordinated marketing and the bad quality of the databases. In 1982 the new British Telecom (BT) reacted with a cutback of the overall system and a redefinition of its target markets. It also

partly abandoned the common carrier approach and became a service provider itself. At the same time Prestel began to feel the effect of the liberalization of British telecommunications. Increasing competition from similar services led to a relative stagnation and finally to a 'disappearance' of the distinct identity of Prestel within the new data services of British Telecom.

In France the DGT had also promoted research activities on the possibility of data transmission over telephone lines since the early 1970s, but more concrete plans were not made until the mid-1970s.⁷ In 1978, the French government responded to the famous Nora/Minc report by setting up a 'plan télématique' which called for the creation of an electronic telephone directory by the DGT and the distribution of 'dumb' terminals free to every telephone user. Between 1978 and 1981 several field trials took place, and in 1982 a communications law with special reference to videotex was passed. Emerging conflicts with the press were accommodated by giving the printed press privileged access to the new medium. In 1983 the electronic directory made its debut, and from 1984 on the DGT distributed terminals region by region, creating within a few years a user community with more than five million participants. This growth led in turn to an increase in services which numbered more than 10,000 in 1989.

West Germany introduced its videotex service 'Bildschirmtext' between 1975 and 1983.⁸ The first official demonstration of the system took place in 1977. Restricted trials involving the German PTT, certain equipment producers and about one hundred information providers followed between 1978 and 1980. Two large field trials conducted from 1981 to 1983 aimed not only at technical experimentation but also at the anticipation of possible social and economic consequences of Bildschirmtext. The service was to be officially launched in autumn 1983, but because of technical problems the new system start was delayed for almost a year. In 1984 there were great expectations, and it was believed that at the end of the decade several million subscribers would be connected to this service. However, only a few — mainly professional — users joined the system. The number of information providers stagnated and even began to decline while large capacities in the public database remain unused. In 1985 and 1986 the German Bundespost tried to give a second push to the system by a reorientation of its marketing to professional users and by itself intervening in the terminal market with simple compact terminals

(Multitels). Despite these measures BTX grew only slowly and had 250,000 subscribers at the end of 1990.

Our leading question in the following sections is why the implementation and outcomes of the three national videotex programs were so different. Our explanation will, according to the principle of parsimony, try to reduce the number of independent variables, and thus concentrate only on *key factors* explaining crucial differences.

Our analysis, based on the constrained choice approach, conceives videotex development as the (partly) unintended collective result of purposeful individual action which is constrained and shaped by environmental factors. Videotex development is the result of choices of many actors, by which specific technologies are combined (techno-structure) and co-operation between the different partners is established (governance-structure). One might be tempted to view the French success as being a function of certain deliberate choices and wonder why the other countries did not choose the same strategies? However, such a pure 'decisional approach' would be rather meaningless without taking into account the special conditions, motives, resources and perceptions in the different countries which, in addition, changed over time. A successful strategy thus may less reflect ingenious spirit and particular innovativeness than the unique feature of each national setting at a specific conjuncture. From this perspective, it can be easily understood that identical choices could not have been made in the three countries. Options which were possible, or even 'logical', in one country were not feasible in another. Even where similar technical or organizational choices might have been possible, it is not sure that they would have resulted in the same consequences.

Three Countries and Two Paths: Strategy and Structure of Videotex Development

The key factors explaining the French success and the relative failure of the other system can be summarized under four headings: (1) the particular *terminal design* and the *strategy of terminal provision*; (2) the differences in *systems architecture* and other related aspects of *service provision*; (3) the variation between the *billing systems*; and, finally, (4) the differences in the *regulatory constraints* or *political support* of each system.

Terminal Design and Terminal Provision

One of the central factors explaining the difference in growth is the difference between the typical *terminal configurations* and the *mode of terminal provision*. In Germany and Britain it was initially thought that the TV set, enhanced with a special decoder, would be the typical display device — an ingenious idea in the mid-1970s. Inexpensive alternative technologies were not yet available and almost 80 percent of households owned a TV set. The combination of two common household items, the telephone and the TV, was expected to allow easy access to a mass market. This choice implied reliance on the TV industry. It was thought that such an agreement between PTT and the TV industry would offer the two parties mutual advantages. The PTT would share the costs and burden of terminal development while the TV industry would gain new market opportunities in a difficult period.

