Communications Research Centre

RESEARCH REPORT ON TELECONFERENCING

VOLUME 1

EXECUTIVE SUMMARY

by

G.W. JULL, R.W. MCCAUGHERN, N.M. MENDENHALL, J.R. STOREY, A.W. TASSIE,
AND A. ZALATAN

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1. INTRODUCTION

Volume 1 presents summary results and conclusions arising from a three-year study of the potential of teleconferencing, as a means to improve the effectiveness of communications within federal government departments. Volume 2 provides detail information on the results of this study. It has been found that teleconferencing is feasible and can be very useful as an aid to communications between decentralized units but all available systems have major technical limitations which make them unsuitable for federal government use. Because of the immediate needs in some departments and the needs which may develop in others in the process of decentralization, it is recommended that DOC inform Treasury Board of the current situation regarding teleconferencing.

2. BACKGROUND

Teleconferencing is a means of holding meetings between two or more geographically-separated groups using telecommunications systems as the communications medium. Typical teleconferencing meetings are business meetings between a number of individuals, held as part of the process of their on-going work. On rare occasions, meetings take on the proportions of major conferences; for example, nurses in Quebec recently held a successful meeting with 1,754 participants in eight locations across the province. Teleconferencing systems are also used for specialized communications in medicine, education and engineering. The systems range from conventional telephone handsets and speaker phones interconnected for conferencing, through to new types of audio, computer, and closed-circuit TV systems.

The demand for teleconferencing has developed very slowly, and currently these systems are used in only a few organizations throughout the Western world. Among the most successful and cost-beneficial systems is the system specially-developed for the University of Quebec.. The need in other organizations is now changing under the pressure of recent events. As these organizations come under increasing pressure to decentalize, the need to maintain essential communications patterns, coupled with the expense and inconvenience of frequent travel, has resulted in a desire to exploit telecommunications to its fullest extent, using teleconferencing and related services.

In Canada, various decentralized federal government departments and others in the process of decentralization have used or are planning teleconferencing systems (PSC, DOC, DIAND, DREE, and Consumer and Corporate Affairs). Other organizations within and outside government are studying its potential as a service to meet their needs. Several federal departments have requested DOC to recommend suitable systems.

3. DOC TELECONFERENCING ACTIVITIES

In 1972, DOC set up a project in teleconferencing to assist federal government departments to meet their developing needs for improved communications between headquarters and outlying units. The objectives of the project were;

i) to determine the feasibility and utility of various teleconferencing systems, as administrative and management instruments for use by federal departments and agencies,

ii) to develop a better understanding of the technical and behavioural factors determining the effectiveness of teleconferencing systems,

iii) to identify the technological limitations of existing systems and to make innovations where possible, and

iv) to develop some of the necessary skills and competence within DOC to provide recommendations to other branches of DOC concerned with policy and plans for telecommunciations development.

The project was terminated in March 1975 due to a change in research priorities in DOC. The conclusions of studies directed to meet these objectives could form the basis of recommendations for a future course of action in teleconferencing research and development. The total expenditures over the 3-year life of the project were 27 MY and $445,000, not including salaries.

From the outset, it was realized that behavioural studies would be required to meet the objectives of the project, and these would have to be carried out at the same time as technical and economic studies. Social psychologists, engineers and economists in DOC and Canadian universities collaborated in the project. Their work was complemented by that of social psychologists from the Communications Study Group, London. Social psychologists from the US also made contributions.

During the course of the project various Canadian organizations installed a variety of different audio and video teleconferencing systems. The reactions of many hundreds of users of these systems were evaluated by DOC in collaboration with these organizations. In addition, studies were carried out on an experimental audio teleconferencing system developed at CRC, which overcame some of the principal behavioural and technical limitations of existing systems. Some laboratory studies were carried out in conjunction with the field studies to identify the behavioural variables which could influence the acceptance and use of teleconferencing systems. Other technical studies were carried out to assess the feasibility of various image communications facilities to support audio teleconferencing.

4. GENERAL CONCLUSIONS

Studies carried out by DOC and other organizations in the UK and US have led to some conclusions on the nature of teleconferencing, its benefits and uses. Several of these conclusions are counter intuitive or at least run counter to widely-held opinions.

