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THE CONTINUING REVOLUTION IN COMMUNICATIONS TECHNOLOGY

Implications for the Broadcasting Business

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PROGRAM ON INFORMATION RESOURCES POLICY

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EXECUTIVE SUMMARY

• Will the day soon come when the broadcasting transmitter and its tall tower are found only in the Smithsonian Institution? These two artifacts--the transmitter and the tower--are central to the very concept of broadcasting. Yet they are being challenged by other communications technologies, such as cable, video discs and cassettes, lightweight personal stereo audio cassette players and digital records. There is no single technology which can be identified now as likely to produce sweeping change. The continuing broad advance of information technologies, however, is generating an array of new products and services that could transform major industries.

• New technology creates possibilities--but they remain just possibilities, until someone, in some society, perceives and acts on them. But once new uses of a technology are introduced into a society, there is no telling where the consequences will stop. How should managers in established institutions cope with the possibilities created by new technology?

• There are no simple and sure-fire prescriptions for coping with technological change. There are two broad strategies that may help, however. One is to maintain a "customer-orientation" toward any business, avoiding the plight of the railroads, which in the 1930s still saw themselves in the railroad business, while what customers needed was more generic "transportation." The second ingredient is to maintain an awareness of impending technological developments.

• It helps to recognize three basic points about technological change. 1) The impact of any new technology on an existing business comes about through adoption of the technology, not its mere existence. 2) Technological change takes place through an orderly and predictable sequence of steps. 3) These steps take time, with the result that major change casts a long shadow before it.

• To translate a laboratory prototype into a commercial product takes five years or more. The adoption of that innovative product by half or more of its ultimate market takes five to seven years at best, and a decade or two most commonly. Thus, any technological innovation that will have a major business impact by 1985 is commercially available in 1981. Anything that will be significant by the early 1990s has already been invented.

• The patterns in technological change suggest simple guidelines for policy makers. 1) Fundamental changes in technology imply both threats and opportunities to established businesses. 2) Do not limit views to a few glamorous innovations like satellites or fiber optics. The broad sweep of technological change will exert the most significant force for change. 3) Avoid the tendency to disregard a phenomenon which is shrouded in uncertainty and is potentially very threatening. 4) Do not over-react.

• If the video cassette recorder becomes a mass market appliance, broadcasters may be the first to benefit because of their immediate ability to provide 24-hour programming for users to tape for viewing at convenient hours. But broadcasters also face a long-term challenge from cable system operators, with their multiple channel capacity.

• It is much too early to predict the eventual penetration of video disc players in the mass market place. Should these devices become ubiquitous, they may lead to opportunities in the "video publishing" business, following the pattern of special interest magazines and highly segmented book publishing.

INTRODUCTION

The shape of the broadcasting industries today displays the consequences of past innovations in information technologies. Similarly, the leaders of the industry 25 years hence will see the effects of the myriad innovations now emerging. Unfortunately, technological revolutions are much easier to identify in retrospect than in prospect. Business planners must make their choices now, in the midst of uncertainty, and without the benefit of hindsight.

Broadcasters are not unfamiliar with radical technological change. Broadcasting began as the radio business, the first great industry spawned by the greatest technological force of the twentieth century: electronics.* Radio broadcasting grew to maturity in the 1930s as a business oriented to the mass market, structured around programs and stars, and dominated by national networks. That industry was destroyed by another technological revolution, the advent of television broadcasting. But a new radio industry emerged from the ashes of the old, made possible by technology introduced at the same time that television became a commercial reality. The solid-state revolution in electronics--of which the transistor was the leading edge--made possible low-cost, reliable, and portable radio receivers, and created

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*Telephone and telegraph are, of course, much older industries. The inception of radio broadcasting is directly attributable to the invention of the vacuum tube, which launched "electronics."

the conditions for the kind of industry we now see around us, in which local stations geared to specialized audiences have proliferated and prospered.

The underlying forces that gave rise to these past revolutions are still at work. The continuing advance of technology will make possible new products and services that will create new options for listeners and for advertisers. If those options are attractive--and they probably will be--the consequent changes in behavior will produce significant changes in the broadcasting industries once again.

