

Final Report

TELECOMMUNICATIONS AND DECENTRALIZATION

by

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March 15, 1980

A Report Prepared for the  
Government Telecommunications Agency

Department of Communications  
Ottawa

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# Final Report

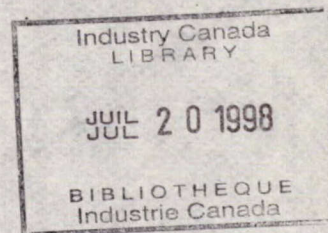
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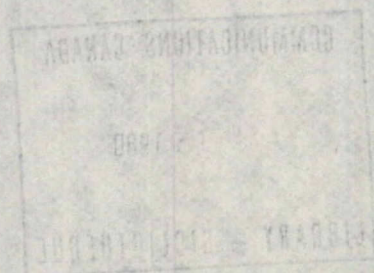
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## Abstract

This report presents the results of a research program concerned with the relation between organizational decentralization and telecommunications in general and with specific reference to the Canadian Government Telecommunications Authority.

The first chapter reviews some of the literature on decentralization and telecommunications and notes the importance of telecommunications media to effective organizational functioning. Chapter two focusses on the communications alternatives which currently exist for GTA and which might come to exist in the very near future. A central theme is that particular media are useful for particular purposes given a particular set of constraints. A main recommendation is that GTA should take a more active role in indicating the necessity for early involvement in the relocation or reorganization process, as well as in the distribution of information and assessment of satisfactions pertaining to effective use of communications media.

Chapter three presents an extended inventory of existing and prospective teleconferencing alternatives, while chapter four reviews some of the existing literature concerning communications utility and effectiveness for particular media. Chapter five reminds us that we must always consider the goals whose achievement these media are to facilitate in choosing from among the growing array of alternatives. Chapter 6 develops additional recommendations for DOC and GTA.

## Table of Contents

### Abstract

### Summary of Recommendations

### Chapter 1: Introduction

The Problem: Decentralization and Communication in Government

The Research Method

The Interviews

Headquarters

Regions:

- i) National Capital Region
- ii) Atlantic Region
- iii) Ontario Region
- iv) Pacific Region

Preliminary Observations

Decentralization

General Characteristics of Decentralized Organizations

Social-Psychological Aspects of Telecommunications in Decentralized Organizations

## Chapter 2: GTA Functioning and Telecommunications

The Organizational Context of GTA

GTA and Communications Media

Communications Modes in GTA

- Face-to-face
- Telephone
- Mail
- Courier
- Telex
- Government Data Network (GDN)
- Word Processing
- Facsimile
- Audio-Teleconference
- Audio-Teleconference and Facsimile
- Audio-Visual Teleconference

Addendum to the Assessments

## Chapter 3: Advances in Telecommunications Systems and Services: Implications for GTA

Introduction

Current Trends

- Teleconferencing Systems
  - Video Teleconferencing
  - Audio Teleconferencing

Office Automation

Data Communications Networks

Viewdata/Videotext Systems

The Introduction of Communications Technology: Prescriptions  
for Success

Implications for GTA



## Chapter 4: Social/Evaluative Research on Teleconference Systems

Introduction

The Material Reviewed

Assessment of the Literature Reviewed

Conclusions and Summary

## Chapter 5: Evaluating Telecommunications Systems

What Questions are Asked

Neglected Questions

Research Alternatives

Values and Objectives

Social Change

Theory and Practice

Summary

## Chapter 6: Recommendations Derived From This Research

Planning

Evaluation

Training

## Summary of Recommendations

I. In view of the importance of communications to organizational functioning, and to the long lead times involved in establishing effective telecommunications procedures, GTA should become an integral advisory component of any governmental planning concerning decentralization, deconcentration or relocation. Specifically, GTA should henceforth be involved in the overall planning of integrated, optimized information systems, so as to (a) ensure compatibility among telecommunications services, and (b) effect pressure for the creation (definition) of standards. This planning should be based in part on answers to immediate questions about technology, cost, and human factors issues; it should also be based on data and decisions about the organizations' objectives and the related social impacts, costs, and benefits of the prospective organizational changes.

II. GTA should adopt and institute evaluation methods that are concerned with social values, social change, and the relation of research to practice. These evaluations should attend to organizational objectives (e.g., improved services) and individual concerns (e.g., issues of privacy and premature access); these evaluations should explicitly acknowledge that any organizational communications system has its own historical antecedents and that the system will remain a constantly changing one. The focus of such research should be less on issues of interest to abstract social science than has been the case previously, and more on personal, group and organizational goals.

III. GTA should become actively involved with education and training of its own personnel and those of other organizations to which it will offer advice and planning (as in recommendation I) or assessment (as in recommendation II). This should be done through many avenues, ranging from continually updated brochures to large-scale education programs. GTA should develop the capacity to (a) train its own personnel and those of prospective clients concerning current and forthcoming telecommunication and information systems; (b) train its own personnel and those of clients in the use and application of new services and systems; and (c) train its own personnel and those of clients concerning assessment and interpretation of data and conclusions from both human factors and behavioural-organizational research.



## Chapter 1

### Introduction

#### The Problem: Decentralization and Communication in Government

The decentralization of government agencies and departments has changed the traditional paths of communication within those organizations and between them and other organizations with which they must interact. Person-to-person communication links have been disrupted, and established information exchanges within and between departments have been altered by the introduction of what are sometimes substantial geographical separations. In addition, requirements have arisen for new and different communications channels because of changes in the division of responsibility and authority that has accompanied decentralization.

Some of the disruptions in established communications processes are obvious: for example, face-to-face contact now requires more travelling; what formerly involved local mail distribution now includes postal services; access to shared central registries has become impossible; local telephone exchanges no longer suffice and calls are now long-distance. Other changes are not so obvious: informal communication networks between individuals, known to be vital to the functioning of all organizations, can be distorted or destroyed; co-workers no longer share a common "sense of community", a loss which can seriously alter their perception of problems; support facilities, such as personnel departments, can become remote and bureaucratic; management channels for supervision and consultation become impersonal and it becomes difficult to effect control and assessment through them.

At the same time, however, many observers of the revolution in telecommunications technology have declared that the time is at hand when telecommunications can support the decentralization of large and medium-sized organizations. This is claimed to be particularly true for organizations that are part of the information industry, and this could include many aspects of most government departments.

Government departments and agencies have been decentralizing in different ways, usually through the relocation of subunits, but sometimes by the movement of most of a department to a new community. Virtually no "dispersion" has taken place, such that work centres are established at locations throughout a city with employees reporting to the one nearest their home, without regard to which part of the organization they belong. Canadian economics, geography and political structure have led the government to a different form of decentralization through the establishment of regional offices and centres in many departments. These are extensions of the original organization and involve duplication of services and functions designed to improve the contact between the department and the public.

Our specific concern in this study was a "decentralized" Government Telecommunications Agency (GTA). Whatever form decentralization takes, changes in the responsibilities, authority and operations of organization can yield a number of problems which are attributed to the disruption of communications. It was felt that through an analysis of the problems encountered, of the communications paths identified, employed and disrupted, and possibly restored by telecommunications, it might be possible to determine whether any problems resulted from a lack of planning for and development of appropriate communications paths to support the new organization, and to identify the telecommunication systems required to restore these paths.

### The Research Method

It was proposed to conduct the research in two concurrent parts. The first was to be based on a series of interviews with senior executives, both from headquarters and from different regions, in a decentralized organization, the Government Telecommunications Authority. The second part of the study was concerned with a review of the literature on decentralization and communications, with emphasis on teleconferencing and other services that might apply to distributed organizations, for the purpose of assessing telecommunication systems in the context of decentralization.

### The Interviews

Early in the planning of this research, meetings were held between the investigators and Messrs. McCrum, Kwan, Sum and Ryan of the Government Telecommunications Agency, Development and Engineering Section, in which formats for the interview portion of the contract were discussed, and a list of prospective respondents compiled. The specific list of respondents taking part in the study will be noted as this summary proceeds, but it may be noted here that directors of GTA headquarters divisions (Planning & Coordination, Systems Management, and Development & Engineering), and managers of four regions (National Capital, Atlantic, Ontario, Pacific) were designated as primary interview targets.

By the latter part of October, 1979, specific respondents had been identified, regional managers and headquarters directors had been informed of the study in the context of GTA's bi-weekly teleconference, and a cover letter with more specific study information had been drafted and sent to all Ottawa-based interviewees. The intent was to perform the Ottawa interviews first in order to ensure that the interview schedule performed well before committing expenses toward the more expensive travel to regions. The interview schedule did in fact perform as anticipated, although the interviewer chose to take advantage of its flexibility as well as his knowledge of the project's goals in adapting the method to the focus and concerns of specific interviewees. Given early success found in the Ottawa area, letters were sent to the other regional managers identified above, and arrangements for in-person meetings were made. All interviews were conducted by Dr. Palys. What follows is a summary of the interviewing itinerary.

#### Headquarters

1. The first interview was held with Mr. Gilles Rouleau, Director of Planning & Coordination, on the 15th of November 1979.
2. The next interview was conducted with Mr. Rene Guindon, Director of Systems Management, on the 29th of November 1979.

#### Regions

##### National Capital Region

3. An interview had been arranged with Mr. Getan LaFerriere, Manager of the National Capital Region (NCR), for the 6th of December 1979. Mr. LaFerriere was unavailable at the scheduled time, and the interview took place with two supervisors; these were:
  - a) Mr. Ken Shaw, Supervisor of Consulting Services, who had been moved organizationally from HQ/DE to the NCR only 3 days previously; and
  - b) Mr. Ray Buttler, Acting Supervisor of Operations for the NCR (the Supervisor, Frank O'Connor, was absent on language training).



## Atlantic Region

4. Arrangements were made to visit the Atlantic Region (AR) offices in Moncton on the 13th and 14th of December 1979. The following meetings and interviews were held:
  - a) The afternoon of 13th of December involved a lengthy interview with Mr. Ian Wilson, AR Manager.
  - b) The 14th of December began with an interview with Mr. Gordon Pole, an AR consultant who has been in charge of the CEIC move to Bathurst. The interview focussed on the specific procedures and requirements involved in such a consult, as well as Mr. Pole's perceptions of some of the dynamics of the decentralizing process from both a GTA and CEIC perspective.
  - c) DOC Moncton was preparing a presentation concerning the Telidon system, and had invited interested parties from GTA and DOC to attend. Dr. Palys was invited to the presentation and was able to spend an hour listening to a state-of-the-art discussion of the Telidon system from a user's perspective.
  - d) An interview was also held with Mr. Mike Dempster, Assistant General Manager of the Superannuation Division of the Public Service Commission, which is in the midst of relocating from Ottawa to Moncton. This useful talk, in the company of Mr. Don McCuaig of GTA/AR, involved a discussion of the relocation process from the points of view of the organization and those persons relocated, and a tour of the Superannuation building coupled with an ongoing discussion of that Division's procedures and requirements.

