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TELECONFERENCE CANADA

RESEARCH PLAN D

A report of the

Socio-Economic Planning Branch

Department of Communications

AUGUST 16, 1972

I. SUMMARY

The objects of this report are threefold:

1) To introduce the reader to the concept of Teleconferencing.

2) To describe some of the issues and factors which will determine the development of operational Teleconference systems.

3) To outline a plan for the development of a comprehensive research program that will investigate the salient variables involved in Teleconferencing as both (1) a human interactional communication process, and (2) as a technological system.

The Teleconference Research Program is "mission-oriented". Its purpose will be to promote the design of teleconference systems that can fulfill the needs of users, principally agencies of the Federal Government. Emphasis will be placed upon a systematic analysis of those communications needs of potential users which might be met by teleconference systems and upon an identification of changes in the design and operation of teleconference systems so that these can best meet the defined communication needs of users.

This report represents an intermediate step between the preparation, February 2, 1972, of a Teleconference Canada Project Proposal, and the commencement on August 15, 1972, of a detailed program which is expected to continue over two years and to provide in addition a basis of knowledge for continuing research into man/machine communications systems.

II. INTRODUCTION

1. DOC Role:

Interest in teleconference systems in the Department of Communications dates back to a research project proposal developed

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by the Communications Research Centre (CRC) in November, 1971. This project, since approved, originally envisaged the construction of a wideband, audio-visual link between CRC, Shirley Bay and the DOC Headquarters, and now involves a narrowband, audio link between the same locations, scheduled to become operational in October/November, 1972.

The interest of the Socio-Economic Planning Branch in teleconference systems dates from early 1972 and was expressed formally in the February 2, Program Proposal. In broad terms (see precise definitions below) the objective of the Socio-Economic Branch's Teleconference Canada Program is to conduct research into alternative teleconference systems, both within and outside DOC, in order to determine their suitability for use by agencies of the federal government as well as a range of other non-commercial users.

The CRC Teleconference Project and the Socio-Economic Branch Teleconference Program are, obviously, closely interrelated. Each unit will make a direct contribution to the work of the other and a close liason between the two activities will be maintained. This particular report, however, presents only the views and work program outline of the Socio-Economic Branch. Thus references in this report to a 'Teleconference Project Group' refer only to the multi-disciplinary group assembled by the Socio-Economic Branch, one of whose members, part-time, is an engineer attached to CRC.

2. <u>The Prospects for Teleconferencing</u>:

The scale of effort being devoted to the Teleconference

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Canada Program by the Socio-Economic Branch warrants an extended explanation. The reasons range from a recognition of the potential for the creation of a new type of communications system or process, to a recognition of the potential for the conduct of innovative and important research into the machine-mediated, human communication process.

The catalyst of interest was the recognition of a lacuna, and possibly even an anomaly, in the contemporary complex of communication systems. On the one hand these technical systems permit almost every conceivable type of person-to-person communication: some 98 per cent of Canadians can telephone and demand another individual almost anywhere in the world (the existing telecommunications system permits also the point-to-point transmission of data and record messages as well as the mass distribution of all types of audio, and audio-visual programs). On the other hand, as a function of the ever-growing complexity of society, there is a continuing growth in the need for organizations and institutions of all kinds, public or private, to hold meetings, group discussions and conferences in order that all points of view and all sources of expertise can be brought to bear on the resolution of specific problems. In addition, the concept of participatory democracy requires for its realization the elaboration of new approaches to the attainment and measurement of feed-back on citizen opinion and to the creation of opportunities for direct citizen interaction with decision-makers.

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Almost any individual can use existing telecommunications systems to reach and engage in discussions with another individual. This capability has been of enormous benefit to organizations and institutions in terms of improving their efficiency and productivity. Yet increasingly these institutions conduct their business by means of conferences and meetings of committees (their members drawn from within the subject institution or including representatives of other institutions).

Telecommunication systems, for all their sophistication and efficiency, provide no assistance to one of the principal thrusts of contemporary organizational activity: they do not permit groups of individuals (or committees) to conduct their business at a distance. Instead participants to a conference must meet in a single room and must therefore travel to the meeting-place, either from separate offices in the same building, from separate offices in the same city, from separate cities or separate countries.

Primitive teleconference systems, which in the light of a theoretical definition would warrant the name, do exist. Two groups huddled around separate SpeakerPhones are in fact engaging in a teleconference. So are three or more participants to a telephone Conference Call. The CBC, much in the manner of Le Bourgeois Gentilhomme's belated discovery of his knowledge of prose, has been engaged in teleconferencing for years: studio audiences or panels in different cities have engaged in joint discussions, commonly by means of an assymetric teleconference system: two-way audio and one-way video.