This paper examines some of the future possibilities for broadcasting, emphasizing those that may be important for the long term, i.e., the period after 1985. There is no single new technology which can be identified now as likely to produce sweeping change. The continuing broad advance of information technologies, however, is generating an array of new products and services. These changes, in aggregate, could radically alter the structure of the industries concerned with program production and dissemination. What follows is an examination of some of the emerging new technologies that may affect broadcasting, suggesting some possible future developments in broadcasting, and proposing a few simple guidelines that may be helpful in understanding how change comes about, and how to cope with it.

There is an ancient Oriental saying to the effect that forecasting is a hazardous occupation, especially when it deals with the future. Prediction, in the sense of extrapolating recent changes into the future, is an unreliable guide for anticipating long-term consequences

in a period of technological ferment. We can say with some confidence that the future of the information industries will be very different from the present. In the longer term, it seems likely that we will see both new opportunities for and new alternatives to broadcasting as we now know it. Whether the current participants in the industry will be able to exploit some of those opportunities and to compete with some of the alternatives will depend upon their vision and the quality of their leadership.

The paper begins with two generalizations about the nature of technological change, using a bit of history as illustration.

AN HISTORICAL DIGRESSION

The Consequences of the Stirrup

In the 8th century, an important new technology for riders of horses--the stirrup--was acquired by the Germanic tribes known as Franks, who inhabited what had earlier been the Roman province of Gaul. The stirrup had come to Europe from India by way of China, and the Franks were nearly the last people to adopt it. But they were the first to sense its possibilities for warfare. Combined with a saddle of the right design, stirrups fused rider and horse into a single entity. With a lance thrust before him, the rider thus mounted could deliver a staggering blow.

This one adaption of an apparently simple technology greatly enhanced the power of mounted troops and changed the nature of warfare. Its effects were far-reaching. For example, since maintaining a cavalry

was costly, the Frankish leader, Charles Martel, grandfather of Charlemagne, confiscated great quantities of Church land which he gave to his retainers on the condition that they remain ready to mobilize to fight on his behalf. The distinguished historian, Lynn White, Jr., traces the effects of these moves and concludes that "the revolution in military technology brought about by the stirrup was the seed of feudalism and ... chivalric culture."*

There were other consequences that could hardly have been foreseen. A knight going full tilt on a strong horse could wreak great damage to any person unfortunate enough to get in the way of his lance. But having impaled someone, the mounted knight would find it awkward to withdraw the lance. The solution to this, soon discovered, was to tie some cloth to a knot near the tip of the lance. Soon men fighting together came to use the same cloth for this purpose. It was then just a short step to an identifying pennant. The seeds of the idea of national identity, symbolized by a flag, were thus planted.

Professor White calls our attention to two points implicit in this story:

1) Invention--as he puts it--is not the mother of necessity. New technology creates new possibilities--but they remain just possibilities, until someone, in some society, perceives and acts

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*"Technology in the Middle Ages," by Lynn White, Jr., Chapter 5 in Technology in Western Civilization, Volume 1, edited by Melvin Kranzberg and Carroll W. Pursell, Jr., Oxford University Press, 1967, page 71.

on them.* Before Charles Martel, the revolution in warfare that was always inherent in the simple stirrup remained latent.

2) Once new uses of a technology are introduced into a society, there is no telling where the consequences will stop. Charles Martel not only revolutionized warfare--changing the balance between infantry and cavalry for more than a millenium--but he set in motion forces that reshaped the political fabric of Western society.

These points are still valid. Some technological innovations can lead to such profound social change as to warrant description as a "technological revolution." Revolutions are often easy to identify in retrospect, but difficult to spot in prospect. It is not possible to estimate the magnitude of the social consequences of new technology by examining only the intrinsic characteristics of the technology. Apparently simple changes in technology can have profound consequences. And those consequences may flow from applications of the technology that may not have been visualized by its inventors.

