

Inter-Industry Relations in Electronic News Services

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The development of intercorporate and interindustry ties by firms providing electronic news through videotex and teletext in the US between 1979 and 1984 is discussed in the context of resource dependence theory. Several important trends are noted: (1) the growth in relationships formed between newspapers and cable firms to provide cabletext, (2) the increasing number of affiliate ties involved in both videotex and teletext services, (3) the more binding or permanent ties in videotex relations, and (4) the rather independent role of information providers in videotex compared to the marked dependency between information providers and transmission providers in teletext.

Developments in computing and telecommunications technologies over the past few years have led to new and changing industrial relationships and products [1-8]. In particular, one industry has emerged to produce and distribute textual information through electronically advanced means of distribution: electronic publishing. Products and services range from CD-ROM disks to bibliographic, numeric and fulltext commercial online databases [9-12] and they are primarily marketed to public organizations and private businesses.

This research attempts to understand the growth of two types of electronic publishing news services primarily targeted to the consumer market: videotex and teletext [5, 12-18]. Specifically, this article charts the growth of videotex and teletext in the United States between 1979 and 1984 by examining the number and types of corporate relationships that have emerged to provide the two information services.

Resource dependence theory is used as a framework for describing and testing propositions about the emergence of teletext and videotex services. While there are numerous studies of users and individual systems [12, 19], and analyses of policy issues [20], there are few theoretical attempts to understand and assess electronic publishing from an intercorporate level of analysis. The resource dependence perspective is useful for this type of analysis because the theory focuses on the interdependence between and particular re-

sources contributed by different corporations in the provision of products and services in the marketplace. This article argues (1) that providing videotex and teletext requires corporate interdependence [4], (2) that differential resource dependencies of videotex and teletext result in different patterns of intercorporate relations, and (3) that resource dependence is useful in characterizing the videotex-teletext segment of the electronic publishing industry and can be useful in characterizing other emerging industries, in whole or in part, which are based on new computing and telecommunications technologies.

The following sections (1) identify the stages of production involved in producing electronic publishing services, (2) describe videotex and teletext, (3) indicate the resources necessary to provide these services, (4) relate these requirements to resource dependence theory, (5) suggest major research questions derived from this theory, (6) identify patterns of resource dependence, (7) report preliminary answers to the research questions, and (8) consider the emerging industry structure for electronic new services.

Stages in Electronic Publishing Production

The growing complexity and convergence of the communication and computer industries is exemplified in the process of providing electronic publishing services. Fig. 1 indicates the major elements of such a process based on the models suggested by Williams [20] and others.

Electronic publishing information is created by writers and reporters specifically for the medium through which the information will be distributed [12], or it is an edited by-product of information originally generated for a different audience, e.g., a lengthy newspaper article. The information is accessible to a market after it is compiled into a database, that is gathered, indexed, formatted, and stored in computer-readable form to allow other systems or individuals to locate the desired information. Information is typically converted to machine-readable form and stored on magnetic or optical media.

The database may then be licensed or sold to an intermediary, a firm which serves as a vendor for the database. Many compilers also sell their own databases, though generally not as exclusive vendors of the databases. Vendors may

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FIG. 1. Simplified Example of Online Information Distribution Chain. Adapted from [20].

Agent or Participant	Process	Example
Generator or author of information	Information provider	Reporter
Primary publisher	Initial medium	Newspaper
Secondary publisher provides information in different source	Abstract, index, organize	Wire service
On-line vendor	Translate to computer data	Dow Jones News Retrieval Service
	Add value to data	
	Requires extensive hardware, software	
Intermediary system provides standard interfaces and access to on-line vendors	Format, update, account	DIALOG Information Services
	Encode, store data, graphics	
Transmission channel	Broadcast or interactive systems	Telephone or computer network
Users:		
Information broker, sells value-added information; residential, business; search analyst, end-user	Uses transmission channels, terminals	Information consultant
	Uses search, retrieval, analysis software	financial trader, reporter, library patron

provide uniform search, retrieval, reporting, and billing interfaces for multiple databases.

The final stage involves data transmission through combinations of electronic media using cable, common carrier, or broadcasting facilities, or physical transport using magnetic or optical storage media [10, 21]. Technical standards determine the format and quality of data received over or retrieved by the user's computer terminal or receiver [15, 16, 22, 23]. The final stage is the retrieval of the information by the residential or business end user.