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These exceptions noted, the core fact remains that telecommunications companies have yet to market a viable teleconference system. While certain systems such as that of the Banker's Trust in New York have enjoyed high usage, a more common and disappointing experience has been that of the British GPO Confravision system which has to date attracted few customers.

Technology is not the constraint. Highly sophisticated systems which replicate most of the characteristics of face-to-face conferences have been developed, notably by NASA. Provided cost is removed as a consideration there are few constraints to the attainable level of quality of reproduction, both aural and visual, to the sophistication of participant-controlled cameras, to the speed and quality of hard-copy transmission and reproduction.

The constraints rather are economic and human. For almost every activity except defence and the U.S. space program (at least until recently) cost is critical. The intended commercial fee for an hour use of the G.P.O. Confravision, for example, is $300.00 up to 125 miles and up to $500.00 an hour for longer distances. (No fee schedule has been developed as yet for the comparable Bell Canada system, though rates are likely to be charged on a value-of-service rather than cost-of-service basis.)

The most obvious human constraint is that people like to meet each other. They also like to travel: it provides an opportunity to escape the office, to make new contacts, to indulge in some expense account living. (Some insight into the

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difficulties of introducing teleconferencing into organizations may be derived from research into the impact upon and resistance from organizations which have been the scene of other new technology programs, such as MIS systems.) A more pragmatic reason for antipathy to teleconference systems is that many of the most productive aspects of face-to-face encounters - the personal contacts, the non-verbal cues, the corridor bargaining - cannot be replicated, other than for each of the separated groups, in teleconference systems no matter how sophisticated.

The preceeding analysis paints a relatively pessimistic picture of the prospects for teleconference systems, yet progress has been made which indicates a general awakening of interest in and of a committment to Teleconferencing. This general awareness of the potential of Teleconferencing indicates that the Department has chosen an auspicious time to embark an extensive study of this highly innovative communications medium. Indicative of the current trend are:

A) Certain T/C systems for example that of the Banker's Trust cited earlier and a narrowband system being evaluated for the GPO by the Communications Studies Group of London University have achieved a high degree of usage and user satisfaction.

B) Within the past year, a number of new Teleconference systems have been established. Among such systems are those of: Bell Canada, New York Telephone, Metropolitan Regional Council (New York), the Office of Telecommunications of the U.S. Department of Commerce, and the U.S. Environmental Protection Agency.

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These systems, with the exception of those of the U.S. Government departments, are all highly sophisticated audio/video systems, employing for the most part, existing off-the-shelf technology.

C) Technological progress can be expected to achieve further reductions in systems costs, of which the most critical are those of broadband transmission for audio-visual systems.

D) A number of systems (Confravision is an example) have been developed without any, or with little, assessment of user needs. Given that T/C systems are novel and unproven, extensive market research, the output of which must become an integral part of the systems design process, is essential.

E) Again, a reflection of the lack of attention to user needs, is the considerable evidence that to date, most teleconference systems have been used in a sub-optimum manner - as a replacement for face-to-face meetings rather than as a supplement to such meetings.

F) The need for, if not the demand for, teleconference systems is undergoing a tremendous increase. In the instance of the principal 'target' of the Teleconference Canada Program - the federal government - the growth in the number of conferences and of committee meetings, and therefore the growth in the need to increase the efficiency of these meetings by the use of teleconferencing or other means needs no elaboration.

There are two other causes for the increase in the potential need for teleconference systems within the federal government. First, the government is committed to implementing

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the concept of participation, a dynamic that encompasses both the involvement by government employees in the decision-making process within their own organizations and the involvement of the public at large in the total governmental administrative process. Second, the government is committed to the concept of decentralization. This process can be both physical, as evidenced in the transfer of the Royal Mint to Winnipeg or the location of the Transportation Development Agency in Montreal, or administrative in the sense of a decentralization of decision-making authority a process which, quite aside from any outward movement of personnel requires an increase in the flow of messages between regional offices and headquarters.

3. Reasons for Research Program:

During the first phase of the Teleconference Canada Program, priority attention will be given to a comprehensive user needs survey. The results of this survey will not only provide some indication of the potential for teleconference systems within the federal government, it will also identify areas for priority attention in the behavioural research program. The results of this research (i.e. that 'X' type of teleconference system is the most suitable for 'Y' type of conference by 'Z' type of organization) will be fedback in a continuous cycle into the user needs program. It is hoped in this way to develop a model for dynamic research into communications, one in which users help system designers to design effective systems at the same time as system designers help potential users to define their needs. The principle here is that neither systems nor needs are

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static: needs create systems and systems if not create, then refine or clarify needs.

The first test of 'success' for the Teleconference Canada Program will be the extent to which it helps develop teleconference systems that are effective tools for information exchange by intended users.