HOW TO SURVIVE A TECHNOLOGICAL REVOLUTION

What are the business implications of revolutionary change in technology? More specifically, how can a business that lies in the path of change, survive it?

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*White discusses this point also in Medieval Technology and Social Change, Oxford University Press, New York, 1962. See page 28.

While there are no simple and sure-fire prescriptions for coping with a technological revolution, there are a couple of ideas worth mentioning. They can be illustrated with a cautionary tale from the annals of business history.

Fifty years ago, when the radio industry was still young, America's largest corporations were railroads.* Two of the 100 largest industrial companies in 1930 were firms whose principal business was manufacturing steam locomotives for the railroads. It is clear in retrospect that technological change brought about the decline of the railroads and the destruction of the steam locomotive industry. Yet, as so often happens, at the time when action had to be taken, few people in either industry perceived the development of new technologies as events that would alter the future of their companies.

For example, in 1938--two years after General Motors had begun deliveries of diesel locomotives -- A. W. Dickerman, President of the American Locomotive Company (the industry's leading firm) told an audience: "For a century, as you know, steam has been the principal railroad motive power. It still is, and in my view, will continue to be." He was wrong, of course, and in little more than a decade his company was out of the locomotive business.

This is, unfortunately, a common failing. Twenty years ago Theodore Levitt gave it a name in an article that rapidly became a a classic. Its title, "Marketing Myopia," aptly describes the weakness.

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*In 1930, the assets of the Pennsylvania Railroad ($2.2 billion) exceeded those of the largest industrial corporation, Standard Oil Company (New Jersey).

The remedy, Levitt suggested, could be found in adopting a "customer orientation" toward any business.* To this prescription one should add a second ingredient, and that is to maintain an awareness of impending technological change.

Maintain "Customer Orientation"

The railroads are in the business of transporting people and freight. Their fortunes have declined dramatically in the last 30 years even though the demand for transportation has increased substantially. Levitt argued that they "let others take customers away from them because they assumed themselves to be in the railroad business, rather than in the transportation business.... [T]hey were railroad-oriented instead of transportation-oriented; they were product-oriented instead of customer-oriented."

Ask yourself what business you are in. For example, you may answer the "broadcasting" business. But to think about that business in traditional terms is to follow the path of those who believed that their business was running a railroad or making steam locomotives. The danger becomes apparent if we recognize that no one needs "broadcasting." "Broadcasting" is a means that is currently efficient for providing services that are in demand. Thinking of it in those terms also makes clear the possibility that someone offering similar or better serives, at lower cost or more coveniently, might just take away your customers.

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*"Marketing Myopia," by Theodore Levitt, Harvard Business Review, 1960, reprinted September-October 1975.

To sum this up in different words, a business can survive and prosper only by providing something of value. If better ways to provide that "something" come into use, they will supplant the old ways. When this happens, the established business has essentially only two alternatives to decline: either to embrace the new ways and stay in the old business, or to find new uses for the old ways.

Think about what happened when television came on the scene. Important segments of the broadcasting industry rapidly embraced the new technology, following the first path mentioned above. The mass-entertainment radio business was rapidly translated into the new medium by the existing national networks. Many station owners won TV channel allocations. Eventually, local radio stations also found a way to follow the second path as well--they created the new radio business, with the technology of the old, exploiting opportunities that were themselves products of technological change.

The radio industry's customers, for example, are its advertisers--predominantly local advertisers.* Its real product, offered to those customers, is its audience. The growing strength of radio has come from its ability to deliver an audience of specified characteristics at relatively low cost.** As formats fragment, the audience profile is

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*Eighty percent of 1978 revenues were from local advertising.

**Radio broadcasters entered the eighties riding a modest boom in business fortunes. In 1976, after a half-dozen years of cost increases outrunning revenue gains, aggregate profits for the industry turned up. By 1978 they were more than triple the depressed level of 1975. Prosperity has attracted new entrants, and roughly 30 percent of the stations now on the air signed on for the first time after 1970.

The aggregate figures mask great diversity. Most stations are small and marginally profitable. Of some 5600 broadcast entities

etched in ever sharper outlines. The audience is there because radio has succeeded in delivering a service that it values and can't obtain elsewhere at comparable cost or convenience.