The focus of this study is on firms that are database compilers and vendors in providing news information.

The implication of this multi-stage process is that electronic publishing services require a diverse set of skills and resources, not previously required in formerly separate publishing or transmission industries, leading to new relationships between firms and across industries.

Two Forms of Electronic Publishing

Two names have been applied to electronic publishing services: teletext and videotex. The two services comprise unique combinations of skills and resources.

Teletext is commonly broadcast over frequencies currently allocated for television and radio. Indeed, Noll [5] refers to teletext as "a textual version of broadcast radio". In the US, the information may be carried in lines 14-18 and 20 of the vertical blanking interval of a television signal. FM radio broadcasters can transmit data over a portion of their allocated spectrum (via the carrier or the sidebands) under the FCC's Subsidiary Communication Authorization [22, 24]. Via either method, information is con-

tinuously broadcast to and captured by a decoder which stores a limited amount of information and requires users to wait for the next set of pages to appear on a screen after that information has been called up. Because of its broadcast nature, teletext has limited interactive capability. Teletext may be delivered using a full TV or cable channel, thus providing rapid access to a large database, but this configuration still does not provide two-way interactivity and does not require the corresponding system complexity. Teletext is thus relatively cheaper to produce, transmit and receive than fully interactive services. Teletext is supported by advertisers or by public agencies with a mandate to inform, and by charges for decoders. Short of imposing annual license fees, it is impossible to charge mass audiences for broadcast programming [25].

Videotex allows subscribers to access potentially unlimited amounts of information stored in computer databases. A personal computer or a specialized or "dumb" terminal facilitates interactivity by sending and receiving information through telecommunications networks. Noll [5] refers to videotex as "a textual version of voice telephony". Subscribers accessing a videotex service typically pay transmission fees along with a flat fee charged by videotex operators for accessing computer facilities and gathering information. Some systems also charge according to the amount or kinds of information accessed.

Electronic Publishing: Resource Requirements

The process of providing electronic publishing services requires four primary resources.

Hardware

Videotex distribution requires combinations of main-frame computers, minicomputers and/or dumb terminals to create, store and process textual and graphic information. End-user equipment included dedicated videotex terminals, dumb terminals, personal computers (perhaps modified for graphic information) or specially designed decoders hooked up to subscriber television sets. Creating text and graphics for teletext service also requires computers. However, requirements for data storage and interactivity are typically less for teletext.

Software

Software is necessary to compile and index information, manage databases, manipulate access techniques, provide interfaces or gateways to databases or other vendors, and create graphics. In many instances the same firms that provide hardware provide software as well. In other cases, the electronic publisher may hire programmers or may acquire software, perhaps by entering into a relationship with a software firm.

Transmission Facilities

Fully interactive videotex service requires simultaneous two-way transmission. Currently, this means that videotex is delivered over local and long-distance telephone systems or common carrier facilities involving landwire, microwave and satellite technologies. There are over 50 suppliers of long-distance telecommunications networks for databases [26]. Some brokers are developing their own transmission networks (such as Dialog Information Services, Inc.'s Dialnet). Teletext, on the other hand, primarily requires local broadcasting frequencies or cable system channel capacity.

Information Providers

News sources for videotex and teletext services overlap. They range from international and national wire services to national publications to local newspapers and other kinds of local news sources. Examples of information sources used in the Times-Mirror Corporation's "Gateway" Videotex service included the Weather and Sports Information (WSI) wire that provided fast-breaking stories of sports events from around the country, a wire from the Bureau of National Affairs primarily covering congressional news, the Reuter news wire, the Associated Press business wire and a wire from CalTrans, the California Transit Authority. Stories from Times-Mirror's Log Angeles Times were uploaded from the newspaper's downtown headquarters to the videotex operations in Orange County [27]. The "Tempo" teletext news service launched by KNBC-TV in Los Angeles used information provided by Dow Jones and Company, Inc., Associated Press, Business Week, the Harvard Medical School's HealthNews, Daily Variety, the California Highway Patrol and the Los Angeles International Airport [28].

Resource Dependence and the Electronic Publishing Industry

Resource dependence theory provides a useful framework for analyzing the development and differentiation of the electronic news industry.

The Nature of Resource Dependency

Resource dependence theory holds that organizations are effective to the extent that they maintain access to those critical resources needed to accomplish their goals. Other organizations which have the critical resources are strategic elements of the focal organization's environment. Environments in themselves are not problematic, but the fact that they cannot be entirely controlled and are not predictable means that organizations must continually deal with uncertainty in terms of securing necessary resources to survive and grow [29].