In contrast to the German or British approach, the French adopted very early on the principle of a dedicated compact terminal, whose diffusion was completely under the PTT's control. The set-up of a videotex infrastructure was combined with a rationalization project in which the printed telephone directory was to be replaced by an electronic phone book. As a substitute for the telephone book, French telephone subscribers were to receive a simple and integrated compact terminal free of charge from their PTT, which could also be used for other information services.⁹ As mentioned, this approach was at the same time a sub-element of a large industrial policy strategy, and both, industrial policy aspects and the DGT-internal rationalization strategy, legitimized the mobilization of large financial resources.

The state-led terminal 'implantation' explains a great deal of the difference in the number of terminals connected to each system. That this strategy not only was feasible but also 'made sense' in France may be explained by several factors. Firstly, the French TV electronic industry was not only weak, it was also more accustomed to state procurement than to developing new markets itself. Secondly, there were conflicts between French telecommunications and broadcasting: the TV set option in France would have obliged the DGT to co-operate with TDF, the TV broadcasting agency, but the traditional rivalry between the two organizations made such a co-operation hardly conceivable. The third factor was undoubtedly the high reputation the DGT gained during the 1970s

by modernizing the French telephone system — compared with the increasingly challenged PTTs in Britain and Germany.

The most crucial point in the French strategy was certainly the *free distribution of terminals*. But this approach is not as radical as it may appear. It is essentially the replication of the PTT's old practice of including the telephone set rental in the telephone subscription. The uniqueness of the French approach is that the DGT still could follow the old practice — while their British and German counterparts were unable to do the same. This question is less interesting in the British case than in the German environment. In Britain, where the system started in the 1970s while there was still a great illusion of a huge latent demand, the technical options were much narrower than in the German case, and pressures for liberalization were put on the policy agenda much earlier than in Germany.

Launching its Bildschirmtext later than the others in 1983/84, the Bundespost had more technical options and more information than its British counterpart. In Germany, however, there emerged a compelling idea that a much more sophisticated display standard (compared with the British 'LEGO' graphics!) and a more decentralized system would make the services more acceptable for private households. The more sophisticated TV set option, however, turned out to be more cumbersome and much more expensive than initially envisioned, and the TV industry failed to produce the adapted TV sets at acceptable prices. Many additional technical snags in the terminal business and the system architecture actually resulted from the overly sophisticated and complex display standard.

To sum up, the British and German PTTs, by relying on the consumer electronic industry, could not control the marketing and the distribution of the terminals. Mostly left to a fragmented marketplace, the production of terminals could not benefit from economies of scale which are possible in huge public procurement.¹⁰ Britain and Germany were thus unable to provide inexpensive terminals — the most crucial precondition for private households to join the system.

Systems Architecture and Mode of Service Provision

Another crucial element in the French success is its highly decentralized network and systems architecture in comparison with the more centralized structures in Britain and Germany.

Rather than providing central storage facilities the French videotex system has installed a number of network access points to allow access to the public packet-switched network 'Transpac' to the electronic phone book and a variety of almost exclusively private databases. Except in its role as electronic directory provider, the French DGT acts as a mere common carrier and restricts itself to the provision of switching, transmission and administration capacities. The storage of information and service programs is left to the service providers. The DGT's control over this service sector is limited to the licensing of access to the special billing system, called *Kiosque*. This decentralization has contributed to a much speedier rate of service innovation and 'creativity' than in centralized systems. Allowing the IPs to choose whatever software they like ensures that only those services prevail which prove to be the most attractive.

In Britain and Germany more centralized solutions had been established. Based on the technology of the 1970s, Prestel started with a system architecture where all information was stored in BPO-operated central computers, each responsible for a given region. The disadvantages of this type of architecture (such as the limitation to mere information retrieval) were quickly discovered. This was the reason why the Bundespost decided on a mixture between a centralized and a decentralized approach used in France. The German objective was also to reduce the costs of storage capacity and the costs of traffic between central databases and users. Going beyond the early Prestel system, it also envisaged offering gateways for the connection of external computers for more interactive applications. In fact, the IBM system established by 1984 allowed this interconnection of the central database system with external computers, but under rather costly conditions. The IBM design was oriented to its closed network tradition, and the communications protocols for the interconnection of external computers became almost prohibitively expensive.