This measure of success may be unattainable. Teleconference systems may be inappropriate tools for the job at hand no matter how skillfully designed; or, even if appropriate, teleconference systems may be rejected for a host of reasons that have nothing to do with their intrinsic effectiveness (i.e. organizational resistance to change; attitude of managers to impact of T/C systems upon authority roles, etc.).

Other measures of success will be used:

A) The extent to which the Teleconference Canada Program provides insight into an operational experience of the dynamic research process. In other words, the research methodology itself will be tested for its ability to provide new information.

B) The extent to which the Teleconference Canada Program advances the state of specific knowledge of machine-mediated human communications processes. The objective here is a significant increase in understanding of the ways by which individuals (or groups) can use communications systems to reach their goals, and therefore of the ways in which those systems can be designed in order that individuals can better reach their goals, individual or collective.

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III. OBJECTIVES

The formal objectives of the Teleconference Canada Program are:

> "In general, to develop the capacity and knowledge necessary to determine the value of teleconference systems as a means of satisfying the needs of non-commercial users within and external to government, with particular emphasis on specific Canadian applications."

And in particular:

> 1) to determine the utility and feasibility of various teleconferencing systems as an administrative and management instrument for use by Federal departments and agencies;
>
> 2) to determine and evaluate the role of teleconference systems as an instrument which could promote national, political and social objectives by improving communications between governments, representative associations and institutions across the country;
>
> 3) to determine the utility and feasibility of teleconferencing systems for specialized uses such as telemedicine;
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> 4) to contribute to research and to the development of appropriate evaluation methodologies, concerning behavioural aspects, into mediated communications interaction in teleconference systems;
>
> 5) to identify the shortcomings of current and proposed systems for teleconferencing and related applications, in order to suggest areas for technological research and development."

The research program developed to fulfill these objectives will have to focus its principal attention upon two sets of priorities.

A) Sub-objectives (1), (2), (3) and (5) all concern research into the effectiveness of teleconference systems; sub-objective (4) relates to the development of research metho-

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dology relating to the human communication process in teleconference environments. Priority in the research program (in respect of timing and of resource allocation) will be given to sub-objectives (1), (2), (3) and (5).

B) Research into the effectiveness of teleconference systems can in turn give priority attention to one of two approaches in attaining the intended goal:

i) to contribute to the design of teleconference systems in order to enable users to conduct their business effectively and efficiently.

ii) to develop insights into the role of psychological and sociological variables in the teleconference process, including user satisfaction, in order to determine their potential contribution to the teleconference process.

It is clear that certain socio-psychological variables, such as role relationship, can effect materially the teleconference outcome: i.e., conference chairmen may find their authority dispersed in a teleconference environment. Nevertheless, it is also clear that many socio-psychological variables, while they can be observed and measured in an experimental setting, cannot be controlled in an operational environment. Observation of such phenomena will add to the body of knowledge of the human communication process; it will not contribute to the design of operational teleconference systems.

Therefore, priority in the research program will be given to an examination of variables which can be controlled, that is

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altered or manipulated, either by system designers (i.e., teleconference equipment, the physical environment) or by users themselves (i.e., duration of conference, size of groups, conference format, etc.).

IV. DEFINITION

For the purposes of the Teleconference Canada Program, teleconferencing is defined as:

> "A process of communication involving an audio and/or audio-video system that connects two or more specially-designed environments through an interactive[1] network so that physically-separated groups can take part in task-oriented conferences,[2]"

A useful definition of a conference is provided in the HSR Working Paper No. 1 for the IDA Teleconference papers, 1963-66:

> "A relatively formalized interaction among two or more parties which is characterized by at least the following properties:
>
> 1) There exists an ostensible purpose for the interaction.
>
> 2) The interaction is conducted according to procedures accepted by all parties.
>
> 3) The outcome of the conference is in some part contingent on the information communicated during the interaction.

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1. The Teleconference groups may be located in the same building, city or country. The key element in the machine-mediated conference is that of real-time interaction among the participants. This interaction may involve:
   - two or more groups of participants
   - an individual and one or more groups
   - three or more separated individuals
2. Any type of conference can take place over the system. A useful classification of conference types is:
   - information exchange
   - negotiation/bargaining
   - problem solving
   - instruction
   - decision-making

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A conference is basically an interaction among two or more participants. It will have an ostensible objective, which may be formalized in a statement or informally understood; although participants may have quite different real objectives. The interaction will occur in the physical environment of certain facilities, which include meeting rooms, communication equipment, secretariat services, etc. The formal interaction of the participants will be governed by some form of procedures which may be a comprehensive set of rules of order or consist of nothing more than unwritten understandings. Interaction among participants consists of formal and informal communication. The communication has effects on the individual participants and there is normally some explicit result or outcome of the conference as a whole which can be stated ... conferences are not simple discrete events the boundaries of which can be readily drawn ... a conference is a brief segment of events in an on-going stream of interaction among participants."