Maintain an Awareness of New Technologies

The central force powering the many contemporary changes in the information industries is the ongoing revolution in semiconductor technology. Steadily, for 25 years, the industry has reduced the size and cost of devices and improved performance at a rate that is truly astonishing. The cost per unit of performance has been falling by 90 percent every five years for the last 25 years. If that continues, it means that a solid-state product made now for $1000 will probably cost only $10 to duplicate (in functional terms) in 1990. The efficiency, power, and versatility of digital solid-state technology will probably lead to its adoption, over time, for all communication and control functions in our society.

The changes in capabilities of information technology will continue to be embodied in dramatically improved and different products for audio, video, and data services, and each of these areas will create new alternatives to radio. In audio, a new standard of music fidelity may become common with the diffusion of products based on digital technology. In video, a proliferation of specialized services

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reporting profits to the FCC for 1978, only some 2600--or 47 percent--reported revenues of more than $250,000 for the year. Even among the larger operations, profitability is not assured--in 1978, 640 of those stations (one out of four) reported net losses.

will augment and perhaps ultimately replace the current mass-audience network service, as technology massively increases the choices available to viewers. Data services are emerging as a distinct service, as information technology of all sorts becomes more easily and inexpensively accessible.

These changes are not on the horizon; they are happening now. What is uncertain is not whether they will occur, but at what rate, and with what consequences. One doesn't need to be able to predict the path of technology in order to anticipate its possible impacts on an industry. In fact, in the past, firms--and entire industries--that have been destroyed by technological change have suffered that fate not because they failed to anticipate the path of technology, but because they ignored the possible implications of change that were already a reality.

The ongoing revolution in information technology will leave no part of the information industries--and broadcasting is a part of the whole--unchanged for long. The question for managers in radio or television is how to track the progress of this revolution and how to anticipate its specific effects on their operations.

TRACKING TECHNOLOGICAL CHANGE

How can a manager anticipate the future effects of technological change on a specific business? The only honest answer to this is "with great difficulty, and substantial uncertainty." But that doesn't mean that the problem should be ignored. Uncertainties can be

reduced, if not eliminated, and the nature of potential threats and opportunities defined and made manageable.

It helps to recognize three basic points about technological change:

1) The impact of any new technology on an existing business comes about through adoption of the technology, and not its creation.
2) Technological change takes place through an orderly and predictable sequence of steps.
3) These steps take time, with the result that major change casts a long shadow before it.

The Case of the Video Disc

These points can be illustrated in terms of an innovation that is very much in the news these days--the video disc. It is surely one of the most sophisticated bits of technology now available over-the-counter in retail stores. The disc itself looks simple enough--just another plastic platter, not so different from the familiar LP record. But put it in a player (which, incidentally, embodies the most glamorous bits of current high technology, a laser and microprocessors), and the startling result is a beautiful color video program with hi-fi stereo sound.

As if often the case, the idea behind this up-to-date innovation is really an old one. John L. Baird demonstrated a working model of a crude system for recording video on a disc in London in 1927.

For the video disc, the next important steps came 40 years later. In 1970, Teldec (a joint venture of the powerful European firms, Telefunken and Decca) demonstrated a disc and player that would reproduce monochrome video comparable to current broadcast quality. By the end of 1972, both RCA and Philips had demonstrated, in their laboratories, alternative systems that produced color pictures and played for longer than the Teldec disc could hope to achieve.

Creating a laboratory prototype of a commercial product is a major step in innovation, but the product has little business significance until it has been refined for volume production and usage, and manufacturing facilities have been created. This always takes time. The first products based on the Philips system reached the market in December 1978, while RCA's disc was introduced nationally in March 1981.

It seems likely that the major consequences of this innovation will be recognizable only in the decade beginning in 1985. Only then will we know whether the video disc will be a success or a failure. And not until even later will disc players be owned by enough American households to become a significant force on mass behavior. At present, the optimists project penetration of 30 to 40 percent of U.S. households by 1990, while pessimists expect the product to flop. As is so often the case, the realists will only be identifiable in retrospect.