Political factors also played a role in the shaping of the German systems architecture. Within the dispute over the legal regulation (media policy, data protection, etc.) of videotex services between the Bundespost and the German Länder governments (constituent states) a centralized architecture had some advantages. As the nature of Bildschirmtext was not clearly established (mass media or telecommunications service), the centralized concept suited the Bundespost much better, because it made it much less likely that

the central public databases of Bildschirmtext would come under the control of the federal states. In addition, business associations claimed that only a system with central storage facilities provided by the Bundespost would provide equal access for information providers, while a decentralized system would have favoured the biggest and wealthiest ones, who would have been able to devote more resources to their own data bases.

Billing and Tariff Systems

Another important feature of information provision in videotex systems is the billing and tariff systems. In all three countries, users are billed for the services by the PTTs, which in turn transfer portions of the collected revenues to the information services providers. However, three main differences in the way these systems are structured were significantly to affect the formation of the demand for new services. In Britain and Germany, the access to videotex services is subject to a standing charge (subscription to the system) independent of the use of the services; in France, in contrast, it is free.¹¹ In Télétel all service charges are time-based. In BTX only the cost of transmission (local calls) depends on time, while the fee of videotex services are page-based. The users are billed for each page they request to see, with the exception of toll-free pages paid for by the providers. In Germany, the information providers have been able to apply a wide range of tariffs from the very beginning.¹² With Prestel there are separate charges for the telephone call, for time spent using the system and, in some cases, extra charges for using specific services which may take the form of extra subscriptions, extra time charges or charges for accessing certain pages.

The differences between France and the other countries reflect the overall systems design with respect to two different logics: a *logic of traffic* versus a *logic of storage*. In the latter countries, because the PTTs operate central host computers, they have greater incentives to recoup their installation and operating costs from standing charges, page charges and also fees from the information providers. The French DGT, in contrast, acts primarily (with the exception of the electronic phone directory) as a carrier and leaves the set-up of the host computers to private information providers. In this position it is clearly more oriented toward an increase in traffic which is reflected in the tariff system.

An important advantage of the French billing system is that it is

easier to understand and to use than the British and German systems. It is not necessary to become a subscriber. Because a constant price is charged for a wide variety of services, users are encouraged to browse in the system. Thus it is easier to become familiar with numerous services.¹³ Many observers consider the French *kiosque* billing system to be one of the core decisions in French videotex design, and it is generally believed that the dramatic increase in videotex traffic was a result of the introduction of the *kiosque* facility for general public-oriented services in 1984.

In contrast, German or British billing systems are less transparent and more cumbersome. Users are forced to make buying decisions frequently: they have to decide whether they want to subscribe to the whole system and they are repeatedly constrained by having to consider the price-for-service-relation for each page. In addition, consumer-protection regulations such as the necessity to confirm the request of particular pages in Germany, have added to the cumbersomeness of the system.

Decentralization, transparency and simplicity gave the Télétel a high flexibility to adapt smoothly to unanticipated usage patterns. In 1982/83, it was widely accepted among French experts that the natural market for videotex would be professional. It took only one year to discover that this belief was wrong, and the system was flexible enough to adapt toward this reorientation. The success of the French 'messageries' — which were so essential to the take off of Télétel — has to be found in this technical and organizational flexibility — and not in the French culture or mentality. When messageries did not develop to this extent in Germany or in the UK it is not because of a lack of taste for these 'divertissements', but rather because the technical conditions do not really permit on-line communication from user to user — or make it too clumsy. Of course, this has to do with the way the videotex developers anticipated the use of their systems. Interestingly, in France the communication from point to point had not initially been foreseen, but was invented by the users (Charon, 1987b). The success of messageries has to be related to the flexibility of the Télétel system.