## Ontario Region

5. The Ontario Region (OR), based in Toronto, was visited on the 21st of December 1979. Interviews were held with:
  - a) Mr. Bob Mitchell, Manager of the OR, during the morning and part of the afternoon of 20th of December.
  - b) Mr. Hardy Gray, Supervisor of Operations for the OR, during the afternoon of the 20th December.
  - c) Mr. Chester Hartman, Supervisor of Applications Consulting for the OR, during the morning of the 21st of December.
  - d) Mr. Sal DiBiasio, Supervisor of Consulting Services for the OR, during the afternoon of the 21st of December.

## Pacific Region

6. The Pacific Region (PR), based in Vancouver, was visited during the first week of January 1980. Interviews were conducted on 4 January, and were held with:

- a) Mr. Walter Wheeler, Manager of PR; and
- b) Mr. Phil Riddolls, Supervisor of Consulting Services.

In sum, a total of fourteen interviews were held (twelve with GTA personnel), each of which lasted anywhere from one to three and one-half hours. A report of the outcomes appears as Chapter 2, although two very general points may be made now:

- (a) GTA personnel were very cooperative and helpful. As one index of this cooperative attitude, it may be noted that (i) while the cover letter indicated that participation in the project was voluntary, every person contacted agreed to participate (or in the case of the NCR, for the manager's representatives to participate); (ii) while only the regional manager was deemed an "essential" participant, all non-Ottawa regions were most helpful in allowing access to other staff, and in one instance, to non-GTA contacts; and (iii) while several respondents expressed initial reservations at the prospect of having the interview taped, all but four of the twelve GTA personnel interviewed consented to this procedure given the interviewer's guarantee that only members of the research team would have access to the tapes.
- (b) GTA appeared, for the most part to be a "happy organization", its officers generally unperturbed by questions of "decentralization". We did not discern a number of acute organizational problems to which the application of alternative telecommunications technologies would provide answers.

## Decentralization

To give the prospective interview findings an appropriate context, a review was made of the research literature on organizational decentralization and on the social-psychological effects of various telecommunications systems. Because there is a vast range of material on both subjects, examination of the literature was guided by two factors:

- a) preliminary findings emerging from interviews
- b) the particular organizational and telecommunications systems of GTA



## General Characteristics of Decentralized Organizations

An organization can be viewed as relatively centralized when high level planning imposes severe constraints on the decision making of lower organizational levels and, conversely, as decentralized when high level planning leaves a great many options open to lower organizational levels [Emery, 1969]. The extent to which an organization is decentralized then depends upon the degree to which decision-making authority has been delegated to various levels within it.

The major implications of decentralization are as follows:

- a) It places decision making authority near the focus of operations [Redfield, 1963; Robbins, 1979].
- b) Managers are freed from close supervision which encourages the exercise of initiative and broadens their view of administration [Redfield, 1963].
- c) An increased identification and participation with local civic and community activities often results in improved service through responsiveness to the conditions of a particular location [Davis, 1974; Redfield, 1963].

Because employees are closer to the individuals that make the decisions that affect them, employee satisfaction generally tends to be greater where authority is decentralized [Robbins, 1979].

Where decentralization (or in the present context, "deconcentration") has not been a success, problems have centred around the lack of effective communication pathways [McFeely, 1972; Redfield, 1963]. The successful functioning of an organization depends upon the delicate balance which must be retained between the autonomy or decentralized nature of its lower levels and the ability of the organization to steadily convey its objectives in such a way that lower levels perform consistently with central organizational objectives. In order to retain centralized control, standards must be set which are communicated downward and control must be maintained via an upward flow of communication [Emery, 1969].

Other literature we have reviewed has indicated some major variables which must be considered in decisions about deconcentration of field services, including:

- a) the nature or purpose of the organization;
- b) the 'span of control' or the number of people a supervisor can effectively supervise;
- c) the workload of offices;
- d) the location of other agencies and interests whose work affects the function of the field source organization;
- e) administrative and personnel conveniences such as office space, staff housing, etc., and
- f) political factors.

#### Social-Psychological Aspects of Telecommunications in Decentralized Organizations

Research on decentralization has focussed on either the process of decentralization or the costs/benefits of alternative systems of decentralization. The replacement of traditional face-to-face communications by alternative modes of communication has commanded considerable concern in these studies of decentralization. In both research areas there is considerable attention given to social and psychological effects of communication changes as well as the effects on economics and management policies. For instance, several studies of decentralized organizations' telecommunications systems which have failed or functioned inadequately have indicated some psychological factors that contribute to such failures, e.g.,

- a) the users' common assumption that face-to-face communication is inherently the best form;
- b) that initial uses of a telecommunication system represent its ultimate functions, and
- c) that optimal organizational functioning requires a great amount of communication.

Further examination of this research literature on the social-psychological dimensions of telecommunications pointed to the importance of:

- a) various means of introducing a new telecommunication system;
- b) various methods of training users, and
- c) techniques of evaluating users' needs, expectations, and attitudes regarding such systems.

## Chapter 2

### GTA Functioning and Telecommunications

The research method employed was effective in its two major goals. First, it provided a systematic means by which we could begin to understand organization dynamics, procedures and processes. Secondly, it provided a vehicle through which to determine and discuss the use and perceived effectiveness of various communications media within the GTA context. The two sections which follow address each of these foci in turn.

#### The Organizational Context of GTA

The general goal of the current study was to investigate patterns of communication and communications problems within a decentralized organization. Our premise was that since GTA was itself a decentralized organization, it was thus reasonable to base a case study of a decentralized organization on GTA. It was on this basis that the interviewer went into the field, only to find that many of those in the regions did not share the perception of those in the headquarters group that GTA was in fact decentralized.

Robbins (1979) has written that

"There has been frequent misunderstanding of the term 'decentralization'. The most widely held interpretation of decentralization is either (1) the dispersion of decision-making authority, or (2) the geographical dispersion of the organization. The latter interpretation is incorrect, for the concepts of centralization/decentralization are meant only to reflect the degree of authority that is delegated to lower levels in the organization" (p.340).

The opinion that was expressed by several of those in the field was that while GTA did indeed conform to the second (mis)interpretation of decentralization described above, skepticism existed concerning the extent to which it conformed to the first. In other words, while all respondents acknowledged the deconcentrated nature of GTA, not all were ready to acknowledge it was decentralized. Not being able to justify the appropriateness of the term at the time, the interviewer was content with the term "deconcentration".



A major mistake by advocates on both sides of the decentralization issue was their assumption that an organization is either centralized or decentralized. In fact the two labels should be viewed as opposite ends of a continuum. Once this perspective is acknowledged, it becomes obvious that GTA lies somewhere in between, and that its place on the continuum varies depending on the particular agency project being discussed. Management of the intercity network, for example, was viewed quite clearly as being dominated by the headquarters group, especially where it pertained to financial matters. Management of local shared services, on the other hand, was viewed as a moderately decentralized activity, since coordination with headquarters was required because of the place of local services within the larger national network. An even more decentralized activity would be the provision of consulting services within the regions which, depending on the project, would frequently lie almost completely under regional auspices.

But while the degree of (de)centralization varies depending upon the activity on which one focusses, a more salient dimension to the interviewer concerned the participatory nature of the decision-making process. While the headquarters group is dominant in the process of forecasting user trends and in decision-making concerning the ordering of circuits, it is nonetheless true that the regions play a major role in appraising headquarters of special regional circumstances to be taken into account. Similarly, it is to GTA's credit that the Procedures Manual (whose development was welcomed by headquarters and regional personnel alike) continues to be developed on an interactive basis among these groups. Given the complementary and equal organizational status these groups enjoy, we see this process as one to be encouraged.

This is not to say that areas of disagreement no longer exist. Two such areas were pointed out by their advocates. The first came after a discussion of GTA's historical development, in which it was noted that the reorganization of 1978 had involved a differentiation between the line and staff functions of the regional and Headquarters groups, respectively. The continuing nature of this process was manifest in the organizational relocation of Mr. Ken Shaw's consulting group from Headquarters DDE to the National Capital region during the course of the current contract. The definition of jurisdictional boundaries remains a concern, but all view the developing Procedures Manual as a vehicle for discussion and an instrument in the reduction of conflict between line and staff functions. However, any assumptions that development of the Procedures Manual will result in the set of jurisdictional and procedural definitions are in all probability myopic and misguided. Rather, GTA should be advised to recognize the continuous nature of this process, and continue to review and redefine so as to avoid obsolescence.

## GTA and Communications Media

In the process of executing their respective roles and responsibilities, persons in GTA deal not only with other persons/groups within GTA, but also with various departments and external agencies. These include common carriers and suppliers (e.g., Bell, CNCP), other DOC branches and government departments (e.g., Department of Public Works, Department of Supply & Services), client departments, provincial governments, task forces (e.g., task force on service to the public), and others. It was on the basis of communications among themselves and with others that the following opinions were derived, and the observations made should be seen as those of the GTA personnel interviewed.

### Communication Modes in GTA

While most (not all) research literature assumes a 'natural' superiority of face-to-face interaction, all else being equal, the respondents in the current study acknowledged that all else is never equal. Any communications medium, including face-to-face, has its own set of advantages and limitations.

Face-to-Face: The importance of personal contacts does not go unrecognized. Most interviewees emphasized the desirability of meeting others in order to establish personal relationships. The lack of such connections was occasionally viewed as troublesome when other communication modalities were used, as will be reported below. But once established, other modes could be utilized effectively. Nonetheless, most respondents reported a desire for periodic contact to "recharge" the relationship, and because they felt it more effective for particular types of communication content and styles (e.g., more abstract or emotionally-laden issues, complex presentations, dynamic interaction).

Face-to-face communication was also seen to have its disadvantages. It takes time, and consequently entails costs of doubtful worth. These costs may be substantial when extensive travel is involved. One is also not left with any concrete product (e.g., hard copy) from the interaction, which may be important for the ongoing purposes of the organization. Hard copy deficiencies are typically overcome by keeping minutes of meetings and the creation of notes to file. Time and travel costs tend to be minimized through use of the telephone.

Telephone: Transmission of voice via telephone is obviously a major mode of communication. It suffers the same absence of hard copy as face-to-face interaction, but may be overcome in the same ways (e.g., minutes, note to file). And, as noted, time and travel costs are lower. In instances where repeated interaction was expected (e.g., ongoing contacts), face-to-face meetings were preferred prior to telephone conversations.

Mail: An old standby, mail overcomes the problem of providing hard copy, but does so at the expense of "presence" in the interaction and of speed. It is most useful (and a very inexpensive alternative) when the message/document/letter to be transmitted is large and/or includes a signature and/or no great urgency is involved. Problems of speed have been overcome to some extent through overnight mail via government pouch, but often several days are still required because of the sheer size of the inter-departmental mail system (e.g., the time the letter spends travelling from Calgary to Ottawa is less than the time spent between the mail room and final destination in Ottawa).

Courier: Courier services such as those operated by Purolator or Air Canada provide the speed lacking in the mail system, but gain this with greater financial cost. Other advantages such as hard copy, reasonable bulk, and signature remain the same as with mail.