Lead Time for Technology

It may seem unusual to find a prospective major innovation surrounded by so much uncertainty eight years after its "invention" and two years after its introduction commercially. On the contrary,

this is the most common pattern in the history of technological change. To translate a laboratory prototype into a commercial product takes five years or more, and the adoption of that innovative product by half or more of its ultimate population of users takes five to seven years at best, and a decade or two most commonly.

Consequently, we can safely say that any technological innovation that will have major business significance by 1985 is already commercially available. Anything that will be significant by the early 1990s has already been invented.

Guidelines for Corporate Policy Makers

These patterns in technological change suggest certain simple guidelines for corporate policy makers:

1) Recognize that fundamental changes in technology imply both threats and opportunities for established businesses. The ongoing revolution in information technology is just such a major change. Right now it is beginning to make available to ordinary households an array of new products and services that previously were available only in special situations (like defense) or not at all.

2) Managers must not limit their views to a few glamorous innovations, like video discs, satellite communication, home computers, or fiber optics. Many elements of information technology are changing all at once, and they are likely to interact in unpredictable

ways. The broad sweep of technological change will exert the most significant force for change.

3) Avoid the very human tendency to disregard a phenomenon which is shrouded in uncertainty and potentially very threatening. Ignoring it won't make it go away. Some of the uncertainties can be reduced. And there may be real opportunities there as well.

4) Don't over-react. Change takes time. Concentrate on trying to anticipate future development of innovations already visible, and on tracking what's happening, the better to improve projections as time goes on.

New information technologies have already touched the broadcasting industries along numerous fronts. Digital computers control the transmissions of the national television networks. Digital recording for audio and video is likely to become a reality soon. Digital broadcasting is a possibility in the longer term.

The broadcasting industries are in touch with and capably adapting to the technologies which are changing the ways in which broadcasters work. If there is revolutionary change in broadcasting, however, its source will not be these. The potential threat to the established industry lies outside it, in the technological changes that are revolutionizing other information industries.

Anticipating the particular ways in which this stream of new technology will alter the information industries is a task fraught with uncertainty. But it is possible to speak with more confidence

about some kinds of predictions than about others. There is not much uncertainty about what new services will become commercially practical in the years ahead. There is some uncertainty about when this will happen in each case, although it is clear that some developments will occur sooner than others. What is most uncertain is the consumer response to each of these opportunities. Unfortunately, it is just that--for example, whether large numbers of consumers will adopt products built on digital sound reproduction technology, and at what rate--which is most important in understanding the future impacts on broadcasting.

Despite the uncertainties, it pays to address those questions, formulating answers in the shape of working hypotheses to guide action. Here is one possible approach:

1) Keep up to date on what technology is offering in the information industries.
2) Concentrate on what it offers users, not on technical detail; in other words, keep a customer orientation.
3) Form the best judgment possible about the likely response that users will have to the new product or service, but be careful to avoid the kind of bias exhibited by the steam locomotive manufacturers.
4) Most important, monitor what is actually happening with the new technology, continually updating your working hypotheses.

IMPENDING CHANGES IN INFORMATION TECHNOLOGIES

This approach can be illustrated by briefly examining a few specific new technologies. Rather than attempt to predict the changes, we will pose the questions that must be addressed for each.

First, radio. Most local radio stations build their programming around music. The low cost and portability of radio receivers and the quality of FM stereo sound have been major factors building radio audiences. What impact will low-cost, high-fidelity portable cassette players have on some segments of that audience? Small players with high-quality earphones are already available at moderate cost. Their prices are falling and their use proliferating. How many current listeners will prefer to play their favorites--perhaps recorded off-the-air--rather than take what comes on the radio in the car or elsewhere?