Regulations and Political Control

Further sources of differences between the three videotex systems are legal and political regulations which are not without consequences for the systems' attractiveness for the users. In this respect

TABLE 1
Differences in Strategy and Structure

	Britain	France	West-Germany
Terminal configuration	adapted TV set provided by TV industry and to be bought by subscr.	simple dedicated compact terminal (Minitel), free distribution	adapted TV set provided by TV industry and to be bought by subscribers (change in 1986: multitel)
Network architecture	several central databases; one update centre; closed system; (external computers 1982)	primarily privately owned databases and service computers connected to Transpac	hierarchical network one central database with regional sub-bases; interconnection to private computers
Information provision	only by private information providers (common carrier) (change in 1983: BT becomes IP)	trigger service 'electronic phone book' by PTT; other serv. by private IPs	only by private information providers (common carrier appr.)
Billing system	subscription fees page-based charges phone call charges	no subscription fees time-based charges	subscription fees page-based charges phone call charges
Regulation political control	no specific regulations, less politicized	specific regulations liberal regime politicized; industrial policy function	specific regulations very restrictive regime politicized

the British system undoubtedly seems to be politically less regulated than the others. There were no regulations dealing specifically with videotex, although information providers are subject to general legislation relevant for this new medium. In contrast, the French Télétel is politically much more regulated, but — very interestingly despite the dirigistic French tradition — with an extremely liberal juridical regime (Charon, 1987a). Bildschirmtext is undoubtedly the most heavily regulated system

among the three. All constituent states of Germany enacted a special media law concerning regulations with respect to content control, equity of access, consumer and data protection in Bildschirmtext. Telecommunications regulations exist also for terminal producers and users. Many of these regulations resulted in constraints which make the system's handling from the user side very cumbersome.

Three Strategies to Reach the Critical Mass

The most important lesson of the French success in videotex development is that the demand for such services is not given but influenced by and dependent on the technical and social organization of videotex systems, their 'implantation' strategies, and the diffusion process of videotex itself. Demand formation, especially in this domain, is an interactive process where user preferences are interdependent and collective learning is involved. Videotex development is on the one hand a process where the 'user-value' of the system depends on the size of the user community (the more users and service providers are linked in the system, the more interesting it is to join it). On the other hand, demand formation in videotex is also a *collective learning process*, where late adopters learn from early adopters (see Antonelli, 1989: 260). Users have to get acquainted with the system, discover or even invent new applications. And the more flexible a system is, the easier it is for new applications to be discovered. Developers and information providers on the other hand have to be able to adapt to these changes in demand.

This interactive process can principally lead to a 'virtuous circle' similar to the growth mechanics of an avalanche: the bigger it is, the faster it grows. The more subscribers are connected to the system, the more attractive it appears to the users (von Weizsäcker, 1982). The more users are acquainted with the systems, the more applications are explored. The problem, however, is often located in the start-up phase of the system. In the beginning there may be a dilemma similar to the famous chicken-and-egg problem (Hohn and Schneider, 1991: 9-10).

First, subscribers of interactive communication systems will only buy terminals and join the network when there is already a certain 'critical mass' of communication partners which make the communication network interesting and useful. Second, videotex as an information system may encounter such a similar problem also at

the level of information providers. The creation of data bases generally requires large financial advances, because those information services are lumpy goods: a data base will be consulted only if the likelihood of obtaining certain information is high — thus needs to be big. But the information industry will only spend major money if it expects that there is a user community with a sufficient size. Third, the terminal producers are also faced with such a 'strategic dilemma': terminals will only sell in large quantities if they are cheap, but low terminal prices will come only if there are large economies of scale. This problem is generally raised in a mass production, and is normally solved by 'strategic pricing' and portfolio management. Big corporations know that they are often forced to make short-run losses during the first phases of the development of new products. If they were to price new products at their real cost from the very beginning, they might never get the minimum market size necessary for a product to become a commercial success. Consequently, mass products are often cross-subsidized in the beginning of the product cycle by profits coming from other commercially successful products ('cash cows').

The basic problem in videotex development is how to overcome the critical thresholds at all three levels. As several authors have shown, there are at least three possible solutions:

1. The *direct approach* (Rohlf's, 1974: 33): In this approach the service provider or systems operator eliminates the cost of access completely and provides the service for free or for a nominal fee. This is essentially what has been done in France.

