



Videoconferencing as a Technology to Support Group Work: A Review of its Failure

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ABSTRACT

Teleconferencing systems and services are the main set of technologies developed thus far to support group work. Within this set of technologies, videoconferencing is often thought of as a new, futuristic communication mode that lies between the telephone call and the face-to-face meeting. In fact, videoconferencing has been commercially available for over two decades, and, despite consistently brilliant market forecasts, to date it has failed to succeed except in limited niche markets. This paper reviews existing teleconferencing literature and provides an analysis of the reasons behind the failure of videoconferencing.

1. INTRODUCTION

Teleconferencing is the use of electronic telecommunications to enable people to meet in spite of physical separation. Although it is often thought of as a new, futuristic telecommunication service, the concept is by no means a novel one.

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Taken to the extreme, it might be considered as old as the telephone, since, after all, a simple phone call constitutes an example of a teleconference. Even more narrowly defined to include more parties and/or communications media such as video and graphics, it is a technology that has been around for over two decades. But over these two decades teleconferencing, particularly videoconferencing, has failed to become anything more than a revolutionary concept on the brink of success.

On the surface, the rationale behind videoteleconferencing seems sound enough. Intuitively, it would seem that a video conference is the closest thing to "being there". Furthermore, there is solid justification in terms of "hard dollar" savings brought about by the potential reduction, if not elimination, of travel costs. The experience to date, however, yields increasing evidence that videoconferencing is not the communication mode that lies between the telephone call and the face-to-face meeting, and that there are few examples of travel substitution directly attributable to videoconferencing or, for that matter, teleconferencing in general. Furthermore, it is becoming increasingly clear that the success of this technology is much more dependent on the nature of the application for which it is introduced than on system details and features.

Thus, the industry that developed around the videoconferencing concept in response to unanimously optimistic market forecasts of spectacular growth is facing less than overwhelming success. In contrast to forecasts of the early 70's which predicted that a full 85% of all meetings would be electronically mediated by the end of that decade (Snyder, 1971), are current statistics which report that the number of videoteleconferencing facilities in existence worldwide amount to about one hundred (including installations associated with teleconferencing vendors and telecommunications companies) (Tyson, 1987; Noll, 1985; Johansen, 1984; Beckmann, Ehlinger, and Macchia, 1985). Thus, videoconferencing has become a synonym for marketing disaster, perhaps displaced only by the Coca-Cola fiasco of 1985. Curiously, however, predictions of large markets continue to emerge (Lineback, 1982; Showker, 1982; Frost and Sullivan, 1983; Bohm and Templeton, 1984), and vendors continue to proclaim the virtues of all forms of teleconferencing at (face-to-face) conferences, seminars, and trade conventions.

There is already a substantial body of work, both systematic and speculative, that is aimed at analyzing the factors contributing to the failure of teleconferencing from a variety of standpoints. However, only recently has it become apparent that these factors lie beyond the scope of technological and economic analysis and include psychological and sociological ones. This paper examines and reviews some of this work with a view toward understanding the discrepancy between the continuing optimism of marketing expectations and the current state of the industry. It is argued that the casting of electronic communication in the image of face to face meetings stands in the way of developing videoconferencing media to their fullest potential.

Following a description of videoconferencing as a communications medium, the paper addresses some common misconceptions about videoconferencing and examines the factors contributing to its lack of success. A

distinction is made between those factors that affect purchase decisions and those that influence usage of existing systems. Finally, the last two sections discuss the likely avenues for the success of videoconferencing, and some factors which may further influence the acceptance of teleconferencing. In reviewing the videoconferencing experience we may draw from the many lessons it offers to avoid analogous pitfalls in the conception of new technologies to support cooperative work.

2. OVERVIEW OF VIDEOCONFERENCING AS A COMMUNICATION MEDIUM

The concept of videoconferencing originated over thirty years ago. Its main use then was for large corporate meetings such as annual stockholders' meetings. In its early days, videoconferencing was used primarily by AT&T itself, who did not have to be concerned with the high cost of leasing terrestrial microwave facilities or establishing private microwave networks. The perceived success of AT&T corporate video teleconferencing meetings prompted the development of a concept that had been bandied about Bell Labs since the 1920's (Ives, 1930): Picturephone.