The Teleconference Canada definition excludes, intentionally, a conventional telephone conversation, as well as Picture Phone. Included in the definition are specialized tele-medicine and tele-education systems. These systems are sufficiently distinct as to require a uniquely-designed research program.

The definition, again intentionally, is not intended to convey the impression that teleconference systems should attempt

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to replicate the conditions of face-to-face conferences. Teleconference is seen as an alternate means of staging group conferences, not as a substitute for them per se. Thus, teleconferences may be used to:

A) Supplement (because held more frequently) regular face-to-face conferences.

B) Supplement conventional communication systems (telephone, mail, etc.)

C) Substitute for certain types of face-to-face conferences (i.e., for 'emergency' conferences; to save costs by eliminating travel).

Thus, it is envisaged that once teleconference systems become available for operational purposes, communication between two groups would be a balanced mixture of face-to-face meetings, telephone and mail exchanges and teleconferences.

V. CURRENT SYSTEMS AND RESEARCH

1. Systems:

So far as is known the first experimental audio-visual teleconference system was developed by Bell Labs and was inaugurated April 7, 1927 to link the Bell Lab in New York and a gathering in Washington. Further experimentation was delayed until the 1960's by which time commercial television had become established - with the exception of a special experimental system, a three-way trans-Atlantic audio-visual teleconference, co-sponsored by COTC, the GPO and AT&T for the Engineering Institute of Canada, which linked studios in Montreal, London and New York.

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In 1963 the Institute for Defence Analysis (IDA) in Washington was commissioned to develop and elaborate teleconference research programs. This program together with the current activities of the Communications Studies Group of London University, represent the only significant body of research undertaken into teleconference systems.

Also in the mid-sixties, Boeing Corporation developed a seven-city, interactive teleconference system, (still in use today) which utilizes two-way audio supplemented by Long Distance Xerox (LDX) facsimile transmission. This system was established in order to expedite problem-solving in the NASA Apollo Space Program and has proved highly successful.

A partial list of teleconference systems in operation today is contained in Appendix 'A'.

2. Teleconference Research:

As noted above, the principal, and for almost all practical purposes, the sole, sources of research material on teleconference systems are the 1963-66 IDA study and the current work of the Communications Studies Group.

Other research programs, with the exception of telemedicine can be quickly noted:

1) The Office of Telecommunications of the U.S. Department of Commerce has established an operational link, using the Western Electric 50-A system, between its headquarters in Washington and a regional office in Boulder, Colorado. A limited research program has been inaugurated to determine the usefulness of this audio-only system.

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2) Currently a number of European PTT's, under the chairmanship of a representative of the Swedish Telecommunications Agency are studying the possibility of establishing an experimental, international teleconference system.

3) MITRE Corporation, under a HEW grant, will build and study a two-way interactive cable-television system in Virginia.

4) Peter Goldmark, under a HUD grant, is developing a project in Connecticut that will attempt to actualize the concept he expounded in The New Rural Society, namely the use of telecommunications to permit population dispersal. The planned experimental program includes a study of the communications processes of government, industry and business in order to determine how some of these activities might be carried on by means of broadband communications systems.

5) The 1963-66 IDA Program, for which the principal consultant was Human Sciences Research Inc. of Washington, resulted in the production in 1965 of eleven papers on teleconference systems as they might be used by government agencies and industries in international relations. The conference situation studied was the high-level, multi-lingual, multilateral, secure, collaborative, international decision-making conference during times of crisis. Among the study objectives were:

A) the development of a data base from available relevant research and through structured interviews and observation of conference situations;

B) the formulation of relationships among variables in the teleconferencing situation;

C) the identification and description of a criterion system which might be used in experimental studies.

For the purposes of the Teleconference Canada Program, perhaps the most useful paper produced by HSR for the IDA study was that by Bailey, Sistrunk and Nordlie, A Look at the Criterion Problem. While the context of this study was typical, that of crisis decision-making by NATO member countries, a table from that paper attached as Appendix 'B' constitutes a highly useful taxonomy for research purposes.

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Of prime current interest and relevance is the work of the Communications Studies Group (CSG) of London University, funded jointly by the Civil Service Department and the GPO.

The CSG comprises fourteen full time staff, including specialists in psychology, electrical engineering, operations research, management studies, urban planning and survey research. The part of the group's work which is most directly relevant to the Teleconference Canada project consists of evaluating the effectiveness and acceptability of alternative person/person communication media. This work involves the conduct of controlled laboratory experiments in which pairs or groups of individuals carry out carefully designed and measurable communication tasks via telephone, television, or face-to-face. Measures are taken of task performance, discussion content, and the attitudes of the users both to the medium of communication and to the other persons. The Communications Studies Group is also engaged in some field trials of audio and video conference systems; questionnaire surveys to identify the existing types and patterns of business communication; and mathematical modelling to analyze the impact of telecommunications innovation on office location and business travel patterns.