2. The *sequencing approach*. This approach needs no subsidies during the initial phase but presumes a heterogeneous user potential and consists in detecting groups for which the service has different 'user-values'. The service provider can begin by providing the service for the group which already sees a utility of the service that exceeds the initial high costs of access (e.g. snobs as early adopters!). This group then may be a critical mass for another group which finds the size of the terminal park adequate for their applications. If this group also joins, then a critical mass for a third group is reached, and so on. Such a strategy places large emphasis on using market research to detect these groups and on the ability to mobilize the right group at the right time (Rohlf's, 1974; Allen, 1988). If each increment of group subscribership reaches the

critical mass for a further group, the growth process functions like a 'chain reaction' (see Granovetter, 1983, 1986; Mayntz, 1988). This approach has been followed by the German Bundespost after its reorientation in its marketing strategy from 1985 on.

3. The *management of expectations* strategy: This strategy reaches the critical mass by triggering and managing self-fulfilling prophecies. The dilemma that 'a prospective subscriber will actually decide to join only if some minimum number of the other prospects also decide to join' (Allen, 1988: 260), can be solved by the active creation or support of shared expectations that others will join.¹⁴ A necessary condition is that shared expectations emerge, as David Allen points out,

that subscribership will be larger than critical mass. If that occurs, enough users will be attracted so that, simply by the fact of their presence, they will then trigger the growth remaining to reach . . . full network maturity. (1988: 261)

The last strategy especially had been pursued by the British and German PTTs, for which optimistic forecasts were necessary ingredients of a successful development. Already in 1982 James Martin emphasized that systems such as Viewdata involve the chicken-and-egg problem that TV sets will

only sell in large quantities if the information they provide is interesting enough to the general public. But the information providers will only spend major money if the sets have been sold in large enough quantities. (1982: 119)

Successful videotex growth depended, for Martin, on a constellation of three conditions:

1. the sets must be cheap enough for the mass public to buy them;
2. the mass public must perceive the information provided as worth buying the set for; and
3. information providers must have the expectation of making substantial profits.

If these 'ingredients' were combined in the right mixture, a chain reaction would sweep over the nation establishing the videotex system with one hoist.

Martin adds:

Explosive takeoff, that is, a high [growth] curve . . . is important for the future of viewdata. If the slope is *estimated* to be great, manufacturers will commit themselves to large-volume production of the sets. Only with large volume will the price be low. And the sets will sell in large numbers only if the price *is* low. (1982: 119)

In Britain and in Germany the videotex development was very contingent upon the engagement of terminal producers and information providers. This presupposed extremely optimistic shared expectations. In producing and stabilizing these expectations, the forecasts were necessary developmental elements. At least in Germany this explains why all forecasts were optimistic — even the most pessimistic one predicted one million subscribers in a short period.¹² That the management of expectation strategy did not work in Britain and Germany is no proof that this chain reaction or ‘virtuous circle’ could not function in principle. The breakdown of the chain reactions was attributable to technical and economic co-ordination problems. Historical technical choices, especially in Germany, constrained the subsequent development to an important degree (Schneider, 1989b): in particular, the newly designed display standard in 1981 was too sophisticated for its time. This resulted in an unexpected increase in terminal prices and some important technical shortages (e.g. delays in the system start). The decision in favour of the relatively closed IBM system made the connections to external computers — with the most interesting applications — very expensive. This meant that the ‘cost of access’ for the users and for some information providers became almost prohibitive. Under these conditions the necessary critical mass was thus never reached.

From this perspective the ‘success formula’ of the French videotex system is an interesting alchemy of technical and economic factors. The ‘direct approach’ not only created a huge user community from scratch but also a self-fulfilling prophecy for the growth of the service market. The technical flexibility of Télétel, finally, was a catalyst for collective learning processes which led to the discovery of new demands and alternative user patterns.

Governance Structures of Videotex Development and their Embeddedness in Ongoing Policy Games

Why could the French follow their successful strategy and implement it without major difficulties? What circumstances

prevented the British and Germans from doing the same? We argue that the two development paths were less the result of bright strategic decisions than of specific technical, institutional and historical contingencies leaving more or less room for appropriate strategic choices. In this respect there are two institutional and structural aspects which should be analysed separately: on the one hand the social or organizational co-ordination structure of the videotex systems, on the other hand the embeddedness of videotex in national traditions and ongoing sectoral policy games (e.g. industrial policy, telecommunications policy and media policy).