Potentially more significant as an influence on audience behavior is the development of digital sound recording. The improvement in sound quality is striking. Will many people care, or will it turn out to be irrelevant, as quadrophonic sound was? The answer will come only as digital records and players become available at affordable cost in a few years. If large numbers of listeners find that they do prefer the enhanced sound quality, it could mean attrition of the audiences for several, perhaps most, music formats. Existing AM and FM broadcasters can't transmit sound that will match the quality of digital recording. But cable television operators may begin to use some of their broad-band channels to transmit this type of high-fidelity

program service, providing another alternative competing for the household segment of the traditional radio audience.

Other technologies are addressing another facet of broadcast services--news and information. A component of most news and information services is the reporting of fairly standard types of data, i.e., factual information in simple categories, unadorned by interpretation. Weather, sports, and financial reports are typical examples. Electronic media have a natural advantage over print in storing masses of data that require frequent updating. New systems now in experimental, prototype, or introductory stages offer users the as yet unfulfilled promise of easy and inexpensive access to data more comprehensive and more current than either newspapers or traditional television broadcasters can hope to provide. Among these systems are two-way cable systems, teletext and viewdata and home computers with a telephone link to central data banks. They all make it possible to gain access to some universe of information on a video screen at the request of the user.* It seems likely that large segments of the population will have access to one or more of these systems by the latter part of this decade. What will that do to audiences for news and information transmitted by existing media processes?

In video, as in the other categories of application, the broadcast effect of new technology is to expand the consumer's reach and offer the means for greater selectivity about what appears on the

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*See, for example, "Why TV Sets Do More in Columbus, Ohio," Fortune, October 6, 1980, page 67.

TV screen and when it appears there. Instead of being limited to the offerings of three networks all aiming at the same broad audience segments, viewers in many markets will soon be able to obtain services from 52 or more cable channels.

The value of those cable channels is being enhanced steadily by linking cable systems with other information technologies. Satellite distribution of programs revolutionized the cable TV industry in the 1970s. In the home, there are experiments in providing new services made possible by combining personal computers with a cable system. Over the next few years we may also see that video recorders and video disc players can be used to expand the choices available to cable subscribers. In addition, home video players have the potential to become a major alternative means for selective distribution of video programming.

The Video Process Alternatives

The commercial introduction of magnetic video recording occurred in November 30, 1956, with the first electronically-recorded delayed broadcast to the West Coast of the CBS Evening News. CBS used the then-new Ampex "Quad" recorder, which served as the standard of the industry for more than two decades. Since 1959, a half-dozen Japanese firms have concentrated their efforts on developing technologies for the helical scan format, producing several generations of innovative products for use in schools, in business, and in the home.

A continuing stream of technical advances in the magnetic materials of recording tape and recording heads, and in microelectronic

circuitry, coupled with imaginative design of tape formats, tape-handling systems, and video circuits, has yielded dramatic advances in product features and performance. Recording density, probably the single most significant performance characteristic, has increased 100-fold in two decades. A 2-inch Quad recorder uses 747 square feet of tape per hour of program. The U-format machines, introduced in 1972 and now in wide use for electronic news gathering (ENG), are ten times more efficient, using 72 square feet per hour. The VHS and Beta machines now sold for home use are again ten times more efficient--using less than seven square feet per hour in extended-play mode. This affects more than just the cost of tape consumed, because greater density permits smaller cassettes and a much smaller machine over-all. Combined with the miniaturization of the electronic components, these advances have made low-cost and truly portable video recorders a reality.

Videotape is replacing photographic film as the medium of television news. Home video has become a major industry in the world, and there is reason to expect that the technical advances of the next decade will be no less dramatic than those of the last two. Some speculate that magnetic recording could replace photographic film in all aspects of TV program production, in home movies, and eventually in all aspects of the cinema and even still photography. Home video recorders are currently being sold, world-wide, at the rate of about six million units annually. Five years after introduction of the first successful design, the Betamax, this was a $4 billion industry, of which the Japanese account for about 95 percent.

Electronics specialists say that it is a mistake to think that the home recorder is near the limits of technology. They expect continuing improvements in features, such as program review, indexing, and slow motion. Smaller products permitting more flexible use may well be available, and prices should continue to fall, in constant dollars. One plausible scenario suggests that video recorders could be at least as common in consumer use in the 1990s as audio cassette recorders were in the 1970s.