There are at two primary ways in which dependence of one firm upon another is manifested [29]. The first dependence relationship is competitive. Two organizations requiring identical resources for survival are competitively dependent in the sense that in a finite environment the resources gained by one can only be greater if the second gains less. Competitive dependence is a zero-sum game. In corporate behavior this amounts to a horizontal relationship. Firms competing in the same industry vie for identical raw materials, personnel with similar skills, customers and so forth.

The second dependence relationship is symbiotic. Here two organizations require different resources for survival but they are dependently related in that the output of one is a resource of the other. Both firms can do better or worse simultaneously. In corporate behavior this is a vertical relationship. Firms in different industries perform complementary tasks and are linked by mutual dependence.

Symbiotic interdependence is manifested in certain types of intercorporate relationships [1, 29, 39]. They are described in order from the most to the least permanent type of relationship. Degree of permanence is an important relational dimension because it reflects the intensity of the dependence between firms. The more dependent the organization, the more it will attempt to control its environment [30-33].

Levels of Resource Dependence: From Acquisition to Contract

The extent of an organization's resource dependence is reflected in its business relations. The more dependent the organization is, the more it will attempt to control its environment by permanent or diverse (horizontal, vertical, diagonal) relations [1, 29-33]. Dependency relations may be manifested in at least five ways [12, 30]. They are described in order from the most to the least permanent relationship.

An acquisition is the exchange of capital assets of the acquired firm for a monetary sum from an acquiring firm. An acquisition most often results in a separate division or

subsidiary. Examples include the Dow Jones' acquisition of Software Ventures, and the Anacomp (a software firm) takeover of Channel 59 in Indianapolis.

A merger is a relationship between two firms which involves the complete pooling of assets [34]. Mergers are the result of negotiations which lead to mutual benefit and often the creation of a single corporate entity. An example is the merger of Telenet with Uninet, although it was accomplished by an acquisition at a higher level.

A joint venture involves only a portion of the parent company's assets and results in the creation of new, autonomous organizational progeny [35]. An example is "Videotex America," the late progeny of Times-Mirror Corporation and the Canadian firm Infomart.

A network relationship involves one company in the distribution chain of another company. Electronic news networking differs from program syndication in that affiliates contribute local news to the service provided to information consumers. Potentially large system operators have been negotiating with daily metropolitan newspapers to enter into videotex networking agreements, or with broadcasting stations to provide teletext services. Knight-Ridder Publication's "Viewtron" and Times-Mirror Corporation's Infomart engaged in extensive networking to market videotex. CBS and NBC have established networking agreements to expand teletext services.

A joint activity is less permanent than a joint venture and does not result in the establishment of a separate corporate entity [36]. Joint activities are special agreements, many times contractual, often exclusive in nature and limited in duration. An example is the deal struck between Harris, the BBC, Taft, Sony, Zenith, Keyfax and Metromedia to provide teletext service during the 1984 Olympics. Most joint activities over the past six years have involved field tests [37].

Finally, contractual agreements simply involve buying or leasing equipment, support systems or transmission facilities. Examples include leases between local newspapers and cable firms for channel access.

Diagonal Relations in the Information Industry

An additional type of interdependence suggested by Astley and Fombrun [1] is a diagonal relationship. Diagonal relationships exist between firms in different functional chains. A functional chain comprises a series of symbiotic relationships between firms in different industries contributing to the performance of some function.

Diagonal relationships can be either competitive or complimentary. Competitive diagonal relationships exist between firms producing products or services that are substitutes for one another. An example is when a videotex firm and a newspaper company both substitute for each other as an information source in the same market. An example of a complimentary relationship is when a newspaper firm uses a videotex service as another means to distribute its information product to individuals in the same market.

Astley and Fombrun [1] call firms involved in diagonal symbiotic interdependence business systems. Firms that are involved in both diagonal symbiotic and diagonal competitive relationships are business clusters. They maintain that there are two large clusters in the US telecommunications industry, one providing home entertainment and the other information handling products and services.