Telex: The telex system allows the transmission of typewritten messages to any other member of the telex system. A disadvantage lies in the fact that messages are typically paraphrased in order to shorten connect time and keep costs down. A further problem is that contact cannot be made when the destination machine is occupied. This results in a waste of operator time while repeated attempts are made to contact. On the other hand, telex possesses several distinct advantages. Once contact is made, the operator is informed and the destination address is confirmed. Addresses across North America and Europe are accessible, and a myriad of organizations including but extending beyond governments are members of the system. Interactive communication is possible, although an operator at the destination end is not required. This latter fact implies that time zone differences pose no problem in terms of getting the message through. In addition, membership in the telex system in Canada gives access to the TELEPOST system, such that next-morning delivery to non-members is assured. And finally, telex has the obvious advantage of hard copy, and sign off from the sending machine is accompanied by sign-off from the destination end which reconfirms the destination address and provides a guarantee that the entire message has been received. There is no guarantee, however, that the destination machine didn't run out of paper in the middle of the message.



Government Data Network (GDN): While the telex system provided written communication capabilities to other members of that system, a parallel, primarily intra-organizational system known as Private Wire Services (PWS) also existed. Each had its advantages. Telex was more economical when messages were fairly short. PWS were more economical with larger volumes of material once lines could be leased at "bulk" rates with less expense. A problem lay in the fact that telex machines could not interact with PWS machines since they lacked the appropriate interface. The software to provide this interface was developed by CNCP several years ago in the form of TELENET, which consequently provided dual access without duplication of equipment.

A modified form of TELENET was provided by CNCP to the federal government in what came to be called the Government Data Network. This system allows the transmission of written alphanumeric messages as described above, although some differences exist in procedure between telex and GDN. Unlike telex where one must wait for contact before the message can be entered, the GDN is a "store-and-forward" system. The user enters the message, indicates the mailing list to which the message should be sent and then is free to do other things. The system provides prompts at predetermined intervals only when it cannot execute delivery. In other words, because of the lack of real time contact and automated nature of the system, one only finds out when one has been unsuccessful in communicating.

Finally, the GDN is a fairly slow system (300 BAUD), but still allows transmission and confirmation in the same day. One respondent estimated there to be approximately 1000 GDN stations across Canada while a second estimated 1200. The market for GDN is still growing, although the former respondent indicated a saturation point of about 1400 GDN stations was probable.

Word Processing: Similar in some ways to telex and GDN, word processors offer even greater possibilities. While the former technologies involve an entered document not subject to further editing, word processors offer full editing possibilities. But while word processors are a reality in most (if not all) segments of GTA, communicating word processors have yet to become a reality. Reactions to this prospect were mixed.

On the one hand were those GTA interviewees who viewed communicating word processors as the "wave of the future". They recognized many advantages. Word processors would allow continual updating of dynamic lists since new entries are easily inserted and deletions easily accomplished without necessitating complete retyping of the list. They were viewed as great timesavers on documents, procedures manuals, and other submissions which require redrafting. Communicating word processors would allow the creation of multiple copies which could be edited, redrafted, and further reviewed without a complete retyping required.

Others expressed less enthusiasm about these prospects. One respondent felt they offered nothing not currently provided, although one may have difficulty accepting that view. A more likely reservation, also expressed, was that storage of information in a computer would allow the possibility of premature or undesired access by others. File security, in other words, was a concern.

The major technological problem which was said to stand in the way of communicating word processors becoming a reality was similar to that faced some years ago by telex and PWS users. With the multitude of word processing systems and word processing machinery around, a major problem concerns compatibility, e.g., different machines/programmers do not understand one another. This problem appears to be becoming resolved, however, since CNCP has developed and is now in the process of testing their software interface called INFOTEXT.

Facsimile: Unlike the previous media which handle only alphanumeric material, facsimile machines allow transmission of any visual image, whether written or graphic. The idea of facsimile is appealing, since it is the only medium other than actual physical delivery of an original document that can reproduce a signature at a distance. On the other hand, it has some significant disadvantages. First, a poor circuit and/or poor machine make for poor copy. It is also very expensive, since transmission involves the long-distance connect-time, paper costs, and operator time. A single sheet may take from 30 seconds to 3 minutes to transmit, depending on the machine. This, coupled with sometimes questionable copy quality, make it an expensive process with limited use. Unless the document is small, graphics or signatures are involved, and time is of the essence, its cost is hard to justify.

Audio-Teleconference: Returning now to verbal exchanges, the audio teleconference allows numerous individuals at various locations to speak with one another e.g., to hold a meeting by telephone. With few exceptions, respondents expressed great satisfaction with the present system. A not insignificant advantage is that it makes travel and face-to-face meetings less frequently necessary, which is an interesting observation given the high esteem with which face-to-face contact is typically held. Besides the obvious saving in travel costs, the system is viewed as much more efficient since it requires no travel time and attendant frustrations, and allows one to remain in the same place as one's resources (e.g., personnel and relevant documents). One respondent also noted that meetings tended to be shorter, since there was less in the way of idle chat and participants stuck more closely to the agenda.

Most persons interviewed were in possession of a speakerphone setup which allowed hands-off conversation. It also meant that colleagues could be present and listen and participate with ease when a group of individuals was at each node of the network. One respondent described how his speakerphone (brand name: Companion Two) had a special mute switch which allowed discussion at his node among the group, such that one could still hear but not interfere with the teleconference. One complaint concerning this practice (of using speakerphones) was that their two-wire design sometimes meant that two persons might end up talking simultaneously, neither aware that another was speaking. A four-wire system (separate input and output) would apparently overcome this problem.

Questioning of all respondents focussed on the circumstances under which audio teleconferences worked best. There was a general consensus that optimal conditions involved participants who knew one another (thus negating the need for repeated identification), were familiar with the system, and who were guided by an effective chairperson who stuck to an agenda and systematically solicited opinion. Attainment of these conditions necessitates the preparation of agendas and relevant documentation well in advance.



Audio Teleconference & Facsimile: This linkage media was suggested by one respondent as a possible development that would allow a more flexible exchange of materials as well as ideas in the context of meetings. There are currently two limitations to this approach. First, facsimile machinery and teleconference hookups are currently separated by a significant distance in all regional and headquarters facilities. Secondly, no technology currently exists which allows simultaneous transmission of a document to more than one destination. This capability is, however, being developed by a Toronto supplier. Without this capability, the transmission of a single page document to each of the participants in the biweekly regional managers' teleconference would take at least fifteen minutes. The situation seems best met by adequate planning.

A number of computer controlled facsimile networks accomodating a wide variety of facsimile machines are being put into operation in the United States and Europe. Facsimile standards have been adopted by the CCITT, and this has led to the store-and-forward networks. Some of the services are ITT's Faxpak, Southern Pacific Communication's Speed-fax and Graphic Scanning Corporation's Graphnet. As well, AT&T, Xerox, Satellite Business Systems and other business machine/systems suppliers are talking facsimile.

Audio-Visual Teleconference: While many in the literature and technology fields tout this alternative as the wave of the future and yet another step closer to face-to-face communication, our respondents seemed bored by the prospect. It was seen as offering nothing of value at a significant increase in cost. The disadvantages cited were several.

First, many respondents indicated they valued the visual privacy offered by the audio-only hookup. It meant they could be perusing a relevant document or discussing a point with colleagues without attracting/diverting the attention of others on the line. Consequently, visibility was only an invasion of privacy.

Others cited technical problems. If only one monitor were provided per station, then an appropriate switching device would have to be constructed that put one on the screen whenever speaking. At the same time, the image of only the speaker provided little information since an important source of information in approximating person-to-person meetings would be the ability to see the reactions of one's colleagues to specific proposals. The alternative would be to have multiple monitors which would further increase costs and confusion. But again, none of this extra stimulation was seen as being worth the extra cost. The one redeeming feature cited was the existence of a graphics camera which would allow one to show material to others.

## Addendum to the Assessments

It had been stated to the interviewer at one point that GTA may have been a less than appropriate choice for a case study of the current type. GTA is, after all, in the communications business; therefore, one would expect them to be more aware of the advantages and limitations of communications media available to them. But while this latter assertion is true, we feel (with the benefit of hindsight) that this expertise allowed us a glimpse at two separate domains:

1) an experience-based assessment of the attributes of available media; and 2) an inventory of experiences with client departments which revealed something of their perceptions of communications.

Repeated mention was made by many respondents regarding the lack of communications awareness by many client departments. In the assessment of relocation or decentralization costs, client departments were often reported to be quite uninformed/oblivious to the impact this would have on the "communications costs" portion of their budgets. Most were reported to be completely unaware of the requirements for facilities planning, lead time required for hardware installations, and so forth. The universality of this situation is revealed by the common practice of having a well-developed informal network of contacts from whom information relevant to GTA is gathered. Most, for example, had contacts in DPW who would tell them about new facilities planning that would require GTA involvement. But while GTA should be congratulated for their resourcefulness in keeping "on top of" things, it must be recognized that this is a less than ideal alternative. The practice may be reasonable now, but it still involves a probability of developments being missed, and is also subject to significant undermining whenever particular GTA or contact persons vacate their current positions. It was clear to the interviewer that GTA must take a more aggressive position in informing prospective client departments that in view of 1) the centrality of communications to organizational functioning; and 2) the significant lead time required for hardware planning, GTA should be an integral member of the relocation team from the earliest stages of the process.

A second issue which arose in the interviews was the extent to which GTA should be involved with client departments in training regarding communication effectiveness. The model in use at the moment involves GTA's providing expertise at the hardware selection and implementation end of the process, but providing nothing in terms of facilitating and evaluating ongoing effective use of communications alternatives. What we are asserting, in other words, is that GTA should continue contact with client departments beyond mere choice and implementation of physical systems. The information on the previous pages in which the relative merits of different media were compared in a single list, is the first such compilation we have seen. Distribution of a small brochure containing such comparative information is certainly the least GTA could do in attempting to facilitate effective use of media. A more ambitious interpretation of our recommendation, and one which we would support, would involve the development of small training programmes and ongoing evaluations of user satisfactions and competencies.

### Chapter 3

#### Advances in Telecommunications Systems and Services: Implications for GTA

##### Introduction

Whatever might be found in our examination of GTA itself, it was felt that an appraisal of advances in telecommunications would be highly relevant, for obvious reasons, to its organizational functioning. Hence, in this section we consider the interaction between Telecommunications and Decentralization as it relates to the operations of any information processing organization. Rapid developments such as distributed data processing, integrated digital communication networks, and intelligent office equipment are forming a reality that may permit the effective, efficient, and productive operation of decentralized institutions, agencies, and businesses given appropriate planning.

The convergence of these technologies has generated a momentum of its own, creating services that tend to overwhelm existing planning and regulations. The technology that provides the force for change is also providing the direction of change and hence may play the major role in determining both reality and policy in the absence of any alternative planning.

The reality will incorporate many of the ideas heard over the last decade: teleconferencing, electronic mail, electronic funds transfer, access to central information banks; but these will emerge in modified forms as a result of the revolution in microcomputers. Instead of systems having to access powerful central processing facilities, because of the prohibitive cost of computers, systems will consist of networks linking comparatively inexpensive but nevertheless powerful individual processors. For example, "electronic mail" is in existence; not as a network of post offices containing facsimile machines, but as communicating word processors.