In spite of the bandwidth limitations of this system, which precluded the reproduction of motion and fine detail (e.g., printed text), early market forecasts for the "picture telephone", first introduced publicly at the 1964 World Fair, were extremely enthusiastic. At that time it was predicted that replacement of the standard voice telephone by the picture telephone would take place by the early 1970's. Julius P. Molnar, executive vice president of Bell Laboratories wrote in a special issue of *Bell Laboratories Record* (1969) devoted entirely to the Picturephone:

Rarely does an individual or an organization have an opportunity to create something of broad utility that will enrich the daily lives of everybody.

Alexander Graham Bell with his invention of the telephone in 1876, and the various people who subsequently developed it for general use, perceived such an opportunity and exploited it for the great benefit of society. Today there stands before us an opportunity of equal magnitude - Picturephone service.

He continues in another article of the same issue:

Most people when first confronted with Picturephone seem to imagine that they will use it mainly to display objects or written matter, or they are very much concerned with how they will appear on the screen of the called party. These reactions are only natural, but they also indicate how difficult it is to predict the way people will respond to something new and different. Those of us who have had the good fortune to use Picturephone regularly in our daily communications find that although it is useful for displaying objects or written matter, its chief value is the face-to-face mode of communication it makes possible. Once the novelty wears off and one can use Picturephone without being self-conscious, he senses in his conversation an enhanced feeling of proximity and intimacy with the other party. The unconscious response that party makes to a remark by breaking into a smile, or by dropping his jaw, or by not responding at all, adds a definite though indescribable "extra" to the communication process. Regular users of Picturephone over the network between the Bell Laboratories and AT&T's headquarters building have agreed that conversations over Picturephone convey much important information over and above that carried by the voice alone. Clearly, "the next best thing to being there" is going to be a Picturephone call. (Excerpt quoted by Martin, 1977)

But this enthusiasm met with disturbing reports of phenomena such as users' feelings of instant dislike toward parties they had never seen before, self-consciousness about "being on TV" (aggravated by distortions created by the camera's sensitivity to the infrared part of the spectrum), and resulting low acceptance. A special issue of the *London Economist* (1969) devoted to telecommunications talks about the Picturephone as "a social embarrassment" and describes conversing over it as "talking to a mentally defective foreigner".

Picturephone never really took off for a combination of reasons, including its cost and limited functional capability. Nevertheless, in the early 1970's attention shifted back to the related concept of videoconferencing. Rising business travel costs spurred on the idea that most business meetings could be conducted over two-way television or similar systems.

A large number of demand modeling and attitude survey studies that were conducted in the early 1970's concluded that a large share of the total volume of business meetings are candidates for electronic mediation. Among the best known of the demand modeling studies are those performed by the Long Range Studies Division of British Telecom (see Harkness, 1973). Using trip data from a sample of 1000 business meetings in the UK, these studies calculated that 41% of all business meetings involving travel could be conducted over narrowband teleconferencing systems with no loss of "effectiveness". The addition of a visual channel could accommodate another 9%. Paralleling these demand modeling studies, early attitude surveys also painted a rosy future for teleconferencing systems, particularly those that provide a visual channel. For instance, Snyder (1970) surveyed over 3000 Bell Laboratories employees and found that 85% would be satisfied with a system that included audio and video for faces and graphics.

The socio-political climate of the early 1970's also stimulated much research and development effort on the topic of teleconferencing. Two major sources of concern heightened the interest

in telecommunications technologies in general. The first of these was the deterioration of the quality of life in the city. Staggering crime statistics, poverty, disease, and violence were seen as products of high population density. The solution to the problem was envisioned as population dispersion into rural areas, with telecommunications as the means to that end (Goldmark, 1972a, 1972b).