Nature of Teleconferencing: Teleconferencing complements, as well as substitutes, for travel. It can generate unexpected and fruitful new types of communications, as well as substituting for some business trips. If accepted and widely-used, it can be expected to have a major impact on the patterns of communications within an organization. For example, in the University of Quebec some 122 of 255 teleconferencing meetings over the period 1973-74 were urgent meetings without formal scheduling. In the DOC, the use of teleconferencing created approximately four times more meetings between headquarters and regions than had previously been held on a face-to-face basis.

Uses: Teleconferencing is most frequently used for business meetings which are principally for "exchange of information" and "problem-solving" (work-oriented activities). Neither audio nor video teleconferencing are used for "bargaining" or "getting-to-know someone" (or other interpersonal socially-oriented activities). It is not used for confidential discussions. Video telephones are most frequently used for specialized meetings in medicine (US) and engineering (Holland and Sweden) requiring transmission of images.

Characteristics of Meetings: Teleconferencing meetings are shorter and more business-like than comparable face-to-face meetings, but require more preparation, more procedural structure, and are less friendly. Among inexperienced users at two location meetings, audio teleconferencing tends to polarize participants into groups, and fewer recommendations are made in problem-solving activities. For video teleconferencing these effects are not as pronounced. With experience, users of audio teleconferencing find it to be increasingly useful.

Effectiveness of Audio and Video: Video does not add significantly to the uses of teleconferencing for business meetings. UK meeting survey studies show that up to 40% of present day meetings could be held with audio-only facilities with little loss of meeting effectiveness. A further 20% could be held with the addition of video, while for the remaining 40% teleconferencing

is not a suitable substitute. However, other factors such as the *ease of travel, negative attitudes to teleconferencing* and *slight degree of acquaintanceship* of meeting participants will strongly influence the decision to teleconference or travel, and they may result in a much smaller fraction of meetings being held by telecommunications.

Ease of Travel and Location of Facilities: Normally, teleconferencing is chosen for business meetings only when travel times are greater than two hours. It is extensively used for urgent meetings when in-house facilities are available, but not often used for this purpose if travel times to teleconferencing facilities are more than about half an hour.

Attitudes Towards Introduction: Senior managers in federal government departments perceived greater utility and had more favorable attitudes towards teleconferencing than did middle managers or technical groups. In DOC, regional personnel indicated a greater need for teleconferencing than headquarters personnel.

Economics of Teleconferencing: Audio teleconferencing can provide significant economic benefits when used to substitute or complement business trips. During the Apollo program, NASA found that each dollar spent on audio teleconferencing saved three to five dollars in travel. They reduced their travel budget in one year from $2.5M to $1.2M. On the other hand, video teleconferencing costs over ten times as much as audio teleconferencing, and on an economic basis is not cost-beneficial to-day.

In a sample calculation it was estimated that 1500 desk-top terminals and 1500 room terminals could serve the federal government needs across Canada, and these could be installed for an estimated total cost of $18M. It was found that an annual return of 36% could be realized on the investment over an eight year period. In making this calculation it was assumed that the number of government trips in Canada could be reduced by 6% (equivalent to 27,000 trips per annum). This calculation is a conservative estimate of potential savings, and takes no account of increased efficiency due to improved communications (i.e. the use of audio teleconferencing in circumstances where there would not otherwise be any meeting at all). It should be noted that the above is a sample calculation only, and is not intended as a recommendation for an immediate $18M investment!

5. USES AND CHARACTERISTICS OF SYSTEMS AVAILABLE IN CANADA

The principal uses of systems which are available in Canada and have been evaluated by DOC are summarized below:

1. *Telephone Conferencing:* (offered by the Trans Canada Telephone System and by the Government Telecommunications Agency. Handsets or voice-switched loudspeaking telephones are used. Normally, not more than eight locations are connected, with one to four participants at each location). (Information on the use of this service has been provided by the Trans Canada Telephone System).

Principal Use - Short meetings of about 30 minutes duration related to specialized marketing activities.

Advantages - Uses existing telephone facilities.

- Suitable for more than two locations.