## Current Trends

Lynch, writing in a journal "Science and Technology" in April, 1968 made the following observations:

"For the first half of the twentieth century we have been preoccupied with the effort to move people and things faster, further, more effectively and more conveniently - mostly as a replacement for the exchange of ideas. To this end we have built airplanes, highways, railroads, trucks, airline terminals... As a by-product we have produced traffic snarled cities, air, water and noise pollution, highway blighted landscapes, and an awesome transportation death toll. Communication offers a way out. If we can expand our present capability to transmit voices, pictures, data, live images, whole books of information, if we can learn to do these things on a sufficient scale, with sufficient fidelity, and, most important with sufficient economy, we can largely eliminate this troublesome traffic of people and things and replace it with a traffic of information."

"Exciting things are happening to the technology of transporting information...[solid-state electronics, new channels...]...a communications revolution... that unexpectedly fertile combination of communications and computer technology is promising to bring a new richness to communications."

"Of all the places where technology can apply its pressure, communication is surely the most sensitive. Communication is, after all, the means by which people interact across both time and space; it is the stuff of which society is made, a yardstick by which civilization is measured. Anything that can dramatically change the means of communications has potential for making great changes in our society."

Progress during the seventies can bring about in the eighties many of the radical changes predicted. This progress has been both dramatic and extensive in the areas of:

- the basic electronic technologies,
- the telecommunications infrastructure, and
- information processing.

The technical progress has been coupled with substantial increases in inflation and energy costs that radically alter the economics of telecommunications systems and services.

Progress in electronic technology is based on the emergence during the '70's of Very Large Scale Integration: the ability to mass produce integrated circuits of incredible complexity, thus maintaining the trends towards increased functionality, smaller size, lower costs, higher speeds, and greater reliability that has characterized integrated circuit technology. Of particular importance to the telecommunications industry has been the emergence of the microprocessor, which enables the widespread introduction of digital communications and switched digital networks. Equally important are the signal processing devices that interface the analog world of voice and pictures to the digital networks. The electronics revolution of the 70's has also created immense numbers of information handling systems for which communications must be provided.

The 70's saw some basic changes in the telecommunication infrastructures: the introduction of new channels and networks. New channels have become available through the deployment of communications satellites and the introduction of fibre optics. Satellite communications are being used to augment the normal terrestrial services of the common carriers and to provide specialized broadcasting and networking capabilities. Fibre optics are being used to provide broadband services as a replacement for microwave radio links and coaxial cables, and to interconnect the integrated information services of commercial and institutional organizations.

The most significant advance in telecommunications from the point of view of decentralized operations is the introduction of digital communication networks. Until recently, data communication took place over conventional telephone lines, through the switched telephone network, with a circuit dedicated to the call, subject to regular long-distance charges if appropriate. It ties up lines in a very different usage pattern than that for which the system was designed. Now, however, those with data to transmit have access to a variety of all-digital networks. The information on these networks is transmitted in short packets. The packets are switched and routed through the network by computers and the reliability of the information they contained ensured. Customers pay only for the amount of information they transmit and that share of network that they actually use. Thus, the means now exists to transmit digital information directly, which means that not only can existing demands be met but that the development of communicating digital machines will be encouraged.

Another area of information technology in which real progress has been made during the '70's and which is emerging as an area of major importance, and in which there are profound implications for decentralization, is that of "office automation". This is a vogueish phrase to describe the application of the technology of communications, computer systems, and electronics to the creation of a working environment where multiple information processing functions can be performed by an integrated, automated system. The driving force behind the interest in "the office of the future" is the need to increase white-collar productivity and decrease the cost of performing routine business functions. This need is intensifying at exactly the same time that the technology is at hand to cope with the problems and that the methods for approaching their solution from an overall systems point of view are reaching a level of reasonable maturity.

We are on the threshold of commercially supported telecommunication facilities designed specifically to support distributed information processing in multi-branch businesses. The trend is towards distributed data processing as the cost of computers and memory become insignificant compared to the overall costs of maintaining complex organizations. The current credo in information processing is to place the processing as close as possible to the location where the data are generated.

We now review the status of enhanced telecommunications services such as teleconferencing; to examine the applicability of new services such as videotext and integrated business communications systems, and to comment upon the implications of current developments in office automation.

## Teleconferencing Systems

A teleconference is a meeting held over telecommunication links between two or more individuals or groups, who are physically remote from each other. Teleconferencing, then is the obvious way in which business can be conducted on a day-to-day basis between separated units of an organization. Obviously, not all interactions can be successfully conducted with telecommunications; physical proximity is sometimes essential, but teleconferencing can add new dimensions to communications and, in fact, enhance many activities requiring interpersonal communications.

"Teleconferencing" refers to simple telephone conference calls at one extreme to elaborate colour television hook-ups at another. Teleconference technology is often characterized as:

- audio, voice only
- augmented audio, with speaker identification
- audio with graphics, facsimile and slow-scan television
- computer conferencing
- video, with two-way live television

Teleconference systems may be point-to-point with participants at only two locations or multipoint with several locations.

Teleconferencing can take place in two modes: one where each participant has his own terminal (teleprinter, camera, telephone) at his own location; and the other where groups of individuals gather in especially designed teleconferencing studios.

Significant development and study of both types of systems has been carried out in Canada, the U.S., the U.K., and Japan. Canadian studies have been carried out at Carleton University, the Department of Communications, Bell Canada, the University of Quebec, B.C. Telephone and Telegraph, BNR, the Public Service Commission, and Public Works Canada.

Teleconferencing has included remote medical diagnosis (telemedicine), education, law enforcement, urban planning, joint research, video telephone experiments, computer based electronic message/mail systems, as well as commercial video conference facilities.



### Video Teleconferencing

In Canada, Bell operates colour television conference facilities between Quebec City, Montreal, Ottawa, and Toronto, with satellite connections to western cities. Groups may utilize their studios for approximately \$400 per hour for an Ottawa-Toronto conference. That is less than the cost of three return air fares. Bell is looking forward to the eventual installation of a switched video network, similar to the public telephone network, perhaps as a result of the deployment of fibre optic cables.

### Audio Teleconferencing

Audio conferencing is widely used in business, and within GTA, in the form of telephone conference calls. The technology is improving; conference-call facilities are much better than they were and the newer voice switched speaker-phones do not intrude so obviously on the communications process. Especially designed audio conference call facilities, such as the Remote Meeting Table, have not generally proved to be worth the effort and cost involved in their establishment. Audio conferencing, so long as the participants know each other and adequate preparation for the meeting is done, can be very effective. It can be helped by the availability of facsimile and other image/graphics transmission media for the distribution of print material. The addition of voice circuits to communicating word processors will provide a powerful audio conferencing service.

### Computer Conferencing

Computer conferencing involves the use of time-shared, multiple-access computer systems for the exchange of messages. Communications is via keyboard and printer or CRT display, i.e., via text. The major advantage that this rather awkward communications mode provides is memory, the ability to leave messages for recipients who are not present at the time of entry. Memory allows delivery-on-demand and delivery at specified times, allowing asynchronous conferences. In a national system this provides the added advantage of overcoming time-zone differences, a major problem in Canada.

Computer-mediated conferencing provides automatic addressing, record keeping, directories and inventories of stored information, and, ultimately, the combination of communication and data processing. Memory, access to stored information, processing power, a variety of display modes, permanent records - very desirable features in any conferencing system - are present in computer conferencing.

Most computer conferencing systems have been constructed by groups of computer users who were sharing the same time-sharing computer network. Many were basically social communication systems developed on an ad-hoc basis. An increasing number of computer services are offering formal message systems. For example, Public Works Canada has a computer conference facility that supports its computer-aided-design service. Users across Canada may "join" a conference about a specific design program from any computer terminal. Access is provided by local telephone numbers that provide a connection to the central computer in Ottawa via the Datapac network.

Studies of teleconferencing have shown that while it can provide a substitute for travel, it also provides new dimensions for organizational communications. Audio, video, and computer-based systems are all useful and practical. The utility depends a great deal upon availability, reliability, ease of use, and flexibility. Wider bandwidth video systems work better than "blind" audio, but users adjust very quickly. Most systems work well as long as the need to use them is apparent and shared.

Advances in wideband channel availability (satellites, fibre optics, cable television) and technology (image compression, computer networks) coupled with punitive increases in the cost of travel are rapidly altering the economic basis on which the validity of tele-conferencing rests: it is now a viable factor in decentralization.

### Office Automation

"Office automation", the "electronic office", or the "office of the future" - whatever the concept of an electronic, computer-aided environment for the handling of business information is called, it will have a significant effect on telecommunications and decentralization. In the first place, workers who deal with their jobs through communication or information processing terminals: word processors, file/data storage and retrieval, non-real-time message systems, analytical routines, electronic forms filling, etc., can carry out their functions in virtually any location and hence decentralization is a "normal" operational mode for workers in the "office-of-the-future". Social factors, rather than job-related ones, will determine the acceptability of decentralization. Secondly, office automation is based on communications between all units in the office, and hence places a large demand on local facilities.

As offices are automated, more and more information will be in electronic, machine-readable form and hence can be communicated: separation is possible and communications are required.

The information revolution is beginning to have a substantial impact on business. The initial effect is an increase in the productivity of lower echelon white-collar workers such as secretaries, file and mail clerks, but increases in managerial productivity will follow the advances in information flow and the application of the systems approach to office problems.

Office automation is an integration of the different activities that take place there through a computer-based business switching system. The switch provides processing, routing, storage, management control, file maintenance and cost allocation. The elements interconnected by the switch include:

- i) Word processing which provides text editing, single entry output, simplified modification, and retention of information for future use.
- ii) Electronic mail systems which provide capability for distribution of messages both internally and inter-departmentally, and which ensure the most efficient use of existing line facilities.
- iii) Data processing, the most widely adopted element, provides common access to information as well as the establishment of files and a database common to all applications in the office.
- iv) Computerized voice communications to optimize line usage, provide alternative routing, message recording, and other electronic (digital) exchange services including call control and accounting.
- v) Facsimile, used in conjunction with word processing and electronic mail to provide reproductions of graphical and pictorial source material.
- vi) Conferencing which provides the ability to overcome both distance and time, including electronic message and computer teleconferencing systems, telephone conference calls and video conference networks.
- vii) Data Communications provide the means for the high-speed transmission of stored volumes of data.

Office automation is proceeding rapidly in many directions. For example, word processing is being introduced into business as fast as the equipment can be acquired, and electronic private branch exchanges (PABX) are being installed in large numbers. The acquisition of these systems is usually not coordinated, so that the telecommunications planner faces a dual problem: user attitudes and system integration, even before he can consider the telecommunications requirements.

## Data Communication Networks

Prior to 1973, data had to be transmitted over the voice communication networks and much of it is still carried that way. In 1973 the Trans-Canada Telephone System introduced the Dataroute, at that time the world's only nationwide commercial digital data communications system. Dataroute dramatically improved computer communications in terms of lower costs, greater accuracy and increased flexibility and reliability. The improvements were due to digital transmission and the multiplexing of data from many users to obtain maximum utilization of the high-speed data links in the network. Dataroute was functionally separate from the voice network, although they shared the same facilities.

The mid-seventies spawned a new type of data communications service based on a concept called packet-switching. This message transmission technology forms data picked up from transmitting terminal devices into synchronous packets, or groups, that are then moved to their destination through a network of digital communication circuits and computer nodes. These nodes provide the intelligence to ensure virtually error-free transmission, alternate routing around blockages and outages, and transparency between sending and receiving equipment.