The second factor contributing to the interest in telecommunications was the rising cost of long distance travel. Awareness of this factor was made distinctly acute by the energy crises of the 1970's. Separate studies conducted by AT&T, Coopers and Lybrand, Inc. (reported in Bohm and Templeton, 1984), and others done in the UK and Canada (reported by Kraemer, 1982) estimated that 75% of business travel is to meetings, and that 60% of these (45% of the total) are intracompany. Therefore, the Long Range Studies results mentioned above could be translated as a total travel substitution level between 20-30%. In terms of energy savings, Dickson and Bowers (1973) calculated that the energy expended in traveling by air is sufficient for 64 hours of videophone conversation between New York and California, and that one gallon of gasoline contains enough energy to support 66 hours of local video connection.

Not surprisingly, the potential for substituting various forms of telework (neighborhood work centers, remote data terminals, teleconferencing) for intracity travel, and various forms of teleconferencing (audio, video, computer) for intercity travel became the subject of national and international policy discussions, with research peaking during 1972-76 (Kraemer, 1982). Although the concept of a new dispersed rural society (Goldmark, 1972a, 1972b) did not materialize (urban renewal and suburbanization became the prevalent trends), enough impetus remained for teleconferencing on the basis of travel/energy substitution alone.

However, in spite of brilliant market forecasts, with rosy demand models and attitude surveys to back them, and the appearance of great activity generated by the flurry of (face-to-

face) conferences, seminars, demos, and articles about teleconferencing, the 1984 installed base of videoconferencing systems was pitifully small. A recent estimate counts 210 systems in use in the U.S. spread over some 75 companies, including telephone companies and videoconferencing system vendors who have an obvious interest in the technology (Tyson, 1987; see also Beckmann, Ehlinger, and Macchia, 1985, and Johansen, 1984 for older but comparable estimates). Furthermore, as of January of 1985, AT&T had closed down over half of its national conference rooms (Nelson, 1985).

3. FACTORS CONTRIBUTING TO THE FAILURE OF VIDEOCONFERENCING

An analysis of teleconferencing and related literature points to two broad factors responsible for the discrepancy between videoconferencing market forecasts and current realizations. The first of these is the inadequacy of needs assessment methodologies. The second is the questionable portrayal of videoconferencing as a direct replacement for face-to-face meetings. As we shall see below, the most successful videoconferencing systems currently in place depart significantly from this notion. These two factors are at least in part responsible for the unsuccessful marketing strategies used by teleconferencing vendors. As it turns out, many of the sales points used to encourage purchase decisions are the very points that militate against system usage.

The appropriateness of available methods for technology needs assessment has been questioned in the past (Elton and Carey, 1979; Short, Williams, and Christie, 1979). With respect to teleconferencing as a whole, the methodology is suspect on several counts. First of all, the results of surveys of potential users show wild variability that cannot be wholly attributed to experimental error or sampling population differences. For instance, while the Snyder (1971) study mentioned above predicted a potential 85% substitution of face-to-face meetings, a very similar study by Kollen and

Garwood (1974, reported by Kollen, 1975) predicted only 20% substitution. The two surveys are nearly identical in format and methodology; both attempt to match hypothetical teleconferencing facilities (described to respondents in a section of the questionnaire) with descriptions of recent meetings (provided by respondents) in an effort to assess whether these facilities might meet respondents' meeting needs. However, the Kollen and Garwood study goes a step beyond assessing sufficiency of telecommunication devices for satisfying stated needs. Their survey explicitly asks respondents to indicate whether they would have used such devices instead of traveling to their meetings. The crucial distinction here is that what technologists might offer to meet a perceived market need is not necessarily what target users might actually choose to use (see Moore and Jovanis, 1987). Clearly, given the differences between the two results, there are more factors involved than a straightforward facilitation of the mechanics of a process that is candidate for electronic mediation or automation. Surprisingly, the difference between these studies seems to have been ignored, and both are often cited together simply as examples of positive market estimates (see e. g., Noll, 1985; Kraemer, 1982; Johansen, Vallee, and Spangler, 1979).¹

Aside from the inherent difficulties and questionable methodology available for accurately assessing or foreseeing the size and

needs of the teleconferencing market as a whole, we might also add that many teleconferencing vendors have misjudged the needs of individual client organizations. There are numerous examples of mismatches between users' needs at all levels (individual, corporate/organizational, and societal) and technology even at the stage of actual system implementation. Such mismatches are often the reason for the failure of many installations. So, for example, Johansen (1979) points out the importance of recognizing and accommodating the idiosyncrasies of the organizational culture of a user group. A group's culture sets the tone for its meetings, and the physical environment in which meetings take place is not only a direct reflection but a facilitator of this culture. As Johansen puts it, a group of senior banking executives would hardly feel at home amidst the Spartan furnishings of a typical academic meeting room. Thus, many teleconferencing rooms that reflect the culture of the telecommunications vendor who designed them rather than that of their end-users quickly fall into disuse and become expensive fiascos.