The principal on-going CSG research projects related to the Teleconference Canada Program are:

1) Electronic person/person Communications.
To evaluate alternative methods of person/person communications for their effectiveness and acceptability as a means of organizational communications; to investigate

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the likely impact of innovation in person/person telecommunications systems on the location of offices and on the demand for business travel. Methods: Laboratory experiments; questionnaire surveys; mathematical modelling.

2) Telecommunications Field Trials.
To evaluate under real conditions audio and video conference systems (a two-way a/v link between two Government departments in London; a sophisticated audio-conference system between Government offices in London and Edinburgh). Method: field experiments.

3) Office Communications Survey.
To evaluate alternative methods of surveying patterns in inter-organization communication including telephone, mail, data and face-to-face meetings. Method: questionnaire survey.

3. Telemedicine:

A highly specialized sub-set of Teleconference is Telemedicine. In placing Telemedicine apart from Teleconference, recognition is given to the fact that here, the system goes beyond mere voice and video communication, into a realm unique to the field of medicine. Aside from Teleconsultation or Telediagnosis as it is sometimes called, which constitutes a more or less standard form of Teleconferencing, Telemedicine systems utilize such esoteric technologies as Telemicroscopy, and Tele-EEG, and have developed practices such as Tele-psychoanalysis, and Tele-group therapy. Success has even been reported in transmitting X-rays over a Telecommunications system, using a modified telecopying device.

There are obvious Canadian applications for the systems developed and currently in the course of development by various organizations. The Department of National Health and Welfare has conducted studies of different aspects of the Telemedicine

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field, and in particular has indicated a substantial interest in examining a facility which might link remote northern installations being maintained by NHW, with such medical centres as the Toronto General Hospital.

Two of the more important, currently operating Telemedicine facilities are described below:

A) Lister Hill National Center for Biomedical Communications. Under the auspices of HEW, the Lister Hill Center set up, in August 1971, a two-way audio Telemedicine facility utilizing the NASA ATS-1 satellite. It serves remote Alaskan communities which have minimal on-site medical facilities connecting them with advanced medical centres in more populated areas.

The purpose of the Alaska experiment is to determine which useful services can be provided by voice communication. To this end, medical traffic is carried two hours per day, seven days per week. The services provided are:

i) Voice consultation between community health aides and physicians at Native Health Service Hospitals, and between physicians and consultants at medical centres.

ii) Continuing education of health aides, nurses and physicians in remote communities.

iii) Education of villagers in personal health matters.

iv) Communication between hospitalized patients and their families in native villages.

ATS-1 is a low-powered satellite and therefore capable only of transmitting narrowband information. In 1974, however, NASA will launch another in the ATS series of satellites, ATS-F.

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This satellite is sufficiently powerful to provide quality television with simple, cheap ground terminals. Planning for its use is already underway by the health community with technical guidance from the Lister Hill Center.

B) Another Telemedicine project is Teleconsultation in Bedford, Mass., a pioneer project funded by the Education Service of the Veterans Administration. Its purpose is to explore the practicality and value of close circuit, point-to-point interactive television accompanied by appropriate electronic sensing devices in a two-way exchange of medical information. The project grew out of Dr. Kenneth T. Bird's experience with the two-way circuitry now in existence between Boston's Logan Airport and Massachusetts General Hospital.

The compilation of a data base on Telemedicine systems and uses will form part of the Teleconference Canada Program, but no actual research will be undertaken during the first phase (Year One) of the program, and then only subsequent to detailed discussions with the Department of National Health and Welfare. It is hoped, however, that experiments can be developed to investigate the utility of 'conventional' Teleconference systems for certain medical uses.

VI. RESEARCH PLAN

1. Introduction:

Earlier sections of this report have indicated the outlines of the general direction of the Teleconference Canada Research Program. These need to be repeated:

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A) Priority will be given to an evaluation of the utility of alternate teleconference systems as a management support system, particularly for use by the federal government.

B) Priority will be given to an examination of those variables which can be controlled, either by the system designers (technical equipment; physical environment) or by teleconference users (conference format; group size; conference content, etc.)

Certain research parameters are implicit in these two priority guidelines:

i) The teleconference facilities to be investigated will be limited to those with a high probability of being economically feasible to potential users within the foreseeable future.

ii) Stated user needs (i.e. for security; for bi-directional systems as opposed to more complex networks of three or more nodes), will define much of the specific research program. Nevertheless, the behavioural research program will be initiated in approximate sequence with the user needs survey and proceed to examine the validity of a number of working assumptions derived from operational experience (including that of CSG).

iii) The major thrust of research will concern teleconference systems themselves and their shortrun outcomes, with longitudinal supra-system effects (i.e. impact on travel industry; organizational behaviour) being of secondary concern.

iv) Specialized teleconference systems (i.e. tele-medicine, exclusive of tele-consultation) will be of secondary importance during the initial research phase.