- Most economical system for limited numbers of meetings.

Limitations - Uncertainty of presence of others, both of who is speaking and where they are speaking from.

- When voice-switched loudspeaking telephones are used, they result in chopped-up sentences and irritation to users.

- Seldom used for typical business meetings with many participants and a wide range of agenda items.

- Advanced booking of 24 hours required, and, on occasions, delays of up to one half hour in interconnection of more than two locations at the scheduled time.

Acceptance - Low level of acceptance, only 12,000 telephone conferences per year in Canada.

2. *Audio Teleconferencing System:* (offered by CN/CP Telecommunications, using their "Broadband System". Normally, not more than eight locations are connected, with one to twenty participants at each location).

Principal Use - Regular and special interregional meetings.

Advantages - Suitable for more than two locations.

- Designed for large groups.

Limitations - Uncertainty of presence of others, (both of speakers and their locations).

- Voice-actuated microphones (see under telephone conferencing).

- Delays of over one half hour in interconnection of terminals can occur.

Acceptance - was accepted and used regularly by DIAND for communications from Ottawa to Whitehorse and Yellowknife for two years despite technical deficiencies, but presently used very little due to user dissatisfaction.

- Was accepted for a short time (two months) by DOC Policy Branch for communications with regional offices across Canada but is presently used very little due to user dissatisfaction.

3. *Audio Teleconferencing System:* (implemented by Bell Canada, using Western Electric Type 50A Sets. Up to eight locations with one to twenty participants at each location for a meeting. On occasions, many more participants at each location can be accommodated).

Principal Use - Regular, urgent, and other special meetings and some teaching (using "telewriters").

Advantages - Suitable for more than two locations.

- Designed for large groups.

- Rapid interconnection with specially-developed conference bridging system.

Limitations - Uncertainty of presence of others, (both of speakers and their locations).

- Voice-switched microphones (see under telephone conferencing).

Acceptance - Accepted and used regularly for communications between University of Quebec campuses located in cities across Quebec.

4. *Conference TV System:* (Bell Canada, using closed-circuit TV facilities. Two locations with up to fourteen participants per location for a meeting. A similar facility has been tested by the B.C. Telephone Co.).

Principal Use - Regular intercity business meetings and demonstrations.

Advantages - Video presentation of participants and documents.

- Not voice-switched.

Limitations - Can not be used for meetings with more than two locations.

- Advanced bookings and travel to a studio required.

- Not economical for intercity teleconferencing. (Costs are over ten times the cost of audio-only facilities).

Acceptance - In spite of being available at no charge today, it is seldom used except by Bell Canada employees.

6. USES AND CHARACTERISTICS OF SYSTEMS AVAILABLE ELSEWHERE

The principal uses of other systems available elsewhere are summarized below:

1. *Audio Teleconferencing* ("Remote Meeting Table" - improved audio system being implemented for use in UK Civil Service Departments. Two locations with up to twelve participants per location for a meeting).

Principal Use - Regular and special meetings.

Advantages - Identification of speakers.

- Not voice-switched.

Limitations - Unsuitable for more than two locations.

Acceptance - The first system (UK Scottish Office) has been accepted and is regularly used.

2. *Video Telephones* (US, UK, France, Sweden, Holland and Japan)

Principal Use - Specialized meetings - medicine (US) and engineering (Holland and Sweden).

Advantages - Ability to display various types of images.

Limitations - Not economical for intercity teleconferencing (High cost for video which adds little to business meetings).

Acceptance - Accepted for special intracity communications activities.

3. *Computer Conferencing* (US, and more recently, Canada (NH and W, DREE)).

Principal Use - Interactions between experts in various professions, and a "mail-box" service using computer terminals for access.

Advantages - Interaction either in real-time or on a delayed basis, overcoming time as well as geographic limitations.

- Uses telephone network.

Limitations - Currently limited to typing in opinions and information with a teletype keyboard.

- Learning requirements.

Acceptance - Accepted for exchanging opinions and information on a wide range of subjects.

4. *Audio Teleconferencing:* ("Darome Convenor" - improved audio system designed to replace the Western Electric 50A set, implemented and used in the Education Telephone Network of the University of Wisconsin - Extension. Centres in over one hundred communities with a total of 173 locations are connected to a dedicated 4 wire system. Slide projector with remote control capabilities are included.)