The US electronic publishing industry can be viewed as a business system. The interdependence between firms is complementary as well as diagonal. Relationships are diagonal because they occur between firms in different functional chains. The production of newspapers, for example, can be understood as a functional chain involving firms that generate news wire services, paper, ink, and printing presses, as well as distribution systems which commonly means trucking facilities, but in some cases the post office as well. There are numerous functional chains in the marketplace that generate communications-related products and services. Specifically, some of these are the television, voice delivery, and computing systems chains. Astley and Fombrun contend that the US economy has been increasingly characterized by interdependence between firms involved in different functional chains. One of the research questions of this article is the extent to which the provision of videotex and teletext services requires such interdependence.

Major Research Questions Derived from Resource Dependence Theory

This article explores new information services not only with respect to their technologies, services and markets, but also by the nature of the resources they require and the relations in which they engage. Guided by resource dependence theory, the general research question of the present study asks, do videotex and teletext electronic news services exhibit differential patterns of resource dependency, as reflected in levels of permanence and origins of resources in their business relations? There are several specific propositions stemming from this general research question:

Research Question 1. Because of the greater dependency on technological complexity and information in videotex services, firms involved in videotex should form more permanent relationships than firms involved in teletext.

Research Question 2. As technology and markets develop, crossindustry corporate relationships involving videotex and teletext should increase. In particular, the number of more permanent relationships between firms providing videotex and teletext will increase.

Research Question 3. Astley and Fombrun [1] argued that the developing telecommunications industry is characterized by diagonal relationships. The resources required to engage in the provision of videotex and teletext services are diverse indicating these relationships are symbiotic, effectively forming business systems. How different are the na-

tures of the systems for the two services? Diagonally symbiotic ties imply a more diverse dependency. More permanent ties imply a more intense dependency. (They may also imply greater confidence in the market. The data in the present study can distinguish between extensive and intense dependency, but not between intense dependency and confidence.) Videotex should be more dependent than teletext, due to its greater levels of informational and technical resource dependency.

Data

The unit of analysis in this research is a formal business relation between firms. Specific data consist of records of relations between firms providing videotex or teletext news services to households. This set excludes organizations engaged in similar but somewhat different electronic communication services such as computer-based financial transactions, profession-specific system, e.g., real estate data, services intended to be temporary, e.g., systems established for the duration of the Knoxville's World's Fair or Los Angeles Olympics, or public access services. Data were obtained from several sources covering the years 1979 to 1984.

The first source was the Dialog Information Service. Five files were especially useful: "PTS Prompt," "PTS Annual Reports Abstracts," both "PTS Funk and Scott Indexes", and "Standard and Poor's News." Over 1600 records were retrieved from these files using "videotex(t)," "teletext," and "electronic news," as keywords for the search strategy.

The second source was the International Videotex/Teletext News newsletter published by Gary H. Arlen. Seventy-two consecutive issues of the newsletter, which began in July of 1980, were reviewed. On the average each newsletter contained between 20 and 30 news items.

The third source was Mergers and Acquisitions, a quarterly publication documenting an annual average of 1460 mergers and acquisitions occurring in the US. Twenty-four consecutive issues from 1979 through 1984 were reviewed.

The fourth source was the American Newspaper Publishers Association, who provided two extensive lists of newspapers actively involved in providing news text electronically to local cable firms. The first list, compiled during the spring of 1982, contained 69 entries. The second, which included 84 entries, was compiled during the fall of 1984. Records from each of these four sources were reviewed for information on intercorporate relationships initiated in order to establish videotex or teletext services.

The fifth source was interviews conducted during December, 1984. The researchers interviewed representatives of twenty-seven firms by telephone and asked (1) which organizations supplied resources in each of the four areas

designated, and (2) what type of intercorporate relationship was formed in the process of acquiring that resource.¹

Galbraith [30] argued that organizations attempt to maintain autonomy and flexibility as they enter into arrangements to reduce uncertainty. Therefore, the most permanent or binding relationship between two firms was used as an indicator of the minimum level of dependency between those firms. Subsequent relations reflecting less permanent ties were not counted. Each firm was placed into one of the resource categories according to (1) the printed description and (2) the identity of the firm as reflected in the resource contribution to the provision of the electronic publishing service. Further, when more than two firms were involved in a business relation, each pairwise relation was coded. Thus, while there were 256 relations for consideration in the first two research questions, there were 270 for the third question.

Results

Tables 1 and 2 show the number of relationships established for videotex (33%) and teletext (67%).