Inadequate needs assessment is without doubt related to the apparently universal assumption that videoconferencing is a direct replacement for face to face meetings as we know them today.² Videoconferencing needs assessment and

1. There is also reason to suspect the results of both of these studies, and, for that matter, of any attitude survey or focus group study which expects participants to judge the utility of devices which they have neither seen nor experienced. A verbal description of a novel system is open to many individual interpretations, and may bear little relationship to the actual experience of using the system. No less significantly, such a description is also subject to possible biases introduced by the assessor. Anyone aiming to assess potential needs is likely to find needs whether they exist or not. (See Elton and Carey, 1979, for a description of this and other potential pitfalls of needs assessment research.)

2. Many new automation technologies are designed to replicate existing procedures, with little thought given to the impact that these technologies will have on the way things are done. So, for instance, word processors have typically been designed for typists. They are not optimal for the originators/composers of text who might, for instance, find it useful to maintain a "history" of textual modifications (see Lippman, Bender, Solomon, and Saito, 1985 for a notable example of an editor designed for the text composer). However, new office technology has significantly changed work styles in that non-clerical workers now perform many functions which were delegated to clerical workers in the past. Another example, electronic mail, was initially little more than an electronic substitute for paper mail delivery, though it later evolved into the more interactive medium of computer conferencing.

system design, as well as system evaluation (e.g., Duncanson and Williams, 1973), have been firmly founded on this basic assumption. Only recently have a few researchers begun to question this assumption as a limiting and short sighted one (Johansen, 1984).

Though the consensus has long been reached that teleconferencing is more appropriate for some kinds of meetings than for others, careful quantitative analyses of "target market" meetings have only just begun to emerge. The results of earlier laboratory-based and field studies (Champness, 1973; Christie, 1974, 1975; Christie and Holloway, 1975; Noll, 1976) indicated that teleconferencing is best suited for regularly occurring meetings aimed toward the presentation or exchange of neutral information between colleagues in different locations.³ However, it appears that the proportion of meetings that match that description is indeed very small. Noll (1985), for instance, surveyed organizations using a simple self-administered questionnaire to determine the proportion of target meetings, i.e., those best suited for teleconferencing, out of the total number of all types of group meetings. Using the number of target-type meetings as a "rule of thumb" estimate of the total market for teleconferencing in a particular organization, he calculates that the market for two-way interactive teleconferencing is only about 4% of the total of all types of group meetings.

The non-substitution of travel by teleconferencing in itself also supports the notion that teleconferencing should not be regarded as a direct replacement for face-to-face meetings. Examining the "before and after" travel patterns of teleconferencing users we find, not a reduction in the amount of travel, but, rather, an increase in the number

of meetings (Brancatelli, 1985; Johansen, 1984; Mosera and Springer, 1983).

The marketing strategy used until recently by teleconferencing vendors reflects the limiting assumption that the technology is a substitute for face-to-face interactions and is often equally short-sighted. Though we now know that the claim that teleconferencing reduces travel is unjustified, the potential reduction of travel budgets has been used as a sales point aimed at purchase decision makers. On the other hand, the reduced opportunity to travel is often viewed negatively by end-user executives (Johansen, 1984). Similarly, another commonly cited "benefit", is the idea that teleconferencing leads to more effective and efficient meetings. Ronald Bohm writes in "The Executive Guide to Video Teleconferencing":