Both public and private packet switched networks exist. Datapac and Infowitch are Canadian networks, the United States has Tymnet and Telenet. Overseas connections are being developed. International standards have been agreed upon so that all communicating information processors and other digital machines can access every network.

Thus, at the same time as the tremendous growth in applications of information processing is occurring in office automation, and distributed data processing is becoming an accepted mode of operation, specially designed data communication facilities are available. This is not a coincidence, since each of these developments has been the result of the same advances in integrated circuit electronics and computer systems engineering. The focus of application, of course, is business and particularly dispersed, decentralized, or deconcentrated business.



Several major American communications and computer firms have announced plans for integrated communication networks that will profoundly affect the environment in which nation-wide and multi-national organizations will operate.

As a first example, consider the moves being taken by General Telephone and Electronics (GTE). GTE has formed the Communications Network Systems Group, based on its Telenet packet network, to bring integrated value-added network services to users. This organization will combine Telenet with other of the GTE divisions, such as Sylvania Electronics, to provide a broad spectrum of networking capabilities, including the British viewdata system. The services will be in competition with those offered by AT & T's Advanced Communications Service (ACS), Xerox's Xten, and the Satellite Business Systems offerings.

The network will include both terrestrial and satellite links and, according to GTE, will "open the door to expanded terminal support plus office automation services - all by 1981".

High-speed bulk data transmission will be provided, utilizing the X.25 network protocol. An electronic message service for office automation applications will allow CRT's, word processors, computers, Telex terminals, and other devices to interact. Special terminals will be provided to implement customized electronic mail service. Store-and-forward, delayed delivery, and unattended delivery of messages will be included.

Radio will be used for local delivery, so that telephone facilities need not be used.

Viewdata is being tested by GTE with business users in Florida.

It is worth noting that another public packet-switched network, Tymnet, has terminal access nodes in Argentina, Australia, Austria, Belgium, Brazil, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Mexico, Netherlands, New Zealand, Phillipines, Portugal, Puerto Rico, Singapore, Spain, Sweden, and Switzerland. Users in these countries can access approximately 250 computers linked to Tymnet.

A second major effort in integrated value-added networking is AT & T's Advanced Communications System. Similar in concept to the GTE network, ACS proposed to give users a transparent data network that would interface otherwise non-compatible terminals. The promises of ACS seem to have been over-optimistic, but first offerings in 1981 will probably include a message capability. When users of the telephone system can create, manipulate, edit and update files and create application programs, they are getting close to having the capability of a general purpose computer and the regulatory distinctions between data processing and communications becomes very blurred.

The Satellite Business Systems (SBS) satellite communications-based network is intended to provide for voice, data, teleconferencing, and bulk document distribution, as part of an integrated service offering. SBS will start with 10 to 12 earth stations in 1980, carrying voice over a satellite to be launched in 1980. Meanwhile, SBS will conduct experiments on one of the Anik satellites. SBS intends to provide service to key "Fortune 500" companies, and thus its services are in support of business processes. SBS has been formed by IBM, Aetna Insurance and Comsat General, a firm indication that communication specifically designed for the support of dispersed businesses will become a reality; more than that perhaps as commonplace as the telephone now is.

The Xerox Corporation has announced plans for a similar communications system; they call theirs "Xten". Xerox has also revealed a system called "Ethernet" designed to link elements of an office system. It is a packet system that permits the exchange of data between work stations, printers, disk files and so on.

## Viewdata/Videotext Systems

Viewdata and videotext are information systems that combine television, telephone and data communications technology to provide access to stored information. Viewdata systems involve the use of the telephone network for the retrieval of text-like data from a data base. Coded text messages that are received over the telephone are stored in a TV-set attachment and displayed on the TV screen with the help of a character generator or graphics processor which creates the signal for a page. Videotext or teletext systems employ the same type of TV-set attachment but operate upon text transmitted within the blank lines of the TV signal.

This is a crucial time for teletext information systems. The British with Prestl, the French with Antiope, the Germans with Bildschirmtext, and the Canadians with Telidon are all engaged in production of prototype equipment, the establishment of data bases, and extensive field trials of both broadcast and independent systems. Whether or not these systems survive to become an integral part of the information/communications infrastructure will depend on the current trials. Processors that can be sold at a reasonable price must be developed; information that is of sufficient interest to enough subscribers must be assembled and maintained; and the system must be sold. Like many new technologies, teletext systems will be adopted if they appear as an adjunct to existing systems. Word processing is being accepted because it appears as modifications to a well-known technology: the typewriter. Teletext can provide a new service for decentralized organizations, in both its public and private forms, by enhancing or replacing current routine information sources such as directories and catalogues.

Teletext can replace the distribution of paper copies of directories, catalogues, manuals, regulations and such information, forcing the user to refer, through telecommunications, to the data. Access permission lists replace mailing lists; each user has access to the same, current version; those responsible for the accuracy of the available information need only deal with a single master copy; the system is amenable to management, the costs of reproduction and distribution-by-mail do not have to be met; and new information is available as it is entered.

It would appear that Telidon information systems are particularly well matched to the needs of a decentralized organization, both to support its own functions and to supply information to its "customers".

Data base suitable for basic Telidon would not be a central registry replacing current correspondence files, personnel records, and the like; it would contain those documents and print materials to which frequent reference must be made by a reasonably large number of users. For example, telephone directories, administrative procedures, regulations and so on might be available for in-house use, whereas copies of current application notes from the Department of Agriculture might be available to citizens.

Once Telidon is in place, and information vendors are assured of a market for their wares, it will be self-sustaining as long as it fills a need. However, current trials, in Canada at least, appear contrived, in the sense that the system will not be placed in an environment where subscribers currently access information through CRT data terminals on a regular basis, nor will the information available be any that they access on a regular basis as it is. Government agencies, on the other hand, are engaged in these activities continually, and, hence, may be a better environment for the introduction of Telidon.

One example of where Telidon is being used by a government agency (in which it facilitates a fundamental objective of the program) is with the Ontario Educational Communications Authority. OECA is providing information that supplements their normal television programming. Ordinarily, they have a great deal of difficulty in determining to whom to send their print material. Mailing lists are expensive, difficult both to acquire and to maintain. With the material available through Telidon, any viewer who is interested may access it, and all subscribers to the Telidon system will know that OECA "print" material can be accessed.

Interactive television, as Telidon is sometimes described, is many things; basic Telidon is just the first stage. Once in place it can be expanded with message services, electronic mail, reservation services, and interactive courses. The latter application is a matter of considerable significance for large organizations, such as the federal government. Again, to realize any of the considerable advantages that a nationwide Telidon service could provide to the private and public activities of a decentralized organization, it must exist. To exist, there must be a reason for it: the need for Telidon is as a component (perhaps the first) in integrated, multimedia tele-information services. It should be a natural adjunct of any value-added data network, and included in the telecommunication services available.



## The Introduction of Communications Technology: Prescriptions for Success

The following paragraphs contain technologically based "folk wisdom" concerning the introduction of the sorts of equipment discussed in this chapter. Although much of it is common sense, the social research, which should supplement the "human factors" studies on which these assumptions are based will be found to be lacking, or even missing, in the next chapter's discussion.

Each organization should have a plan for the integration of its information processing systems. The system must be designed so that components can be added in a step-by-step, application-by-application basis. A question is which functions to integrate first, how to prepare personnel for the changes, and what communication facilities to provide to accommodate current and future functions.

Personnel are resistant to change, particularly if it is perceived in the form of a technology that is acquired to increase productivity and reduce staff and is "impossible" for ordinary mortals to operate. It is apparent that personnel must be helped to accept innovation and new systems must positively reward users with enhancement of their performance. If properly introduced, the users will identify the change as a means to make work easier. The users must be part of the change to more reliance on communications to such a degree that they not only welcome the new tools but are also in a position to expand and extend the applications of the systems they obtain.

The introduction of new services should not alter arbitrarily the structure of the users' offices. Human factors will determine the success or failure of implementing advanced office information systems. The integrated system (that requires telecommunications) relies upon the success of the first phase of office automation: the introduction of stand-alone electronic equipment. As mentioned above, intelligent typewriters and CRT work stations are selling well and users are becoming familiar with the technology without being threatened or displaced by it. If the initial systems work well then more advanced communications functions can be added modularly.

The communications function should be transparent to the user, that is, it should be activated by simple commands. The user should not require extensive training and should not be forced to reorient his approach to his job to use the communications facility. Good communications will be the backbone of all office information networks, and user transparency is one of the keys to the utility of advanced technology in the office environment, particularly if it is to be used by executive level personnel. The user must be helped to adapt to his new environment.

User-oriented, interactive machines that perform tasks in a familiar way, i.e., "friendly" machines are becoming common in office equipment. The same features should be designed into telecommunication systems. The user's work habits and preferences should be considered during the design of the system. Often, technical and economic considerations have been applied without full concern for the user, with disastrous results. The telecommunications system must be tailored to serve the individual department for which it is required.

The telecommunications system must be structured to accommodate both the short-term and long-term requirements of the user, providing for current needs and having the flexibility to respond to development. The design should allow for the integration of telecommunications hardware and information processing functions such that all elements of the system are functional, adequate, and cost effective.

In summary, many of the innovations in business methods facilitated by intelligent electronic information processing systems referred to as "office automation" exist now, and applications, modifications and extensions of the technology continue to appear at a tremendous rate. The implications for telecommunications services are profound. The network planner must be involved in the design of the individual offices and must be prepared to accommodate an ever-increasing flow of information between them.

#### Implications for GTA

It is apparent that the momentum of progress inherent in information systems, communications and business methods must be of concern to GTA. In particular:

- i) To reduce the potential chaos that can develop, GTA must be in a position to inform their own personnel in the Department of Communications and clients elsewhere about current and forthcoming developments not only in telecommunication services but also in the general area of information handling.
- ii) To ease the introduction of new technologies, GTA must be prepared to train clients, as well as their own personnel, in the use and application of new communication services and information systems.
- iii) GTA must carefully review and assess assertions arising from "human factors" research in light of their own experience with telecommunications usage and that of their "clients".

- iv) GTA must be ready to point out those applications in which evaluation studies are crucial to the successful usage of communications.
- v) GTA should be active in those areas in which, as a major specifier and user of telecommunication services, they can effect the introduction of standards that can ease the confusion that would be caused by the introduction of a plethora of incompatible systems.
- vi) There are implications of the new technologies that are fairly subtle. For example, it is well understood that the reliability of information in data banks and in digital communication systems must be protected by error detection and correction, but it is now clear that the privacy and security of the information must be ensured by encryption as well as physical means. What has emerged from this study is that these techniques must be an integral part of every computerized information system, including electronic message/mail systems, or users may not adopt them. GTA must be able to assure users that electronic systems are "safe" to use, and do not constitute a threat from the evaluative or surveillance points-of-view.

## Chapter 4

### Social/Evaluative Research on Teleconference Systems

#### Introduction

The decentralizing organization that is aware of its impending telecommunications problems (few seem to be) faces the awesome problem of readying for one or another view of the future, such as that just presented in Chapter 3. It may well look for behaviorally-based "advice" from psychological research, in addition to the usual "human factors" data for helpful cues on which to base cogent decisions. It will find the pickings deplorably slim, as we shall see.