Permanence of Interindustry Relationships in Teletext and Videotex

Contracts and joint ventures were collapsed into a single category to represent "less permanent" relationships. The remaining relationships—network links, joint ventures, and mergers/acquisitions—were collapsed to represent "more permanent" relationships. Table 3 shows that proportionally more permanent relationships were formed to provide videotex services than were formed to provide teletext services.

Since a large number of the less permanent relationships involving teletext were contracts between newspapers and cable firms for the specific purpose of providing cabletext (broadband teletext, or teletext using a full cable TV channel) service, these were excluded to assess their influence on

¹Even with such extensive reviews, however, a comprehensive list of all corporate relationships was not guaranteed, nor even likely. Most troubling was the lack of data on information providers. Some firms maintained that such information was proprietary. Moreover, wire services such as UPI and AP reported that they do not have accurate records on the cable systems using their services for cabletext on an annual basis. Thus, the Information component contains firms listed or known as direct suppliers (e.g., newspapers) rather than individual database providers. Some gaps existed also with respect to hardware suppliers. In these instances, it was not possible to obtain complete information either because the service was no longer in existence or because individuals in firms who were knowledgeable were not accessible. The data represent neither a full census of relations, nor a systematic sampling of relations. Further, it is unclear whether these data represent likely patterns of relations in a mature electronic news market. Thus, the results may not be generalizable to other electronic news services during the same time period or in the future. However, the data do exhibit good face validity. The intention here is to describe as well as possible how and to what extent a particular developing information industry requires interdependent resources.

TABLE 1 Videotex Relationships, 1979-1984.

Relationships by Increasing level of Permanence						
Year	Contracts	Joint Activities	Network Links	Joint Ventures	Mergers & Acquisitions	Total
1979	1	1	0	0	0	2
1980	0	5	0	0	1	6
1981	3	1	2	3	2	11
1982	3	4	7	3	1	18
1983	5	6	14	3	4	32
1984	3	3	7	5	2	20
						89

TABLE 2. Teletext Relationships, 1979-1984.

Relationships by Increasing level of Permanence						
Year	Contracts	Joint Activities	Network Links	Joint Ventures	Mergers & Acquisitions	Total
1979	0 (8)*	1	0	0	0	9
1980	0 (8)	4	0	0	1	13
1981	3 (28)	8	0	1	0	40
1982	2 (36)	11	0	3	1	53
1983	3 (13)	3	1	1	1	22
1984	3 (4)	5	16	2	0	30
						167

*Number in () indicates contracts for cabletext, or broadband teletext.

TABLE 3. Permanence of Relationships by Service Type.

Permanence of Relationship*			
Service	Less	More	Total
videotex	35 (39%)	54 (61%)	89
teletext	140 (84%)	27 (16%)	167
	175	81	256

Note: Chi-Square = 53; $p < .005$; $d.f. = 1$.

*Less permanent relationships are contracts and joint activities; more permanent relationships are network links, joint ventures, and mergers/acquisitions.

the overall pattern of relationships. The pattern is the same as before; proportionally more permanent relationships are formed to provide videotex (Chi-square = 7.7; $p < .01$; $N = 159$).

Change Over Time in Types and Permanence of Relationships.

The following summary of growth and change applies only to electronic news services from 1979 to 1984. The wiser, and less successful, market for videotex will be considered in a following section.

The data indicate that there was sustained growth in the number of corporate relationships formed to provide videotex between 1979 and 1983, with a drop off in 1984. Fairly dramatic growth can be seen in the number of ties created to provide teletext between 1980 and 1981, but ties declined between 1982 and 1983. (Several more permanent relationships were being discussed among firms interested in

videotex at the time the data were collected. However, since they were not yet finalized, they could not be included in the data.) Thus, total and crossindustry electronic news relationships increased, except for videotex between 1983-1984 and teletext in 1982-1983.

Overall there has been growth in the number of more permanent relationships over the six year period: videotex demonstrated a dramatic increase between 1982-1983; while teletext did so in 1983-1984. Growth in more permanent relations for teletext lagged behind that of videotex.

The average yearly growth rates of more permanent relations for videotex and teletext news services, in spite of yearly differences, were both quite strong (247% and 163%). However, more permanent ties were consistently a greater proportion of videotex relations (an average of 61% over the period) though they reached a steady two-thirds by 1981. For teletext, the average yearly proportion was only 16%, but reached nearly two-thirds in 1984. One type of relationship in particular accounts for a great deal of the variance, namely network relations. Table 2 shows a large increase in the number of such relations for teletext in 1984. Similarly, Table 1 shows nearly a doubling of network relations in 1982 and 1983 for firms providing videotex. More permanent links showed a strong average annual growth: absolute rates were nearly equal, but the relative rate was much stronger for videotex. Thus videotex news services show greater resource dependency and greater attempts to control their environment.