Governance Structures

An important aspect of videotex development was the way in which the functionally necessary partners were tied in and co-ordinated in the videotex project. Videotex development was not only a technical structuration process by which computers, networks and terminals were linked into a communications system, but also a process of co-operation between various partners (network operators, software companies, information providers, manufacturing firms) developing economic interests in the establishment of this socio-technical configuration. Traditional concepts distinguishing between market and hierarchical or state co-ordination have recently been more refined by the debate on 'governance mechanisms' where a multiplicity of intermediary forms between market and state have been discussed.¹⁶

In our context it seems sufficient to distinguish between three dimensions in videotex governance structures. *Vertical integration* refers to the organizational structure by which the system inputs from producers (hard and software), information providers, operators and other important partners are linked into the system. These inputs may be exchanged through market interfaces or may be completely vertically integrated in a public or private hierarchy, or they may be organized by mixtures of both. *Horizontal integration* refers to the organization of output relations between system and users. A videotex system may be in a monopoly position with its services (e.g. Télétel in France, and currently BTX in Germany) or may have to compete with other systems providing identical or similar services (like the British Prestel).

A third dimension refers to *the degree and forms of state control of videotex systems* — both in a supportive and in a restrictive way. Systems may be constrained by state regulations with respect

to media policy, data and consumer protection, but they may be supported also by policies in the industry or the telecommunications domain.

Within this three-dimensional classification the French system enjoyed the highest vertical and horizontal integration and the strongest support by the state. The French videotex introduction process, was under almost complete horizontal and vertical control of the French PTT and it was promoted not only by telecommunications but also by industrial policy. Videotex in France was an element of a wider industrial policy strategy by which the American hegemony in information technology was to be challenged. The French telephone authority (DGT) provided the service, distributed the terminals free of charge and controlled the most important 'magnet service', the electronic telephone directory. However, the services beyond the electronic telephone book are subject to an extremely liberal market regime. This high integration allowed the French to build up their system from scratch over night without major economic and technical coordination problems. The politicization of the French Télétel, however, was not only supportive. The mass scale of Télétel produced many fears, and the conflicts with the printed press had to be bought off by extremely liberal conditions of information provision.

The governance structure of Prestel could be characterized by a low vertical integration and an initially high horizontal integration which declined in the aftermath of the liberalization of British Telecom. When Prestel was launched in the late 1970s, the British PTT was responsible only for the storage and transmission of information, and the terminal market was under the control of private firms. The information providers had full responsibility for information content. The Post Office was therefore dependent both on the co-operation of terminal producers and the information providers. When the growth problems of Prestel became apparent, the new BT increased its control over content by providing some information services itself. When British telecommunications became liberalized from 1981 onwards, the new corporation lost its 'horizontal' control and Prestel had to fight with more and more competing telematic services.

The German governance structures had many similarities to the British: the development was initiated by state policy in telecommunications, was highly horizontally integrated (a service monopoly), and its vertical integration was rather low. Like the British PO the Bundespost controlled only systems operation and

the provision of storage capacities, but the terminal provision and the information business was completely left to the private market. Like the PO, the German Bundespost was therefore dependent on the co-operation of a large number of private firms in the terminal industry and the information business, domains which are governed by 'markets'. However, the DBP still performed the role of an informal system leader. With large amounts of financial subsidies and an array of organizational instruments (co-ordination by committees, organization of trials, R&D funding, PR-support, etc.) it enjoyed a hegemonic position in the promotional co-ordination network of BTX. In this function it was also considerably supported by the association of information providers and by business organizations. This network co-ordination, however, could not unravel the critical technical problems associated with certain choices in terminal and system design. Only when it was obvious that the industry was unable to provide inexpensive terminals was the DBP allowed to enter the terminal market with dedicated BTX compact terminals.

With respect to the political dimension BTX was certainly less supported from measures outside the narrow telecom domain (e.g. industrial policy) than the French Télétel. On the contrary, the politicization of this technology had retardive effects on BTX development. Since BTX was not only seen as a new telecommunications service but also as a new mass medium, it became heavily regulated by the federalist Länder governments.

Changing Environments and On-Going Policy Games¹⁷

Governance structures of videotex developments are embedded in broader structural or institutional environments. These conditions change over time. An important difference between the three developments is therefore *timing*. In the technological context of the communication revolutions of the 1970s and 1980s it makes a big difference if the key parameters of a communications system were set in the 1970s or in the early 1980s. When the British launched Prestel, switched data networks had just been developed and computer capacity was still very expensive. Given these technical constraints, and given also the socio-political constraints imposed by a deep-seated liberal tradition of discrete state intervention, and given also the increasing challenges to the old institutional order in telecommunications, the British approach follows almost naturally from these conditions.