Principal Use - Teaching extension courses.

Advantages - Suitable for more than two locations.

- Designed for groups of up to 200 people at each location.

- Rapid interconnection with specially-developed conference bridging systems.

- Uses dedicated 4-wire system.

- Feedback and sharing resources in education.

Limitations

- Uncertainty of presence of others which makes it difficult to make geographically-dispersed people feel like a "group".

- Voice-switched microphones (see under telephone conferencing).

Acceptance

- Used extensively by the University of Wisconsin, Extension. More than 25,000 are enrolled in extension courses, and use the facilities located in the centres.

7. REMAINING TECHNICAL PROBLEMS

All systems available today have technical deficiencies which restrict their usefulness. Some organizations, the University of Quebec for example, has initiated the development of facilities to overcome some major deficiencies. Others such as DOC, DIAND, and potential users of the TCTS or GTA telephone conferencing service and the Bell Canada Conference TV System for example, are not using the facilities which have been available to them. Furthermore, implementation of systems in federal departments is proceeding in an uncoordinated and fragmented manner.

Research at CRC on an experimental audio system and developments elsewhere has shown that some highly desirable improvements are within the state-of-the-art, while others require further research and development. Improvements within the state-of-the-art are:

- improved conference bridging systems to provide automatic and reliable interconnection of terminals;

- provision of indicator signals to identify speakers and their locations, and thus reduce uncertainty of the presence of others;

- graphics transmission facilities, required for specialized use by some organizations, to supplement or substitute for facsimile transmission facilities.

Improvements requiring extensive research and development are:

- improved audio terminals with suitable conference bridging systems to permit free-flowing conversation, with provision to minimize acoustic feedback and line-noise problems, preferably without using current types of voice-switching systems.

Major research and development programs to improve audio teleconferencing systems have been virtually non-existent in Canada. It appears that the common carriers are not yet convinced that a large market exists, or if they

are, then it is not identified as a high priority development. It also appears that the potential user organizations have not defined and demanded essential improvements within the current state of technology. The notable exception to this has been the University of Quebec which has demanded and obtained some improvements to meet their basic needs.

8. ROLE OF SOCIAL SCIENCE IN TELECONFERENCING DEVELOPMENTS

Results obtained over the past three years have demonstrated the important role that social science can play in complementing technical research and development of interpersonal telecommunications systems. We believe that this will be increasingly important in the future. To help avoid repetition of costly errors, such as the hundred million dollar video telephone programs, the analysis of needs for new teleconferencing systems and the evaluation of proposed systems to meet these needs should be carried out by social scientists at a sufficiently early stage of system development.

Recommendations arising from the following social science studies will be required, prior to decisions on major development and installation of new terminals and systems.

- Studies to determine the acceptance and use of simple desk-top terminals compared with conference room terminals.

- Studies to determine the most satisfactory new types of audio terminals to replace current ones.

- Studies to define the desirable methods for identifying speakers and locations during meetings.

- Studies to determine the particular communication systems characteristics to meet the needs of various groups.

- Recommendations on new forms of meeting procedures and the requirements for training for various types of communications activities.

- At a later stage, it will be necessary to have results from studies to predict the usefulness of integrating audio teleconferencing with computer conferencing and new image communications systems.

Finally, for future planning, it will be necessary to have social science input to studies which will consider the implications of a major growth in the use of teleconferencing or other related interpersonal telecommunications services. This growth will impact

- the patterns of communications developing throughout Canada,

- the characteristics of networks and systems,

- the use of other telecommunications services,

- the postal service,

- the transportation industry.

Currently, DOC has access to some of the few resources in Canada to carry out the range of behaviour/technical studies required to provide these recommendations. These resources include the laboratory established in collaboration with the PSC at their Management Training School in Carleton Place with government management personnel as research participants, and the laboratories of the Wired City Project at Carleton University. These laboratories have made significant contributions to teleconferencing. Other studies concerned with evaluation of user attitudes to teleconferencing have been carried out in collaboration with various Canadian organizations, within and external to government.

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