Different Structure of Relationships for Teletext and Videotex News Services

Each relation was categorized according to which resource components it represented. These relations were used to create the matrices shown in Tables 4 and 5.²

Table 4 shows a significant, but not strong, differentiation among the raw frequencies of videotex system components. The bulk of the difference comes from a lack of relations among transmission and among software firms, compared to expected values. The standardized percentages (raw divided by the grand total) show that the primary relations involve information providers—in relations with themselves and with transmission firms. These percentages were then clustered to identify levels of differentiation.³

²There are numerous ways of analyzing structural differentiation of a matrix [57]. However, because (1) there is no nonarbitrary way to determine the maximum number of possible links, (2) hierarchical clustering of the doubly standardized frequency matrix lends too great a weight to the cells with low frequencies, and (3) most methods require larger matrices, the researchers opted for simplicity. The two raw frequency matrices were constructed by adding a "1" to cells (i, j) and (j, i) for each ij relation. Because the legal relations reported in the data sources were reciprocal, the matrix was symmetric. However, this also required adding a "2" in cell (i, i) whenever a relation occurred within resource component i . That is, a relation involves two one-way ties, which are distributed on the off-diagonals or combined in the diagonals. Then, each cell's raw frequency was divided by the grand total of all the cells' raw frequencies.

³The IPFPHC procedure of SAS version 82.4 (without double standardization) was used on the complete raw matrices (diagonals included) for the cluster analysis.

TABLE 4. Matrix of Videotex Component Relations, Standardized.

Component	I	T	S	H
Information	0.36	0.13	0.10	0.03
Transmission	0.13	0.00	0.03	0.01
Software	0.10	0.03	0.00	0.01
Hardware	0.03	0.01	0.01	0.00

Note: See footnote 2 for explanation of standardization procedure. Sum of cell values less than 1.00 due to rounding. Base $N = 178$. Chi-Square = 19.7; $p < .05$; $d.f. = 9$ for matrix of raw frequencies.

TABLE 5. Matrix of Teletext Component Relations, Standardized.

Component	I	T	S	H
Information	0.02	0.31	0.05	0.02
Transmission	0.31	0.01	0.06	0.03
Software	0.05	0.06	0.00	0.01
Hardware	0.02	0.03	0.01	0.01

Note: See footnote 2 for explanation of standardization procedure. Sum of cell values less than 1.00 due to rounding. Base $N = 392$. Chi-Square = 223.0; $p < .001$; $d.f. = 9$ for matrix of raw frequencies.

Information and transmission providers clustered together first, at the threshold value of 0.13; hardware was then included at 0.10; and software, clearly a minor player in the network of relations, was added at 0.03.

Table 5 shows a very significant and very strong differentiation among the raw frequencies of teletext system components. The strong relation involving information and transmission components can be seen as a diagonal business system. Cluster analysis reinforces this description, as information and transmission providers clustered first at the threshold of 0.31, hardware at 0.06, and software at 0.03.

The information-transmission relation stands out as the single best representative of relationships of teletext news services, as the higher clustering threshold of 0.31 indicates. Teletext services are diagonally linked with transmission resources, which creates a differentiated resource environment, but the relationships involve more negotiating than controlling activities. Videotex relations are centered among information providers, with ties to transmission and software firms playing a palpable, but secondary role, as the more similar clustering thresholds of 0.13 and 0.10 indicate. Videotex services are less integrated into the telecommunications infrastructure, but seem to be more resource dependent and thus controlling.

Statistical comparison (quadratic assignment; [38]) showed a Pearson correlation between the two matrices of 0.81, (significant at only $p = 0.1$ for the two-tailed test because of the small size of the matrix). That is, the structuring of the resource environments of the two electronic news service types are overall quite similar. They differ in the patterns and permanence of their dependencies, but both primarily involve information and transmission resources.