In operational terms, the Research Program will comprise four inter-related activities:

a) User Needs. As stated earlier, this will be a dynamic process: the results of the initial user needs survey will help shape the behavioural research program; the results of the behavioural research program will help re-define user needs.

b) Behavioural Research. The principle disciplines involved will be those of sociology, psychology, environmental design and management science.

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c) Cost/Benefit/Effectiveness Analysis. This will encompass both an examination of the costs of teleconference systems in relation to benefits derived (increase in intra-organizational communications; reduced travel expenses) and an examination of the extent to which teleconference systems enable users to fulfill their communication goals in relation to alternate means of doing so.

d) Technical Analysis. The Teleconference Canada Program will not encompass technological research. It will, however, generate recommendations for technical research, to be carried out by CRC, and specific behavioural research experiments will be carried out on the basis of an assessment of technical possibilities and constraints.

2. User Needs:

1) Summary

A carefully researched survey of User Needs - latent and actual - must predate much of the actual Teleconference system development. One of the more difficult aspects of this exercise is that the task involves the testing of interest in and attitude concerning a product with which potential users have no previous experience. This fact requires that the potential clients for Teleconference be given a minimal education in order to help them decide as to whether such a system might serve their purposes.

Once having familiarized potential Users with Teleconference in its generic sense, a series of questions must then be answered:

A) What Government Agencies could benefit from Teleconference?

B) What are the basic communication activities in which Government Agencies are engaged, and which might be served by Teleconference?

C) How would agencies actually use Teleconference if it were available?

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Phase I of the Teleconference Canada Program will concentrate primarily on satisfying needs related to Federal Government administration. Non-governmental users, provincial governments, and specialized applications requiring esoteric technology (e.g. some aspects of Telemedicine) will be left to Phase II of the Programme, once a sound base of expertise and knowledge has been formed in the Department. Phase II will in all likelihood provide for even more innovation and ground-breaking than will have been the case for Phase I. A possible future use of Teleconference might be, for example, a hookup amongst Maritime provincial capitals. Such a network could enhance the moves by these governments towards the integration and rationalization of their common administrative and political activities.

During Phase I, which will be concerned primarily with the needs of the federal government, the following factors will be examined:

i) The ability of Teleconference to lower communications costs.

ii) Projected improvements in communications to be brought about by Teleconference.

iii) New communications requirements to arise as a result of the introduction of Teleconference.

iv) Degree of acceptance of Teleconference as a communications medium.

v) Ability of Teleconference to strengthen communications in the light of current moves towards decentralization.

vi) User reaction to actual Teleconference systems.

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2) Activity Phases

User Needs research will be conducted on the basis of the following six-step sequence:

A) Pre-planning (in-house)

1. Preliminary list of potential 'high intensity' T/C users. Initial examination has identified the following candidates:

i) Ministry of Transport	a) Headquarters and Regions b) Project Management (Ste. Scholastique) c) Transportation Development Agency (Montreal)
ii) Public Service Commission	a) Training Courses (Ottawa and Regions) b) Language Training c) Headquarters and Regions
iii) Communications	a) Headquarters and Regions b) DOC/CRC
iv) Privy Council Office	a) Cabinet Committee Meetings link-up with Senior Public Servants required for information purposes
v) Manpower and Immigration	a) Headquarters and Regions b) Intra-Region - (Manpower Centres utilizing teleconference as an employer/potential employee interviewing mechanism)
vi) Environment	a) Handling emergency situations (e.g. oil spills). b) Communication with widely dispersed parts of the org.
vii) Public Works	a) Headquarters and Regions b) Northern Centres

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viii)	Unemployment Insurance Commission	a) Headquarters and Regions b) Inter and intra region communications c) Special programmes (e.g. Claimant Assistance Program)
ix)	Indian and Northern Affairs	a) Headquarters and Regions b) Communication with Territorial Governments
x)	Royal Mint	a) Headquarters/Winnipeg
xi)	Parliament	a) Ministers in the House communicate with officials in their respective departments.
xii)	National Health & Welfare	a) Headquarters/Regions and Hospitals b) Telemedicine
xiii)	Provincial Governments	a) Federal/Provincial Consultation b) Interprovincial Consultation

B) Survey of Communications Patterns between CRC and DOC/HQ.

A survey of CRC staff is being carried out in order to determine the level and type of communications they are engaging in with staff at DOC/HQ. Respondents are asked, amongst other things to record details of their last meeting with headquarters, relating to duration of meeting, number who attended and so on. The results of this survey will be used as design input for the Narrowband System, as well as for guidance in the design of a data gathering protocol to be applied in the broader, User Needs Survey.