Teleconferencing not only decreases the lead time for meetings, it also tends to make meetings more effective. A teleconference requires more planning than an "in person" meeting; consequently, shorter and more effective meetings are usually the result. Since personnel in two or more cities must be prepared for the meeting, more attention is devoted to the preparation of agendas, handouts, and presentation media. Less time is spent socializing because meetings are held more frequently with more accomplished in each meeting. In some cases the use of long-distance transmission seems to reduce the urge to waste time with small talk. (Bohm and Templeton, 1984)

Efficiency claims such as this also turn out to be two-edged swords. First of all, managers easily recognize that there are much less costly ways of teaching their employees to conduct efficient meetings. Secondly, if preparation time is greater, meeting time may be reduced, but it is questionable whether there will be any savings in *total* time. But more importantly, it is precisely the reduced opportunity for informal, unofficial interactions that makes teleconferencing unattractive to politically

3. Note, however, that some researchers (e.g., Watzlawick, Beavin, and Jackson, 1967) hold that it may be oversimplistic to believe in the existence of any such "low risk" interactions.

savvy employees. There is a large body of literature that suggests that it is often over informal chats outside of official meeting rooms that important information is transmitted and real decisions are made (e.g., Mintzberg, 1973).

Much systematic research has also been conducted to compare the effects of different communication media on various tasks such as problem solving, decision making, and information transmission (for reviews see Williams, 1977, Chapanis, 1980, and Short, Williams, and Christie, 1976). Results generally point to the dubious value of adding a visual channel that allows visual contact between participants; performance does not improve significantly over that achieved with narrower bandwidths. However, these results should not necessarily be taken to mean that teleconference systems should never include video capability. Visual contact among conferees does not add significant content, in the information-theoretic sense, to a teleconference. However, it can provide a sense of social presence and mutual knowledge of the sort that is crucial for effective communication (Krauss, 1988). Furthermore, it can add to its desirability or appeal if it is provided cheaply enough. There is, in fact, evidence that people in office environments would include video in the "optimal" information system design if they were not constrained by budgets. A 1982 survey by the Institute of the Future (reported in Johansen, 1984) found that about 50% of respondents would do so⁴. On the other hand, when asked to select optimal features for system design given a fixed, finite budget, only 15% of respondents chose video. Data such as these indicate that potential users realize the current limited utility of a video channel. However, people may show greater willingness to pay when new video-based services become

available that increase the utility of having a video capability.

4. AVENUES FOR THE DIFFUSION OF VIDEOCONFERENCING

Even if the market for two-way interactive teleconferencing is in actuality very small, the study of the diffusion of innovations teaches us that the actual uses of many technologies are often different and/or broader than the applications envisioned by their inventors/designers (Dickson and Bowers, 1973). Furthermore, it teaches us that the diffusion of innovations can follow unexpected paths (Rogers, 1973). So, with respect to videoconferencing, the bulk of the anecdotal success stories that one finds in marketing documents and business reviews are largely related to special applications that go beyond direct substitution of face-to-face communication. These "successful" applications would, for the most part, not be possible without videoconferencing; face-to-face meetings in these cases are simply not practical.

A recent *New York Times* article (Nov. 10, 1985) cites many examples of such successful applications. For instance, a number of companies, including Wang, Digital Equipment Corporation, and Kodak, are making extensive use of their two-way videoconferencing facilities to train sales staff and services technicians distributed across the country (in fact, Wang is even linking their system with that of the Ford Motor Company to train Ford employees to use Wang equipment). The speed with which training can be delivered to large numbers of employees often gives these companies a competitive edge. For instance, when IBM announced last August that it would drop support for its System 34 software, Wang quickly set up a conference with sales people at 13 sites to disseminate this information and to tell the sales force how to best use it to attract IBM customers.

Another example of a successful installation is that of the Boeing Company. In 1980, under

4. This result is not artifactual in the sense that everyone in the study did not select every option; only 13% did, in spite of the common belief that people will take as many features as they can afford.

the pressure of having to meet strict deadlines for the development of the 757 commercial aircraft, Boeing engineers jerry-rigged a two-way TV system to connect its airfield, engineering, and manufacturing facilities located within a 30 mile radius. Personnel at these locations foresaw a strong need for frequent interactions and no time to waste on interlocation travel. Videoconferencing was, and still is, seen at Boeing as the only way to meet ambitious schedules.