How have consumers been using VCRs?

1) As a "time-shift" device, permitting the viewer to record broadcast or cable program for later viewing at the time of the user's choice.
2) To expand the menu of available programs, by using pre-recorded cassettes.
3) For home movies, as a direct substitute for photography.

Of these three uses, it is the first that could have the most fundamental impact on the structure of the broadcasting industry.* A broadcaster addressing an audience equipped with VCRs can consider any time to be "prime time," since viewers can program recorders to capture items of interest whenever they appear on a scheduled basis. If and when VCRs are found in 15 to 20 million American households,

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*The second use might also have a longer-term impact, but the current economics of tape duplication make mass-market use unlikely. Home movies, as an alternative leisure-time activity, compete, in a sense, with time spent on TV viewing, but probably not significantly.

there will be incentives for around-the-clock broadcasting, with perhaps early morning hours used to transmit programs of relatively narrow appeal, to be recorded by interested viewers. What we are talking about here is really a form of publishing. The technology is here today. The existence of a market (or markets) is yet to be determined.

If that market materializes, the broadcasters may be the first to tap it, but they face a formidable long-run challenge. The broadcaster, in command of a single channel, will be competing with the cable system operator controlling 20, 30, 50, or more channels to distribute programs. The perishability of video now lessens the value of those many channels. Will video recording shift the balance of power?

Video Discs

Another type of video publishing industry is in prospect now with the advent of the video disc. In comparison to VCRs, all video disc systems share two important characteristics: they can be used only to play pre-recorded programs, but they utilize a medium--the plastic disc--which provides notable economic advantages for that function. Even for quantities as low as 10,000, discs can be made profitably to sell at retail for $15 to $25 per two-hour program,* while the same material on tape today sells for $50 or more.

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*It is interesting that those price and volume figures correspond closely to the present economics of book publishing. The publication of trade books--now a $1 billion business in the U.S.--typically takes place with first printings of 8,000 to 12,000 units to be sold at retail prices ranging from $10 to $20.

The video disc may turn out to provide the best medium on which to create a true "visual publishing" industry. Those promoting this hypothesis point out that "soft publishing" of programs by transmission to recorders in the home requires a high degree of organization and planning on the part of consumers. This could inhibit large-scale development, especially if discs provide a real alternative. The "hard publishing" of programs on discs fits into well-developed shopping patterns, permitting impulse buying, word-of-mouth recommendation, and so forth.

On the other hand, discs require continued reliance on physical distribution channels--including the Post Service, trucking, retailers and middlemen, etc. One of the supposed attractions of the electronic highways is the ability to bypass their traditional labor- and energy-intensive structures.

When viewed as publishing media, from a user's perspective, the alternative disc technologies do have significant differences. The "optical disc," developed jointly by Philips of Holland and MCA, uses a laser to "read" microscopic markings impressed in a plastic disc. Players produced by Magnavox (a Philips subsidiary) and Pioneer Electronics (of Japan) are now on sale in most areas of the U.S., along with discs produced by Discovision Associates (DVA), a joint venture of MCA and IBM. RCA introduced an alternative system, called the capacitance electronic disc (CED), on a nationwide basis in 1981. A third, an incompatible capacitance system developed by JVC, has been announced for early 1982 introduction.

The optical system has the ability to address any single frame out of 54,000 on a disc. With stop, slow, and reverse motion features and two audio channels, the product has a high degree of versatility for educational and other uses, limited primarily by the imagination of software producers and users.

The capacitance systems, while lacking some of this versatility, have the advantage of inherently lower cost (based on technologies now available) for both disc and player. The first CED players had limited special features, but the technology can be used to offer two audio channels, slow and fast speed, and indexing to relatively small program segments (though not as precise as a single frame).