Emerging Industry Structures Based on Resource Dependence

Resource dependency theory provides one perspective for describing the developing telecommunications in-

frastructure. In particular, firms involved in providing teletext news services may be characterized as diagonally symbiotic and dependent on diverse resources while firms involved in providing videotex news services are as yet horizontally competitive and more intensely dependent on a smaller set of resources. More diverse dependence is reflected in greater structural differentiation in teletext relations. More intense dependence is reflected in more permanent corporate ties between firms involved in videotex.

Teletext News Services

The greater number of less permanent relationships involved in teletext services is largely due to contracts between newspaper and cable operators to provide cabletext. These relationships are interesting in light of the historical change they represent in terms of text provided by operators over cable channels. During approximately the last 30 years, news wire services such as the Associated Press have provided a special text service to cable operators who would transmit the news continuously over a single channel. No doubt part of the motivation for such news services was based on the need for programming over the additional number of channels cable made available. A more comprehensive investigation of broadband (cable) teletext would have to include all of the cable systems throughout the country which subscribe to wire services—unfortunately information providers such as Associated Press do not maintain these historical records. Growth in the number of contractual relationships between local newspapers and local cable operators conceivably reflects a different, or additional, type of motivation than merely finding programming for cable channels.

Newspapers, large and small, are driven to experiment with new modes of distribution because the technology makes alternatives available [39] and exploiting those alternatives early on is a way of controlling environmental uncertainty. Further, cabletext allows newspapers to publish advertisements, particularly want ads, electronically. But the decline in the number of contracts between newspapers and cable firms to provide cabletext (see Table 2) might be due to an awareness that cabletext ventures are not all that lucrative for newspaper publishers.

The more recent growth in network links among firms engaged in teletext (see Table 2) represents the involvement of NBC, CBS, and other firms such as Keyfax National Teletext and Satellite Network Delivery (all of which later discontinued their teletext services). The teletext network link resembles relationships that currently exist between broadcast networks and their affiliates. Stations receive and broadcast network programs under contractual agreement and add their own local material. Tables 1 and 2 indicate that the establishment of network relationships between firms engaged in teletext lags behind those of firms providing videotex.

Videotex News Services

The greater number of more permanent relationships established to provide videotex news services is largely due to

network relationships (see Table 1). The economics of newspaper publishing are such that once the cost of producing a news story is covered it generates profit based on the number of times it is sold. A large publisher such as Times-Mirror generates profit not only by selling printed stories on the newsstand, but by transmitting them electronically for marketing to other publishers as well. Videotex is another means to market stories within and outside a local broadcasting or cable market. Videotex firms investing heavily in computing systems and personnel seek recuperative revenues and future sources of profit by strategically negotiating with newspaper publishers in cities throughout the country. These could become potential conduits for multiple distribution and, overall, constitute at least one critical dimension of an emerging telecommunications infrastructure which could eventually support the interactive and electronic distribution of news. As negotiated activities, these relationships function as safety devices in case current attempts to develop and control markets for electronic publishing prove premature.

There is indeed considerable uncertainty in this segment of the communication industry. The marketplace has not shown exceptional enthusiasm for the more ambitious graphics-oriented services such as Prestel [40, 41], potential Swedish services [42], or some Canadian offerings [43]. Major US services such as Knight-Ridder's "Viewtron" (21,000 subscribers), Times-Mirror's "Videotex America" (2,800 subscribers) and Time Inc.'s electronic magazine have all been shut down after heavy financial losses due to insufficient growth in their subscriber bases. Reasons for the lack of success of such services include the poor cost/benefit ratio of videotex graphics, the large and abstract nature of generalized databases, differential innovativeness of audience segments, the absence of a US national information policy, incompatibility among technical standards, low functionality of television sets as receivers, hierarchical "menus" which take users step-by-step through levels of information, limited frame size, low levels of information-seeking by most consumers, regulatory decisions, users' avoidance of lengthy searches, an initial dependence by providers upon advertising revenue before the market was large enough, unrealistic expectations by users as to the kinds of information available, difficult logon sequences, relative advantage of traditional media, and individuals' ritualized newsreading habits [19, 38, 39, 44-50].