The following section reviews available research in the area of social evaluations of different modes of communication keeping three issues in mind:

- a) the participants' perceptions of what implications the use of various media will have;
- b) the nature of the participants' behavior when utilizing various media, and
- c) how these two factors might possibly affect each other.

The limitations of available research are considered and, finally, conclusions from our observations are presented.

#### The Material Reviewed

Since it makes up the greatest proportion of the research, the studies are largely limited to social evaluations of computer based, audio, and video teleconferencing as well as face-to-face meetings. Both laboratory and field experiments are examined, although, as will be discussed later, the former are disproportionately represented. Examination of the use of various media, primarily by academic and civil service groups, has occurred over very brief observational periods.

The research reviewed pertains to social evaluation of teleconferencing systems and focuses on small group communications. Investigation of organizational and societal issues is only just beginning to be carried out and for a brief review of the three major types of systems, the reader should see Johansen, Vallee and Spangler (1977). For a more detailed description of teleconferencing systems in operation, see Hough (1976).



It is clear that there may be a substantial difference between what system is adequate or appropriate for a particular purpose and what system a potential user would prefer or choose to use. This disparity is an important one. Certainly the relative success or failure of meetings which utilize various forms of conferences depends, in part, on the participants' expectations and perceptions of a given media.

This is not to say that these attitudes remain static over time. As users become more familiar with the technology available to them, expectations and perceptions will no doubt change according to user training and experience. As the psychological "set" of conference participants changes, so probably will the differences in the success or failure of certain types of tasks performed across different types of conferences.

There may be other variables, apart from the user's perception of the appropriateness of a particular mode of communication to the task at hand, which may lead to biases concerning to the use of teleconferencing.

Example: While a high proportion of members of the business world may be able to imagine adequate replacement of business meetings that require travel with meetings held via telecommunications [Klemmer, 1974, cited in Short et al, 1976], only a small percent of business travellers may be willing to do so [Kollan and Garwood, 1974]. Other factors besides the direct outcome of business meetings are probably operating in this situation. There are obvious reasons why there might be a discrepancy between the perceived effectiveness of telecommunications and the choice to utilize them. Short et al (1976) propose that, apart from concerns about the direct cost of technological innovations to the organization, employees may be unwilling to give up certain aesthetic and financial gains that they personally enjoy as a result of travel.

Other barriers to the use of teleconferencing, even when such a route seems most rational economically, include inertia and problems of accessibility [Short et al, 1976]. Inertia may be reflected in the slow death of old habits. It may also be due to the fact that the utility of various systems depends directly on their widespread use by other groups with whom an organization wishes to communicate. Forms of accessibility, such as (i) how available a system is in terms of its physical distance from the participant; (ii) the ease with which the system can be booked, and (iii) how complicated it is actually to operate the system, are all important factors a user may consider as well. Often the mutual accessibility of groups which are widely dispersed geographically may be problematic due to differences in time zones [Stone, 1977]. This situation radically restricts the range of time all groups can be accessible to one another.

Face-to-face contact is typically considered the standard with which other technologically mediated forms of conferencing must compete. Hence, most teleconferencing systems are compared with the traditional face-to-face meeting. As a result of this type of analysis, several advantages of the medium have been suggested.

When participants are physically introduced to and experience different forms of telecommunication, there is a general preference for face-to-face contact. It has been described as a more "friendly" medium [Williams and Holloway, 1974 in Johansen et al, 1977]. This may be due in part to the tendency for participants in a face-to-face meeting to address the group, while in audio or video teleconferencing there is a tendency to address individuals or a subgroup [Weston, Kristen and O'Connor, 1975].

The meetings conducted face-to-face have been rated most favourable compared to other technologically mediated ones [Champness, 1972; Ryan and Craig, 1975] especially when meetings are considered important or involve complex tasks [Connors, Lindsey and Miller in Johansen et al, 1977]. Face-to-face contact appears to be more successful than other modes of communication in meetings where there is an emphasis on negotiation [Morley and Stephenson, 1969] or conflict resolution [Short, 1972 in Johansen et al, 1977]. As well, it has been suggested that telecommunication systems can, by separating the group into subgroups, affect the lines along which coalitions will form [Williams, 1975]. There are additional relevant findings.

Time is spent differently across various media. More messages are exchanged via face-to-face contacts than any other media in a given time frame [Weeks and Chapanis, 1976]. Less time is spent maintaining group organization in the face-to-face situation [Weston, Kristen and O'Connor, 1975] and more possible solutions are considered before reaching a decision [Champness, 1971; Davies, 1971, 1972 in Johansen et al, 1977].

While face-to-face contact feels the most natural, it too has its own weaknesses. It is not always practical. Obviously, where there is a need for a short meeting between people located large distances from one another, something other than a person to person meeting is desirable in order to save time, money and energy. It is estimated that only one-third of business meetings actually require face-to-face contact [Christie and Elton, 1975 in Johansen et al, 1977].

It may even be that some of the personal dimensions inherent in face-to-face contact may be detrimental to the effectiveness of a meeting. These include visual distractions which reduce concentration [Short et al, 1976] and the domination by one person of face-to-face meetings which limits the range of ideas presented and hence influences the quality of final decisions [Hiltz, 1975; Hiltz and Turoff, 1976 in Johansen et al, 1977].

One must also question the extent to which the advantages people attribute to face-to-face communications are attributions only. Participants perceive that their understanding of another person is more accurate with increasing visual cues [Young, 1974 in Short et al, 1976] and that they can better distinguish when another person is lying in the face-to-face situation than when visual cues are missing [Reid, 1970 in Hiltz et al, 1978]. However, in these studies the participant's confidence in his or her perception is influenced by medium but his or her accuracy is not.

As has been stated, teleconferencing systems are often evaluated with respect to how closely the processes of their use resembles the processes of face-to-face contact. The three basic forms of teleconferencing - computer, audio and video are usually seen to approach, in that order, the face-to-face situation. However, people's perceptions of how these media compare may be different than they compare in fact.

Hiltz et al (1978) report that computer conferencing can compete effectively with audio or video conferencing for giving and receiving information, exchanging opinions and generating ideas. This particular mode of communication is the least expensive and, in many ways, most convenient; hence, in a case where a telecommunications system would be mainly performing the above mentioned functions, computer conferencing would seem to be the attractive alternative. The authors point out that functions on which computer conferencing is not rated as highly satisfactory (e.g., getting to know someone, bargaining and persuasion) groups will probably want to keep meeting face-to-face. Further support for this preference comes from the finding that audio and video systems are not rated as performing those functions satisfactorily either.

Pye (1977) has pointed out that numerous carefully conducted experiments on information transmission, problem solving, group decision making and interviewing have found all vocal media to be similar in effectiveness but that people perceive audio to be less satisfactory than video.

## Assessment of the Literature Reviewed

Studies directed toward social psychological evaluation of teleconferencing systems suffer from a number of limitations. Participants are generally novices, often experiencing certain media for the first time. Of the individual studies presented in the preceding review of the literature, the lengthiest one was carried out over three consecutive weeks for forty-five minutes per week! Individuals who have had more training and experience may respond very differently to a particular medium than those who are experiencing a novel situation. Over time, individual and collective users will develop more skill in addition to shared norms and understanding about etiquette and level of participation so that observed behaviors and subjective feelings of competence, for example, will be radically altered [Hiltz and Turoff, 1978].

The generalizability of experimental studies in teleconferencing to "real world" use is highly questionable. A limited scope of organizational settings have been tapped. Participants were typically members of an academic setting (i.e., students) or of the civil service. The majority of these investigations took place in a laboratory rather than within the context of some organization.

Finally, highly tenuous extrapolations have been made from existing literature. For example, in support of a general statement that audio teleconferencing can create an impersonal, uncooperative, communications environment, Johansen et al (1977) cite Milgram's (1965) laboratory studies on destructive obedience! This is just one instance of experimental results being taken out of context.

## Conclusions and Summary

Most of the existing literature in assessment of teleconferencing techniques, facilities, etc., is highly suspect in its usefulness. Most studies seem to disregard the conceptual leaps that must be made from the laboratory to the field. Thus, taken on their own terms, we can learn little from them that we can apply with confidence. Our next section discusses the possibility that even these "own terms" were the wrong terms.



## Chapter 5

### Evaluating Telecommunications Systems

#### What Questions are Asked

The literature on telecommunications, as exemplified by Chapter 3 of this report, predicts major innovations in mediated-communications systems. Even confining a review of such predictions to those addressing communications in large organizations, the future appears to be bringing massive transformations. The fantastic forecasts are contained in both technical and popular articles. For instance, a recent article in The Futurist described such imminent telecommunication changes as telecommuting where employees would work at home and "communicate" their work by word-processing machines, electronic libraries and data-base services where information would be searched and forwarded to any number of employees, and widely-used mobile communication links [Martino, 1979]. In a similar fashion, a technical report described computer conferencing of the future to be as widely used as the telephone by the mid-1990's, to have "dramatic impacts" on organizational structures as well as on other sociological and psychological dimensions, and to "facilitate working at home for a large percentage of the work force during at least half of their normal work week" [Hiltz and Turoff, 1978, p. xxix]. Such forecasts resemble the latest utopian fiction, Ecotopia, which depicts a community that eschews travel in favour of a country-wide video-communication system [Callenbach, 1975].

Beyond their utopian quality, these predictions - technical and popular - exhibit two substantial oversights. First, they pay minimal attention to the social impacts of new telecommunication systems, an omission shared by many studies on telecommunications. Second, they do not consider seriously the ultimate objectives of introducing more advanced telecommunication systems.

One consequence of these omissions is that researchers may be asking the wrong questions - wrong in the sense that they bear little relevance to the actual installation and evaluation of new telecommunication systems. A good example of "asking the wrong questions" is the apparent failure of researchers to explain, or even form a consensual explanation for, the remarkably slow growth in the use of teleconferencing systems. To one researcher this unexpected situation "immediately raises questions of whether teleconferencing is unsuited to many essential interpersonal communication tasks, or whether improvements in technology might lead to greater use" [Jull, 1978, p. 356]. These two questions are based on assumptions about social values, social change and the relation of research concerns to every day practices. Some of the implications of these assumptions will be considered later in this chapter. What is important at present is that only two questions were generated, questions that frequently delineate the direction of telecommunications research.

This example is merely suggestive of the disorienting effect of inappropriate questions. More telling indications are found in the abeyance of telecommunications research findings by users and potential users. For instance:

Research on effectiveness and acceptability of telecommunication systems has had very little impact on the user's choice to adopt a particular system [Hough, 1976; Tyler, 1978].

Considerable research findings indicate that, in terms of human factors, video systems are not significantly more effective - and in some situations may be less effective - than audio systems. Nevertheless, telecommunication administrations have invested far more effort in the development of video than audio systems [Pye and Williams, 1977].