Input from the Communications Studies Group, in particular with respect to their expertise in questionnaire construction and application will also be utilized in the development of the data gathering instrument.

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C) Survey Plan (contract) - August 1-mid-October, 1972

The output of the survey plan, to be carried out by Human Sciences Research Inc. will comprise:

i) a description of a procedure for:

a) familiarizing respondents with teleconferencing capabilities;

b) a description of means to be used to help respondents project communications needs.

ii) a description of methods of interrogation and questions designed to elicit information as to:

a) duties and tasks of respondents and communications needs that emanate from these;

b) the character and nature of communication traffic between potential user terminals, and the circumstances under which teleconferencing might permit improvement of present communication practices;

c) system configurations and specific features which are believed to best satisfy the needs of respondents, and their organizations;

d) such other relevant information as may emerge during conduct of the study.

iii) recommendations as to the scope and coverage of the survey proper; guides for integration of information obtained from respondents.

iv) a sample of completed interviews.

D) Analysis of Survey Plan (in-house: GRA, CRC, DOC/HQ) October 1972

i) Time Allocation (completion date and interim reporting stages).

ii) Resources Allocation (in-house or contract).

E) User Needs Survey - November 1972 to March 1973

Conducted in-house and/or under contract, and in collaboration with GTA.

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F) User Attitudes Survey

Attitudes toward T/C systems will be examined in the light of actual experience with a view to re-definition of user communications needs. Cognizance will be taken of the necessity for follow-up analysis of needs as familiarity with Teleconference develops and uncovers as yet unthought of uses for such a system. That is, it is anticipated that the very use of Teleconference will give rise to requirements which are unique to and soluble only by Teleconference systems. Any system to be devised must readily adapt to changing conditions and to the demands these changes will place upon it.

3) Survey Plan

Essential to the development of an effective User Needs Survey, is the stage wherein the Survey Plan is designed. For purposes of clarity, and to allow the expression of the specific objectives of the Survey Plan, the following section goes into detail as to the outputs expected from the Survey proper. The principal objectives are:

A) To identify potential users who indicate both an interest in, and a need for, teleconferencing facilities; to establish locations of terminals that would connect users having greatest needs.

Undoubtedly communication needs among agencies will vary greatly. Personnel offices who indicate the greatest need must be identified. Interviews with potential users and an examination of existing traf-

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fic will indicate the volume of information exchange, its form, and media used.

B) To describe the communication tasks visualized by each user agency, the types of content material that would be transmitted, the circumstances under which users would employ teleconferencing, the number of terminals visualized in use concurrently, and the frequency and duration of use.

A number of potential uses have been suggested already, Examples include management, decision-making, coordination and supervision, bargaining, and exchange of data concurrent with use of teleconferencing facilities. These provide insights into content of communications and the frequency and continuity of communications between terminals.

C) To derive information as to functional requirements of teleconferencing systems.

Having identified uses and circumstances of use, it should be possible for potential users to infer preferred design parameters. For example, should arrangements of terminals be symmetric? What are the requirements for exchange of data concurrent with verbal communications? What specific systems of data exchange might be best adapted to their needs? Thus, tentative information can be obtained as to desired configurations of the system and its elements.

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D) In conjunction with survey of in-being systems:

i) Define criteria for evaluation of system performance.

ii) Determine costs that potential users of their organizations would consider reasonable for teleconference facilities.

Both of the above areas of questioning should be better served by discussions with users of any existing teleconferencing systems, a related research task. However, it may be possible to obtain some such information from potential users. Information as to costs may provide a useful indication of degree of commitment.

E) To provide inputs to teleconferencing systems development programs to include:

i) identification of system parameters that are especially worthy of study;

ii) consensus as to task systems should be able to perform;

iii) from the description of tasks, information for scenarios to be employed in the experimental study of systems and system prototypes.

3. BEHAVIOURAL RESEARCH

Within the guidelines established at the start of this chapter it is possible to classify the theoretical concerns that will provide a framework for the behavioural research program.