The winners and losers in the competition among the technologies may be determined by the ability to manufacture high-quality discs, in volume, at a cost. This is the sine qua non for entry into the business. It is still too early to comment on how convincingly the suppliers have demonstrated the ability to do this.* If they can get past this hurdle the systems have a greater chance of surviving or failing based on their inherent appeal to the market. The capacitance technology, now backed by manufacturers with great marketing clout (collectively they have a majority of the U.S. market for TV receivers) seem to be looking to reach the mass market. The optical system employs technology that has been seen as being particularly applicable to users with more specialized interests, such as home instruction,

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*This refers to information available to the public. Presumably the suppliers have satisfied themselves that they can meet this test.

games, etc. In combination with home computers and other new technology, the optical technology could lead to uses still not thought of.

The next overriding question is, where will all the program material come from? The first batch has been the existing stock of theatrical films. Beyond that, there is the model of thriving industries publishing magazines and books of relatively narrow appeal. Given the fundamental characteristics of the video disc technology, and particularly its economic characteristics, manufacturers of the machines are not expecting to run into any great obstacle to its growth into a major industry. Again, only a retrospective view will attest to their predictive insights.

IMPLICATIONS FOR BROADCASTING--AND OTHER TRADITIONAL MEDIA PROCESSES

When will the day soon come when the broadcasting transmitter and its tall tower are found only in the Smithsonian--along with the telegraph key and the vacuum tube?

That question is likely to be somewhat unsettling to a group of broadcasters. Those two artifacts--transmitter and tower--are central to the very concept of broadcasting. Yet they are being challenged by other communications technologies. It is, after all, characteristic of our industrial society that its institutions are constantly seeking--and producing--new and better ways. The resultant stream of technological change nowhere flows more briskly than in communications.

If it is inevitable that there will be changes in the ways in which society's needs are met, then it is dangerous for any institution to define its mission in terms of a particular technology. That is what the manufacturers of steam locomotives did. And that is what can happen to those who persist in calling themselves "radio broadcasters," "newspaper publishers," etc.

The remedy, already suggested, has two ingredients. First, broadcasters should be encouraged to understand their business from the customer's point of view. They need to identify what it is about their business that creates value for others--for advertisers and for audiences. Focus needs to be on the elements of value, not on the machinery now employed to create them.

At the same time, media businesses must try to anticipate the effects of technological change. In a fast-changing world, an organization that depends on being reactive, rather than proactive, runs a greater risk. But note that it is technology's consequences, and not the innovations themselves, that need to be forecast. Timing is the critical variable, since it can be as costly to respond five years too soon as it is to be five years too late.

History tells us that it is risky to focus on any single innovation as the likely cause of future changes in broadcasting. What is significant is the broad array of new products and services being developed from the new information technologies. There is a common thrust to these changes: lower cost, a richer menu of possibilities, and greater control by the user.

These characteristics may create great advantages over the traditional media of mass communications for performing certain old or as yet unrecognized functions. To date, we have experienced only the beginning of change in information technologies. The communications industries in the next decade or two will be characterized by more change--that is, by the appearance of more great opportunities for and more serious threats to the established institutions--than in any previous period.

Yet the change will not come overnight. It will come gradually at first, as it usually does. In 1981, it is taking form in the beginnings of an erosion of the position of the television networks and their local affiliates as the only channel for mass distribution of audio-visual information and entertainment. If this trend continues, it will certainly threaten the primacy of traditional network television. What effects would this have on the operations of the television networks and their program suppliers?

What will be the impact on radio by 1990? Those that specialize in news and information may have to watch the development of teletext and viewdata more carefully to determine their threat. Stations with certain music formats are advised to track the personal audio cassettes and digital recording markets. And, of course, because it has so many ties to television--sharing audiences, advertisers, some ownership, and a single regulatory agency--the radio industry is likely to feel the effects of any radical change in television. There will, no doubt, always be an audience for radio. But it is fair to

question whether that audience will remain large enough to sustain broadcasting as a commercial activity.

Those whose careers and businesses are tied to broadcasting have a personal stake in technology that affects communications processes. But those with the foresight to face the inevitability of change, and the vision to perceive the many opportunities created by the very developments which appear to threaten broadcasting, will at least have the opportunity to create a challenging alternative for themselves.