Some videotex services have managed to overcome or avoid these obstacles to acceptance, however. The French PT&T's computer-based telephone directory and gateway to information providers, "Minitel", at first met with political and consumer hesitation but has recently gained considerable success [40, 47, 51]. In April 1986, for example, users had access to 2 million terminals, 100 new services joined the system, and information providers gained \$40 million in revenues. Our data indicate that a few, small videotex operations developed in moderately sized US markets by local newspaper firms have been successful. Videotex operations such as Viewfax supported by the Toledo Blade, Informant by Bloomington's The Pentagraph, and Electronic Editions by The Spokesman-Review and the

Spokane Chronicle, seem to survive on low budgets and scaled-down marketing goals. Systems such as these that simply provide an electronic alternative to local printed news for consumers who own personal computers may be successful because they are content to satisfy a limited but existing demand for nongraphics videotex services, rather than attempting to create large, new markets.

Online and Integrated Services

Unlike general market graphics videotex services such as "Viewtron", ASCII-text services (without graphics) and public access online database services have shown strong growth rates. Currently there are over 3000 commercially accessible online databases, developed by nearly 1400 producers and provided by over 450 vendors [26]. While the print publishing industry's revenues grew 11.4% in 1983-1984, revenue from online databases is expected to grow 26% to \$1.9 billion in 1985 [52]. 1984 growth rates for the number of databases, their providers, and brokers were around 23% [26]. The 29 leading services grew more than 40% in 1984 in terms of customers, terminals and passwords; since 1980 the growth rate has been 652%. CompuServe, Inc., for example, had a 50% increase in subscribers in 1984 to 150,000, and a 270% increase in pre-tax earnings to \$4.7 million [53]. CSP International [54] projects an average real annual growth rate of 13% for the entire online information and transaction industry through 1990. Online usage increased by 27% between 1982 and 1983, from 1.25 million to 1.59 million hours [55].

Some public access systems have become well established. For example, in August 1986, the San Francisco Chronicle's "Bay Area Teleguide" was used by 250,000 people who accessed over 9 million pages from 262 terminals in public places located throughout the city [47].

In the United States at least, it seems that national teletext services cannot survive, because of their limited information base, in an environment of multiple competing sources for information. Videotex services seem to be surviving in the form of massive information vendors which enjoy economies of scale through diagonal symbiosis (such as CompuServe, Inc., Dialog Information Services, Inc. or Dow Jones News Retrieval Service). However, their future may depend on providing additional services such as transaction processing and electronic mail [46, 50]. The three most recent announcements by large corporate players to establish videotex services signal this strategy: IBM, CBS and Sears formed "Trinitex"; AT&T, Time and Chemical Bank formed "Covidea"; and Nynex, RCA and Citicorp have agreed to form an as yet unnamed videotex venture [56].

Although it is not evident from the data reported in the preceding sections, the local partner in videotex news network links is the dominant newspaper publisher in the larger metropolitan markets. On the other hand, with teletext the local partner is inevitably a broadcasting station—as technological demands require. If these networking trends continue, local teletext will become a competitive service whereas local videotex will tend to be a monopolistic

service. The primary exception is the large number of relationships between local cable stations and local newspapers to provide cabletext. However—again this is not evident from the summary data given here—these cabletext links involve newspapers with smaller subscriber bases in smaller metropolitan areas, where cable systems typically are monopolistic franchises. Local newspaper or cable videotex providers cannot prevent users from accessing the larger national information services; thus the local videotex monopolies may in fact be vulnerable services, except those, as we have seen, that are content simply to provide alternative access to the local newspaper. The vulnerability of videotex news services and the need to diversify is indicated somewhat by the focused dependency on information providers described by the present research.

Conclusion

Charting the early growth of electronic publishing is not unlike trying to understand the adoption of other telecommunication technologies: the meaning of early patterns of diffusion are clearly understood only in hindsight [46]. Electronic news services, a product of the convergence of communication and computing, show significant and meaningful patterns of resource dependence. Resource dependence theory, particularly as it applies to telecommunications services, appears to be a useful perspective from which to understand the development of electronic news services in the United States. Though the data analyzed here do not represent all relevant links, and the analyses primarily involve summary data, the research questions generated from prior work led to a more focused description of dependence relations in the evolving telecommunications community than earlier attempts to identify videotex and teletext "service clusters" [5].

A major resource upon which electronic news services in particular, and electronic publishing services in general, are dependent, is the mass audience. This is a resource often ignored by resource dependent theorists (except 3 and 8). For an increasingly well-understood variety of reasons, there is an insufficient audience for the combination of technology, software, transmission and information as currently marketed in the form of graphics-based videotex. Perhaps, at present, teletext and videotex comprise a malleable but as yet undefined link in the evolutionary chain of a new telecommunication era.

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