One last example of how videoconferencing can permit activities that would otherwise not be possible can be found at J.C. Penney's Dallas and New York headquarters. Penney takes advantage of its videoconferencing facilities at these locations to include in meetings junior executives whose travel budget would not allow for attendance. According to a member of J. C. Penney's Systems Engineering staff (personal communication), senior executives (who attend meetings in person) are able to call upon more junior managers for consultation over the video link. In addition, Penney managers feel that "attendance" at these meetings is invaluable for the junior executives' own development.

For J.C. Penney, this application is just a small part of a company-wide effort to shift responsibility downward on the managerial scale. As another example of how the company is using videoconferencing to achieve this goal, individual stores' senior buyers from around the country are now picking the styles they want via televised fashion shows arranged in and broadcast from New York. Before videoconferencing, merchandising specialists at the regional level would make frequent trips to New York and select merchandise to be sold in all the stores in their territories. Distributing this responsibility to middle managers in individual stores allows for more appropriate merchandise selection for each store.

Thus, the first question to ask given a view of videoconferencing as a supplement rather than a replacement for face-to-face meetings is what this technology allows us to do that we couldn't do otherwise. The next question to ask given the

increase in communication to which videoconferencing can potentially lead is how to maximize the utility of this increase, and, relatedly, how to technologically enhance communication intensive functions that are already in place. To achieve these goals a thorough understanding is required of the kinds of communicative tasks that are commonplace in communication intensive domains, of the interaction dynamics that drive these tasks, and of the way people use their current communication tools. Thus, two types of studies are required. First, detailed studies of collaborative work tasks are essential. Secondly, evaluative studies of collaborations conducted over videoconferencing testbeds are invaluable. By itself, technology driven research that evaluates the utility of various design features has poor chances of arriving at useful innovations; the space of possibilities is too great. On the other hand, task driven research alone requires a great leap of imagination on the part of the researcher (and potential user), and as such, runs the danger of overlooking, among other things, crucial changes in the nature of the task or work style introduced by new technology.

Previous research on usage of and reactions to trial videoconference systems has already suggested some new directions for designers and marketers, who are now shifting their focus away from conference room systems toward office systems. The results of a one year study which monitored users of two portable audiographic office teleconference systems (Mosera and Springer, 1983a; Mosera and Springer, 1983b; Springer and Mosera, undated), led to the following recommendations for system design. First, the study found that users most frequently prefer office over conference room teleconferencing. Dedicated office systems (or at least systems that can be easily accessed and connected in a matter of minutes) permit spontaneous "working-session" style meetings of the type that are best as supplements for more formal face-to-face meetings. Office systems also allow conferees to be surrounded by their own resource material and/or colleagues. In cases

where users indicated a preference for conference room teleconferences, reasons given had to do with 1) greater facility for assembling groups larger than about three people, and 2) the fact that conference rooms typically have higher audio quality. Thus, Mosera and Springer recommend maximizing audio quality and providing two camera angle settings, one to capture individuals and another for small groups.

Mosera's and Springer's inferential data on the importance of audio and video quality for user acceptance are typical of what is available to date on this topic (at least in the public domain). Though responses to evaluative surveys commonly include complaints about the poor audio quality of teleconferencing systems, there are no concrete data to define user acceptability requirements. Anecdotally, it is worth noting that success of existing systems is spread over many types of systems varying widely in audio and video quality. So far, it would appear that the success or failure of teleconferencing systems is more closely tied to the nature of their intended application than to details of technical quality.

A survey conducted by the Institute for the Future in 1982 (reported in Johansen, 1984) constitutes an example of a study that is more purely task-driven. This study obtained data about workers' frustrations which strongly indicated that store-and-forward capabilities would be highly valued. Respondents listed the following as major sources of frustrations in their day-to-day work life:

- too many interruptions
- difficulty reaching others
- time wasted at meetings
- communications too slow
- difficulty maintaining continuity in communications over time

The prediction has been borne out in the growing success of computer conferencing services and systems. Store and forward capabilities can potentially alleviate the

problems associated with synchronized communication over media that demand instant response and may augment the utility of teleconferencing systems. Innovative combinations of technologies such as this, as well as the integration of media in ways that will create more flexible and useful services (e.g., voice annotation of images) may expand the market for teleconferencing.