Why does social/psychological telecommunications research appear to be asking inappropriate questions or, as we have seen in Chapter 4, to be of little practical value? One could posit that disciplinary ego-centrism is at work, suggesting that much research has originated with problems of the researcher's primary disciplinary background - psychology, sociology, or economics - rather than with the actual problems of telecommunications in large organizations. But this hypothesis is itself narrowly-conceived. The reasons for the framing of inappropriate questions might be found by returning to look at the two oversights common to the research: those concerning social impacts and objectives.

## Neglected Questions

Social impacts and desired objectives have become high-priority subjects in the burgeoning field of technology assessment. However, both subjects have produced dilemmas, primarily because they imply normative assertions - explicit statements about valued ends. The development of cost/benefit analysis and quantitative risk assessment has not resolved the dilemmas [see Neigher, 1978; Nelkin and Pollak, 1979; Papon, 1979; Ravetz, 1979].

The study of normative standards is neither a simple nor well-practiced activity within the social and technological sciences. Yet some researchers, such as the energy analyst Amory Lovins, criticize our failure to clarify value objectives: "We must be unabashedly normative in exploring our goals, then figure out how to achieve them, rather than blindly extrapolating trend into destiny" [Lovins 1979, p. 34].

Without the articulation of values, planning tends to follow either piecemeal strategies, hidden agendas, or implicit values which may be dysfunctional. This approach, with respect to the telecommunications field, frequently entails attacking a problem only when it blazes brightly, and then introducing increasingly sophisticated solutions based on the criterion of technological innovation, not feasibility or longevity. Issues of social impact and objectives seem to be overshadowed by studies of the interpersonal and technological causes of unexpected problems, or loosely anticipated "failures".

In addition to the difficulties inherent in evaluating normative issues, there are other reasons why telecommunications research has not focused closely on issues of social impact and expected objectives. In the opening session of the 1977 NATO Symposium on Evaluating New Telecommunications Services, Michael Tyler described some of these reasons quite effectively.

Perhaps the subject would have attracted more attention if the operation of telephone switching equipment was typically accompanied by black smoke belching from tall chimneys, or some other nuisance of that sort. As it is, no telecommunications equivalent of the innumerable social, environmental, economic and energy-economy studies of the transportation sector - for example - existed until very recently. And because the 'social impacts' associated with telecommunications tend to be less obvious, more pervasive, and more subtle than those of, say, transportation, the methodological problems have proved to be severe [1978, pp. 18-19].

Tyler views 'social impacts' to be a necessary but problematic subject of inquiry in telecommunication research. Other researchers stop at this point of difficulty. In a study of organizational impacts of office automation, including the portable office concept of at-home work, the experimenter concluded that "the secondary impact of the extended working day may be more difficult to overcome. It is due in part to the fact that the forerunners in office automation are caught between the preautomated office expectations of physical presence in the office during normal business hours, and the additional expectations inherent in the removal of physical boundaries" [Edwards, 1978, p. 136]. The experimenter implies that conflicting expectations should be overcome and that they will change eventually, and in the appropriate directions. Yet, researchers such as Tyler in telecommunications, Lovins in energy policy, and analysts in technological assessment suggest that being "caught between" conflicting "expectations" about telecommunications may create problems. In turn, such problems may prove to be more pressing and substantial than the currently-studied effects of telecommunications - visual cues, response delays, impression formation, problem solving rates, etc.

Overall, questions about social impacts and social or organizational objectives are absent in the research evaluating telecommunications. However, given that these questions are neither common to conventional social science research, nor easily investigated by existing methods, how and where does the researcher obtain more appropriate questions? One indicator of appropriate questions can be found in open-ended research, such as the interviewing process used in the present study. For example, the respondents' statements that they valued the visual privacy offered by an audio-only system is a worthy indicator that perceived privacy in the workplace is important.

Equally significant clues to more appropriate research questions can be found outside the telecommunications research literature as it is strictly defined. Here are just two examples. In the last decade, organizations have become sensitive to social changes and have adjusted their management approaches accordingly. They have recognized the social trends toward greater interest in the self, leave activities, the women's movement, and alternative lifestyles. Many large organizations have adjusted their practices to accommodate these changes. Such adjustments include cafeteria-style selection of employee benefits, flexible working hours, systems for mid-career change in work specialty, greater choice in work location, etc.. In this manner, organizations have gained sensibility to social impacts of modifications in the work environment by studying social trends. Organizational researchers are observing social trends as an indicator to relevant research questions in organizational behaviour and management (see footnote 1).



Similar guidelines for research can be found in the popular reaction to technological innovations. Concerns such as "limits to growth" and the "Conserver Society" are a real part of contemporary Canadian social thought (Starrs, 1976). The objectives of the Canadian citizen, or employee in an organization, are not always parallel to those of unrestricted technological innovation. Telecommunication research could benefit by further investigating social objectives and the manner in which they impact on attitudes towards telecommunications systems.

In summary, the social impacts and desired objectives of telecommunications constitute relatively unexplored questions. In part, these oversights are due to the seemingly elusive nature of social values and the methodological difficulties inherent in their study. These difficulties are avoided when researchers engage solely in the assessment of the effects of systems on various social-psychological dimensions.

However, other researchers are concerned with social impacts and objectives, and are challenged by the problems associated with investigating them. They are combining their conceptual and methodological techniques with alternative strategies for research. These alternatives differ from conventional research practices. Since the conventional research approach receives considerable attention in the telecommunications literature, and is reviewed at some length in a previous section of this report, several alternative approaches to evaluating telecommunications are summarized below.

## Research Alternatives

This chapter began with a comment on the astounding predictions found in the literature on telecommunications. It was argued that such predictions omit consideration of important phenomena - social impacts and objectives - and, consequently, may direct the asking of inappropriate questions. It is possible that this optimistic but restricted attitude may account, at least in part, for the minor influence which telecommunications research has had on users' decisions to adopt, monitor, modify, or abandon a system. As some researchers note, these forecasts - and the research generated with the same attitude - are constructed on a questionable foundation.

They suggest a world in which people behave as they are supposed to behave. These inhabitants of the better society are clear about their goals. They are cognizant of all of their alternatives and the consequences of these alternatives; they make their choices to maximize their goals. All that is required to ensure successful uses of electronic technology is that the projected use make rational sense [Johansen, Vallee and Spangler, 1979, p. 128].

In other words, research on effectiveness, acceptability, and future uses of telecommunications systems rests on certain assumptions about social reality. The assumptions cover three conditions:

- a) the structure of behavior - individual and group;
- b) the process of change in individuals, organizations, and society, and
- c) the potentials of a technological system.

On a general level, such assumptions are evident in the above-mentioned researcher who sought an explanation for the slow adoption rate of teleconferencing. He raised the "question of whether teleconferencing is unsuited to many essential interpersonal communication tasks, or whether improvements in technology might lead to greater use". In turn, these questions are narrowed further by his assumptions about what are "essential" interpersonal communications and technical "improvements". While this case has been exaggerated somewhat, it is illustrative of the type of assumptions in social scientific research on telecommunications.

The pervasiveness of assumptions about social reality - assumptions which are valuative, not neutral - represents one thesis in an emerging re-assessment of conventional social science research [for examples, see Israel and Tajfel, 1972]. This re-assessment has examined several norms governing conventional research which restrict, and may even distort, our understanding of certain aspects of social reality: values and objectives, social changes, and the relation between theoretical research and practical applications. Without becoming entangled in philosophical argument, it is worthwhile to show how these norms of conventional social science research affect telecommunications research.

Values and Objectives. Although a fundamental norm of social science is that it describes social reality, these descriptions are based on basic assumptions that are valuative in nature. For instance, social psychological theories are often developed with the assumption that individuals ideally possess all attributes necessary for a self-sustaining existence [Sampson, 1977]. Since conventional social science makes claims only to be descriptive and not prescriptive, these valuative assumptions often are interpreted as representing not only what is but also what ought to be. Thus, models of future social behaviors are essentially linear extrapolations of the social reality as it is currently studied (described).

This norm of descriptive practices is found in most research on telecommunications and organizations [Argyris, 1975; Susman and Evered, 1978]. Argyris has listed some assumptions about social reality that are commonly imposed on research on organizational behaviors: that one attempts to achieve purposes as he/she perceives them, maximize winning, suppress negative feelings, and to emphasize rationality. Argyris has demonstrated how organizational structures which are actually developed with these assumptions often deteriorate, and enter into organizational entropy. Johansen, Vallee and Spangler (1978) have described how telecommunications research and usage patterns are similarly misdirected by unexamined assumptions: the superiority of face-to-face communication, the importance of maximizing communication frequency, and the advantages of decentralization, among others. Clearly, researchers must not continue to confuse what is with what might be, with respect to the emerging "new social reality".

Social Change. Another norm of conventional social science is that human behavior patterns are universal and relatively stable over time. Coupled with the above-cited misconception that what is corresponds to what ought to be, researchers have not seriously investigated social change, nor have they the methodology to do so [Gergen, 1973]. Thus, conventional social science research does not attend to the changing environment - physical and social structures, social rules, goals and objectives - that influence social behaviors over extended periods of time.

In organizational and telecommunications research, the consequences of this ahistorical position has had two notable effects. First, it has restricted the nature of understanding organizational and social change: "Individuals and organizations are not born in an instant with their present structures and functions intact. Rather, present patterns of behavior can many times only be understood as the product of shared definitions held by organizational members regarding what their common endeavor is about" [Susman and Evered, 1978]. Second, an ahistorical position has restricted research options in telecommunications. Tyler (1978) has noted the absence of research on the natural history of telecommunications systems within an organization as well as on the dynamic process of user adaptation to a system. Likewise, Hiltz and Turoff (1979) have suggested that teleconferencing research would profit by viewing social behavior as a conglomerate of conventions and rules that involve in accordance with changes in situation and time. Room must be allotted to the concept of change in social science assessments of telecommunications effects.

Theory and Practice. The norms of conventional social science pose several problems for the practical application of research findings. In addition to the well-documented problems of external validity - the extent to which results found in a particular experimental situation can be generalized to other non-experimental situations - conventional research incorporates no methodology or procedures for practical endeavors. If anything, it is assumed that research findings will be assimilated eventually into practice.



In much organizational and telecommunications research, this condition has contributed to the inefficient or inadequate utilization of research findings by administrators and decision-makers [Pye and Williams, 1977; Hough, 197; Tyler, 1978], and to the failure to develop appropriate and ongoing training and evaluation procedures [Johansen, Vallee, and Spangler, 1978; Gold, 1979; Susman and Evered, 1978].

These re-assessments of social science research, specifically those pertaining to telecommunications and organizational behavior studies, are not simply critical reviews: in fact, numerous researchers are involved in the construction of alternative research strategies. While a comprehensive taxonomy of the alternatives is beyond the scope of this review, three of the newer perspectives are identified for illustrative purposes.

1. Critical Perspective. Telecommunications research may be directed toward more appropriate questions if the objectives of the user and the assumptions of both the user and researcher are made clear. Once articulated, these objectives and assumptions can be subjected to careful examination, either by empirical research or by qualitative analysis. They can be sharpened, rejected, or revised to help form a basis for future objectives and value clarification. Johansen, Vallee and Spangler (1978) listed many such assumptions in the telecommunications field, some of which were found to be erroneous or poorly conceived. These assumptions include: "the system is the solution", "face-to-face is always better", "first uses correspond to future uses", "more communication is preferable", "telecommunications is a substitute for travel", "decentralization is better than centralization", "telecommunications enhances cross-cultural understanding", "telecommunications maximizes citizen-government interaction", and "telecommunications in education does not involve significant social changes". In future research, such assumptions must be stated.