When in 1980 Prestel was launched to full-scale operation,

France and Germany were still testing their videotex technologies in field trials. Both countries could thus learn from the early British experiences.¹⁸ The most important weakness of the British system was its centralization and closedness. This deficiency was quickly discovered, and the other two countries modified their systems toward more decentralized and open structures allowing also interconnections of external computers. The French, however, were much more radical in this undertaking. This can partly be explained by the technical conditions of the French telecommunications network in the early 1980s. In the 1960s and 1970s the French telephone network was still called the 'joke of Europe', but it was rapidly modernized and expanded in the 1970s. At the beginning of the 1980s France then had the most modern telephone network and the most advanced packet-switched data system in Europe. These networks were then used as the infrastructure for their videotex system Télétel.

The terminal diffusion strategy in France is also coloured by specific national orientations: a mercantilist 'deep structure' and the tradition of '*grands projets*' in industrial policy (Mayntz and Schneider, 1988: 289f). That the French DGT could engage in such a large-scale project, at a time when the postal monopoly came under increasing criticism in other countries, was due to the successful role it played in the telephone modernization in the 1970s (Morgan and Webber, 1986). A further condition was that industry in France is much weaker vis-a-vis its centralized state than in the other two countries. The fact that the French telecom administration could capture this new market indicates that the strong position of the DGT and its symbiotic relations with industry were still unaffected by the international pressures transforming the 'old telecom order' (Dang Nguyen, 1985), in other industrial countries. Deregulation and liberalization were not discussed in France until 1986 (Vedel, 1988).

The institutional change in Britain provides a striking contrast: its telecom administration had been criticized since the mid 1970s and when BT was liberalized and privatized under the Conservative government of Margaret Thatcher, it had to accept the entry of new competitors in the terminal, service, and network domains. In German telecommunications, liberalization and deregulation only became effective in 1989 and early 1990 (Grande, 1989). How these changes will affect the further development of BTX is still unclear.

In Germany BTX development was also partly shaped by a media policy game. The decision in Germany to follow the trajectory of the TV-set terminal configuration produced a kind of *technical path-dependency* transforming videotex into a media issue (cf. Schneider, 1989b). The fact that the PTT was forced to fuel the great expectation that BTX would have millions of users in the 1990s supported this perception. At about the same time there was a large public debate in Germany concerning cable TVs and the liberalization of broadcasting. The amalgamation of BTX topics with mass media issues transformed BTX into an object of bitter disputes between the German Länder governments, responsible for broadcasting, and the printed press. The press perceived the involvement of the federalist governments as an intention to extend the TV monopoly also into the telematic services domain, whereas the Länder feared that if videotex were private, market forces could gain ground in the broadcasting domain. These battles within the media policy arena resulted later in the relatively tough regulation of BTX.

Conclusion

The different fates of videotex in Britain, France and Germany underscore the importance of a somewhat 'paradoxical mixture' of decentralized and flexible technical solutions, large financial investment capacities and a functioning co-ordination. A key factor for success is undoubtedly a *central co-ordination mechanism* by which the different components of a videotex system (services, network, terminals) are developed in a coherent and balanced way so as to solve the different economic dilemmas and the technical problems inherent to large technical 'network systems'. Where such a co-ordination failed to be provided — because of misperceptions, wrong PTT strategies, too prudent measures or overly restrictive regulations — videotex has remained anaemic.

This central co-ordination function may be performed either by a 'public' (state agency) or 'private' (large corporation) hierarchy which enjoys sufficient resources and freedom to be a pivot for videotex development. A state agency may well be best-placed to perform this co-ordination function since the state, as recognized as the legitimate authority to set the rules of the social game, has greater legal and institutional capacities to organize the co-operation between various partners. Moreover, compared with a

big corporation, the state is an authority which is politically accountable.