5. FACTORS THAT MAY INFLUENCE THE ACCEPTANCE OF VIDEOCONFERENCING

So far, videoconferencing is not much more than a small conglomeration of "niche" markets each of which is being addressed by different vendors with different system formulas. However, there are a number of external factors that may positively influence its acceptance in the near future. Among these are organizational and social changes that may already be emerging as trends.

The decreasing cost of bandwidth, the proliferation of satellite communications, and the emergence of cheaper, more convenient technologies and of new video-based services are often mentioned as factors that may increase the utility of a video capability (e.g., Kraemer, 1982). In addition, market forecasters such as Frost and Sullivan (1983) predict that increases in the number of installations and subscribers alone should have a positive influence because, as with most interactive technologies, the more people that have videoconferencing, the more useful it becomes.⁵

5. This prediction must be taken with caution, however. First, videoconferencing will probably be limited to business applications in the foreseeable future. With a few isolated exceptions (e.g., Wang-Ford teletraining) these applications are primarily intra-company, so the "critical mass" argument breaks down. However, a certain amount of diffusion is likely to occur as a result of companies emulating competitors who adopt the technology.

It is also possible that the current explosion in office automation systems, and the resulting attitudinal changes toward high technology, may open some avenues for related technologies such as videoconferencing. Some of these may be adopted as a by-product or side effect of general office automation, particularly as new employees enter the work force with greater computer and technological skills and orientation. Already, some of these effects are visible in the expansion of computer conferencing.

A severe fuel shortage could also have impact on videoconferencing. It is conceivable that people might desperately try to substitute telecommunications for travel should the latter be severely disrupted. This scenario is in the mind of many telecommunications managers, and many large companies are actually working on videoconferencing-based contingency plans. It is, at least in part, this fear which maintains the continuing level of interest in videoconferencing as reflected by the steady flow of articles on the subject in business magazines and periodicals. Concern is most evident in the hotel/motel industry, in which a growing number of corporations are hedging against the possible consequences by installing and promoting video teleconferencing facilities between hotel locations. In 1979 Holiday Inn started a nationwide network of more than 200 facilities in its motels. Marriott Corporation began offering video teleconferencing services in 1982, and Hilton Hotels Corporation followed in 1984 (Selz, 1984).

Another positive influence on the acceptance of videoconferencing may come from changes in organizational structures, particularly changes in managerial scales. Numerous recent business publications advocate the softening of managerial hierarchies and shifting responsibility to lower levels of management as the latest strategy for corporate success. While there is as of yet no concrete evidence that such changes are actually taking place on a widespread basis, it is interesting to speculate on the effects such a trend would have on videoconferencing. Decentralized decision

making in the form of project teams, for instance, may increase the proportion of "working session" style of meeting of the kind that is best suited for electronic mediation. Furthermore, a downward shift in responsibility places decision making in the hands of lower level managers with limited travel budgets. It is interesting to note that over one third of the companies described in the book *In Search of Excellence* (Peters and Waterman, 1982) use teleconferencing on a regular basis.

6. CONCLUSIONS

To the present, videoconferencing has not met with widespread success except in limited "niche" markets. The reasons for its overall failure revolve around its misrepresentation as a substitute for face-to-face meetings and the current lack of real utility for a video capability. However, changes in the industry's overall focus, as well as various other external factors, may increase the acceptance of teleconferencing as a whole.

The shift toward office rather than conference room teleconferencing not only lowers its cost but also makes the technology more easily accessible for more spontaneous and informal types of communication that complement (rather than replace) face-to-face meetings. Furthermore, factors such as the increasing technical orientation of office workers, the proliferation of office automation technologies, and structural changes in the nature of managerial hierarchies may broaden the market for teleconferencing.

In the midst of these trends, it is difficult to predict the future of videoconferencing. What emerges clearly is the need for further research that explores how this technology can allow users to do business in creative and innovative ways.

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