2. Natural History Perspective. Information about the acceptance and success of telecommunications systems after actual installation is rarely gathered. It is difficult to acquire this information later because dates and details of the system's introduction are not recorded. Information collection is also hampered by the fact that before and after measures are usually non-existent, and data collection is impeded by everyday activities - employee turn-over, holidays, etc. Tyler (1978) has suggested that organizations and research teams develop procedures and materials for recording information about the decision to adopt a particular telecommunications system, the dates of installation, operational difficulties, and user patterns. This information could complement other empirical studies of user attitudes and expectations, and contribute to better understanding of the acceptability and impact of systems.
3. Action Research Perspective. The field of action research is not new. However, its use in organizational settings is undergoing a re-emergence. Action research comprises an approach where the researcher works closely with the clients (members of the organization) and engages in diagnosis, investigation, and resolution of organizational problems. Through collaboration and participant observation, the researcher may be better equipped to assess organizational needs, relevant situational factors, objectives, and future options. Regarding the introduction or modification of telecommunications, action research enables better assessment of social impacts and goals [Susman and Evered, 1978].

### Summary

Research on telecommunications in organizations - particularly those with atypical structures, such as decentralized organizations - has tended to be conducted with the methods and concepts of conventional social science. While such research has resulted in a substantial body of data, the findings often have not been utilized, or even utilizable, in the real world of large-organization management. As discussed in this section, the failure to perform genuinely valuable research is related to the prior assumptions about impacts and objectives, the type of questions asked and not asked, and the apparent hiatus between research and practice.

Some investigators recently have begun to correct these impediments to optimal utilization of telecommunications research. Their work suggests that future research include several modifications. First, evaluations should attend to an organization's functions and objectives as well as to those of individual employees. Second, research should not be confined rigidly to conventional social scientific methods; it should incorporate analyses based on qualitative assessments, historical materials, and experiences from the interaction of researcher and client. Finally, some of the research should be ongoing, essentially a process of information gathering that can be conducted regularly from within the organization.

## Chapter 6

### Recommendations Derived From This Research

The following recommendations do not always derive directly, or even obviously, from the observations in preceeding single chapters. Often, they emerged as the investigators discussed their different research activities with one another. The reader will immediately discern, however, that our recommendations fit neatly with our observations, perhaps at different stages of the entire report. Our recommendations to GTA fall within what should be three major aspects, or perhaps phases, of their general concern with telecommunications and telecommunications effectiveness: planning, evaluation, and training.

#### Planning

Technological innovations invariably give rise to images of their benefits to the social environment. These images of future improvements have overshadowed the actual instances where innovations have failed to materialize, or have had detrimental effects. The recent history of the video-conference and video-phone has alerted telecommunication researchers to the danger of assuming the successful implementation of technological innovations. The present review of telecommunications research suggests some considerations that might guide the planning of new telecommunications installations. Above all, the review has indicated that both researchers and users ask a broader range of questions. In addition to the obvious questions about existing technology, cost, and human performance functions, they should investigate the social impacts, the organization's objectives, and the social costs and benefits accrued by introducing a particular telecommunications system. During these preliminary studies, researchers should be sensitive to many common beliefs about communications systems such as the assumptions that successful systems maximize communication and remain stable in their functions over time.



Planning is very difficult when it involves systems and services with which no one has ever had experience as is the case with new telecommunications and information services. However, GTA should maintain close scrutiny of the technical and business literature and close contact with the telecommunications and business information processing industries in order to prepare forecasts of the probable dates of availability of various systems as well as their utility and acceptability by various government agencies. On one hand, it is sufficient to monitor actual developments such as Telidon, business data networks, two-way cable TV, teleconferencing, and so on without attempting to predict for future possibilities, such as dispersed work centres. On the other hand, GTA can participate with other sectors of the Department of Communications, the government and industry in the development and actualization of many forecast services, as it suits their requirements.

Telecommunications systems planning is going to be more and more a constituent part of information systems planning. GTA should endeavour to be involved in the overall planning process, so that the telecommunications component of the organization under consideration is incorporated as an integral part of its information processing infrastructure. In particular, as it relates to decentralization, GTA must be represented on all relocation teams from their inception.

### Evaluation

The evaluation of telecommunications systems has tended to utilize conventional social science methods, primarily laboratory studies and quantitative assessments of users' performance, reactions and attitudes. As such, telecommunications research has been limited by the inadequacy of these methods for exploring changing and complex situations. The effects of these limitations are seen in the relatively minor reliance on research results by users and potential users.

The present review found that conventional research has omitted consideration of three important factors in the evaluation of telecommunications systems: social values, social change, and the relation of research to practice.

Several alternative approaches which enable systematic study of these factors have been suggested. Whatever methodological approach is adopted, the telecommunications researcher should attend to several dimensions of communications within organizations.

- 1) Communication: whether face-to-face or mediated, is not a stable situation but a process which changes over time. Thus, evaluation and assessment should consider these changes by utilizing a flexible and continual assessment technique.

- 2) A users' receptivity is a function not only of successful technical and physical communications, but of the values and preferences which they bring to their work situation. Assessment of telecommunications systems should include measures of social values such as privacy, need for face-to-face interaction, job location, working and leisure time expectations, etc. Like the process of communication in organizations, social values are not static. Thus, the researcher should construct evaluation measures which assess particular social values and their changes over time.
- 3) Much telecommunications research has addressed questions of greater relevance to social science theory than to practical application. As a result, there has been little utilization of research results and few procedures which could be used in practical situations. One suggestion for altering this under-utilization of social science research involves creating a closer relation between research and practice, either by maintaining an in-house evaluator or by encouraging researchers to become well acquainted with the operations and problems of the organization.

### Training

New telecommunication and information systems mean new working environments, new relationships, new job functions and new skills. There is a requirement for GTA to become involved in three training areas.

The first training area is the most apparently needed, and it has two parts. For the first part, in-house system planners and designers must be conversant with and skilled in the use and application of current state-of-the-art available telecommunications. Since these are in a state of rapid evolution, and there are many systems vying for dominance in the marketplace, continuous updating of GTA personnel is imperative. Seminar series should be organized to provide this knowledge. The seminars should take full advantage of commercial offerings.

The second part of the fundamental knowledge and skills training area involves the clients. Users of the systems provided through GTA must be trained in their use. Again, seminars and short courses could be developed for this purpose.

The second training area involves general telecommunications and information systems awareness. Clients in particular must be educated in the range of alternatives available to them. As it now stands, some government departments are very sophisticated and can implement advanced telecommunications through their own resources, while others have no knowledge of what is available, let alone how to use it. GTA could be the medium through which telecommunications services were interpreted. This requires active and continual presentation of the facts and figures regarding services in a manner understandable by client departments.

The third area is the least specific and entails the involvement of GTA in communications literacy; that is, in the development of the use of communications in the conduct of business. While the first area involved the specific skills required to operate a Telidon terminal or a facsimile machine, general literacy involves the creation of an environment in which the use of multi-media telecommunications is considered natural and effective. GTA might, perhaps become a model of that environment.

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### Footnotes

1. Examples of the attention given to social changes by organizational researchers can be found in "Social Change Affects Work", Canadian Office, 1979 and "Management: Capitalizing on Social Change," Manpower Argus, December, 1979.



## Appendices

A. The Research Group

B. Letter to Prospective Interviewees

## APPENDIX A

### The Research Group

The principal investigator was Dr. David C. Coll. Professor of Engineering in the Department of Systems Engineering and Computing Science. Dr. Coll is an authority on communications and computers, and was a founder of, and investigator in, the Wired City Laboratory at Carleton from its inception in 1971. He is interested in the application of information technology, particularly as it relates to broadband, multi-media communications.

The co-investigator was Dr. Lloyd H. Strickland, Professor of Psychology in the Department of Psychology at Carleton University. Dr. Strickland is a social psychologist with particular interests in communications. He was also a major researcher in the Wired City Laboratory.

The researchers aiding Drs. Coll and Strickland were Dr. Jill Morawski, Dr. Ted Palys and Ms Gloria Baker-Brown. Dr. Palys, who has completed the requirements for the doctorate in Psychology at Carleton, has considerable experience in assessing social organizations through interviews and testing procedures. Dr. Morawski, who completed her doctorate in psychology at Carleton, is primarily concerned with the history of science; this has involved her in examination of applied psychological research trends in the context of historical and social pressures. Ms. Baker-Brown, a graduate student in psychology, has had extensive experience in literature research, particularly related to current issues in telecommunications developments.



Carleton University  
Ottawa, Canada K1S 5B6

October 29, 1979

Dear

This is a request for your help in an investigation on the general topic of telecommunications and organizational decentralization.

We have recently received a university research contract managed by the Government Telecommunications Agency to study communications patterns and problems within decentralized organizations. We are attempting to identify the sorts of communication links that are used, the means by which they are realized, and the particular problems or successes associated with their use. One particular goal is to develop an inventory, or "check list", to suggest technological solutions by which some of the negative consequences of decentralization may be overcome. It has been agreed that GTA be used as an example of a decentralized organization, particularly since it is so intimately involved in the use of telecommunications. It is our hope that the results of the study will be beneficial both to you and to other organizations now considering or undergoing decentralization.

The research process has been divided into two parts. The first involves a review of the literature on the capabilities of communications systems, based in part on our experience of the past 10 years in the Wired City Laboratories here at Carleton. The second aspect is to be based on interviews with senior management persons within GTA itself. We have begun to contact different GTA regions to request their participation in our study, and one of the regions we hope to visit is yours.

... /2

Although you may already have assumed it to be the case, we wish to emphasize that participation is voluntary. Should you agree to participate, however, your complete cooperation would be appreciated. The findings from each particular region would be presented first to that region before its inclusion with the final report. No specific references to your region would be made without your prior permission. Further, each office which participates would receive a copy of the final report.

Our proposed procedure first involves an interview with you, the manager ..... This will take approximately two hours, and will be conducted at a time mutually convenient with you and the interviewer, Ted Palys. This interview will involve a general discussion of your views on the decentralization process, followed by a number of questions about the major projects in which your branch is involved, the communication paths involved in carrying them out, and the real and potential effectiveness of telecommunications in completing these projects. With your permission, the interview would be taped so that no information would be lost. The tapes would not be heard by others than the research team members, and they would be erased or returned to you at the completion of the study. After interviewing you, we would want to hold additional interviews with the project coordinators identified by you.

You and your staff can make a significant contribution to this study. We feel that the results will be of practical value to decentralizing organizations generally, and to the Government Telecommunications Agency and the Department of Communications in particular. We hope that you will agree to participate.

Dr. Palys will telephone you soon to make specific arrangements. If you wish to contact him sooner, he can be reached at (613) 231-6609. If you have any questions regarding this research, please feel free to contact Professor Coll at (613) 231-3624.

Yours truly,

David C. Coll  
Professor of Systems Engineering  
Principal Investigator

Ted Palys, Ph.D.  
Research Associate





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