Co-ordination, however, is not necessarily dependent on central control. Co-ordination of technical and economic activities may be achieved in various ways, ranging from direct control and development of a particular service, to a 'network co-ordination approach' or to the more 'hands-off approach' now being tried in Britain. Here state regulators set the ground rules for fair competition and equality of access for existing and new service providers, and promote (and in some cases specify) the adoption of standards through which it becomes possible for different service suppliers to interconnect their systems and run them across a variety of networks, in the hope that critical mass can be achieved through the aggregation of smaller systems rather than through the development of a single, universal service. The problem, however, is whether this strategy can work in the context of fiercely competing actors whose previous success has been founded on the supply of incompatible proprietary solutions.

Notes

This article is based on a research project which was initiated and conceptualized by Professor Renate Mayntz, Director at the Max-Planck-Institute für Gesellschaftsforschung (MPIFG) in Cologne, in 1985 and was carried out by research teams from the CNRS in Paris, the MPIFG in Cologne and the SPRU at the University of Sussex. The German team was supported by the Max-Planck-Gesellschaft and the Deutsche Forschungsgemeinschaft. The British team was funded by the Leverhulme Trust and was also supported by the Economic and Social Research Council through its Programme on Information and Communication Technologies. The French team received funds from the Programme Procope du Ministère des affaires Etrangères and the agency pour le développement de l'Informatique.

1. Rice and Paisley (1982: 225) counted almost fifty videotex projects in sixteen countries.

2. There are at least another 50,000 subscribers to videotex services not run by British Telecom.

3. In Germany the number of information providers declined from 4000 in 1985 to 3300 in 1989. In Britain the number of IPs (sub-IPs) stagnated at the level of 1250.

4. The components constituting the first videotex systems (TVs, modems, decoders, telephone networks and computer databases) were already well known in all three countries.

5. Although much of its telephone switching equipment was of an older vintage than Germany's.

6. For a detailed account of the history of Prestel see Thomas and Miles (1989), chapter 2.
7. For the history of Télétel see Vedel and Charon (forthcoming).
8. For the history of BTX see Schneider (1989a, b).
9. A small monochrome monitor, a modem, a decoder and an alphanumeric keyboard were all distributed to French telephone subscribers.
10. The French Minitels were produced by three manufacturers (Telic-Alcatel, Matra and Radiotechnique). This mass production means that the basic Minitel cost the PTT only about FF 1000.
11. More exactly, the French videotex seems to be free, since the standing charge is actually incorporated in the services rates which cover both the transport and the cost of the service.
12. However, in Germany the maximum price for one page is limited to DM 9.99.
13. The introduction of multirate charges since 1987 may slow down this dynamic. However, DGT officials think that users can accept this change for they are now well accustomed to the principles of Télétel.
14. Paul David (1985), for instance, points out that the expectation alone that the MS-DOS operation system promoted by IBM would become a success was sufficient to make MS-DOS a success — even when competing operating systems were technically superior.
15. An international comparison of the forecasts is interesting. In France, where they were not needed so much for the spread of videotex, they were rather low and even much below the actual development (see also Charon, 1987a). In both Britain and Germany the forecasts were quite optimistic.

Forecasts for videotex subscribers (in millions)

France	1985: 0.06	1990: 1.0 (Glowinski, 1980: 80)
UK (BPO)	1981: 0.25	1985: 6.5 1989: 11.0 (Fedida and Malik, 1979)
(ITT)	1981: 0.16	1985: 2.0
FRG (1981)	1984: 0.4	1985: 1.0
(1984)	1984: 0.15	1985: 0.35 1990: 3.6

16. Typologies and classifications have been provided by several authors along different dimensions. Williamson (1985) identified five governance mechanisms ranging from the completely integrated firm (hierarchy) to the market which differs according to the frequency of contracting. Ouchi (1980) identified markets, hierarchies and clans as different forms of governance. Streeck and Schmitter (1985) and Hollingsworth and Lindberg (1985) differentiate between market, state, community and association. More recently Hollingsworth (1990) and Schmitter (1989) developed a pluri-dimensional typology which also conceives networks and alliances as governance mechanisms.

17. The idea of the embeddedness of games in other games is borrowed from Long (1958); see also Vedel (1989). For a more formal approach of connected games see Scharpf (1987, 1989).

18. It is striking how clearly these 'lessons' were spelled out by Roy Bright, a Teletel manager who was formerly working for Prestel, in 1982. Under the subtitle

'the videotex learning curve', Bright made the following points that could be learnt 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"' (Bright, 1982: 28–9).

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