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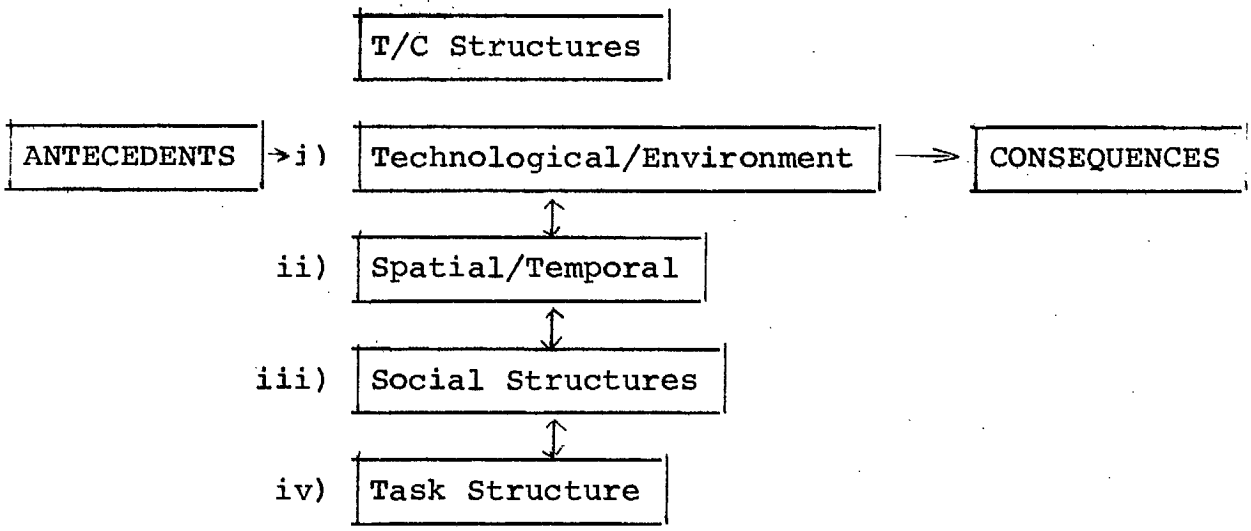
Theoretical Taxonomy

Teleconferencing is viewed as a process that, for purposes of analysis, can be described in terms of:

A) an array of antecedents, largely uncontrollable attributes of the conference that co-act with

B) four basic types of teleconference structures, to produce

C) a set of conference consequences, or outputs



The research emphasis is upon the four structural arrays listed above that influence the process that mediates between antecedents and teleconferencing consequences. This decision is based upon two considerations:

a) The antecedent conditions are personal attributes and personality factors of conferees. While these are in experimental controllable situations for the purpose of developing personality and small group theory, in an on-going organization the manipulation of these factors is often neither practical nor desirable.

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b) The conference outcomes - both the delineation of performance variables and the evaluation of desirable states of these variables - are essentially normative. While the research will be concerned with establishing more accurate and precise measures of performance, prescriptive decisions concerning the nature of intended teleconference outcomes rest with the users of the system.

i) Technological/Environmental Structures

This refers to the array of communication technologies and physical environments available for teleconferencing. As such, they are the controllable factors that are considered in the physical design of the system that include such things as band width, supplementary communication technologies - graphic, facsimile, and display configurations - room capacity, shape, decor and arrangement, the quality of the audio and/or visual systems, lighting, etc. The task of the behavioural research program will be to determine the effects that various configurations have upon critical outcomes of teleconferences.

ii) Spatial/Temporal Structure

Spatial/temporal structures like technological/environmental structures are relatively concrete and readily alterable. Unlike the latter that, for any group of users in a particular teleconference must be taken as given, spatial/temporal structures are controllable, within limits, by the conferees. Components of this structure include

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the size of the node subgroups, the time alloted for the conference, the number of sessions in the conference sequence, the timing of the conference within the matrix of organizational activities, etc.

Experimentation will be designed to determine the range of acceptability that combinations of these factors can take to produce "satisfactory" teleconference outcomes.

iii) Social Structures

A third type of structural factor affecting teleconference outcomes is that which can be identified as being essentially social. From a decision-making point of view, a consideration of these factors will determine the types and mixes of user groups that are best able to use teleconferencing systems effectively. These factors that include the status, authority, organizational level and echelon, of the conferees, are also controllable. However, the on-going control of these factors will not rest with the systems designers or the conferees but with those responsible for the overall communication network of the organization.

The research program will include research projects designed to make comparative statements concerning the functions and dysfunctions of teleconferencing for differentiated user types.

iv) Task Structure

The fourth structural type is the purpose or purposes

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for which the teleconference is being held. Consistent with the guidelines for the research program, the tasks or uses that will be investigated are limited to those normally related to management concerns. Task structures that are regularly imposed on conference situations include, negotiation and bargaining, information dissemination and retrieval, problem solving, problem formulation, etc. A major task of the research program is to provide information concerning the utility to managers and administrators of teleconferencing when used for different types of intra-organizational communications.

As figure 1. suggests, the theoretical concerns can be cast into a temporal model with a variety of conference antecedents, co-acting with four basic structural aspects of a teleconferencing situation, to produce a set of conference outcomes. These in turn affect subsequent teleconferencing antecedents.

METHODOLOGY

a) Case Study

The exploratory nature of teleconference technologies and configurations suggests that some of the initial behavioural research itself be exploratory. Since the purpose of the research is not merely to describe what is going on in a particular teleconferencing situation but to gain insights into those alterable factors that parsimoniously will permit a more 'satisfactory' system, the array of possible

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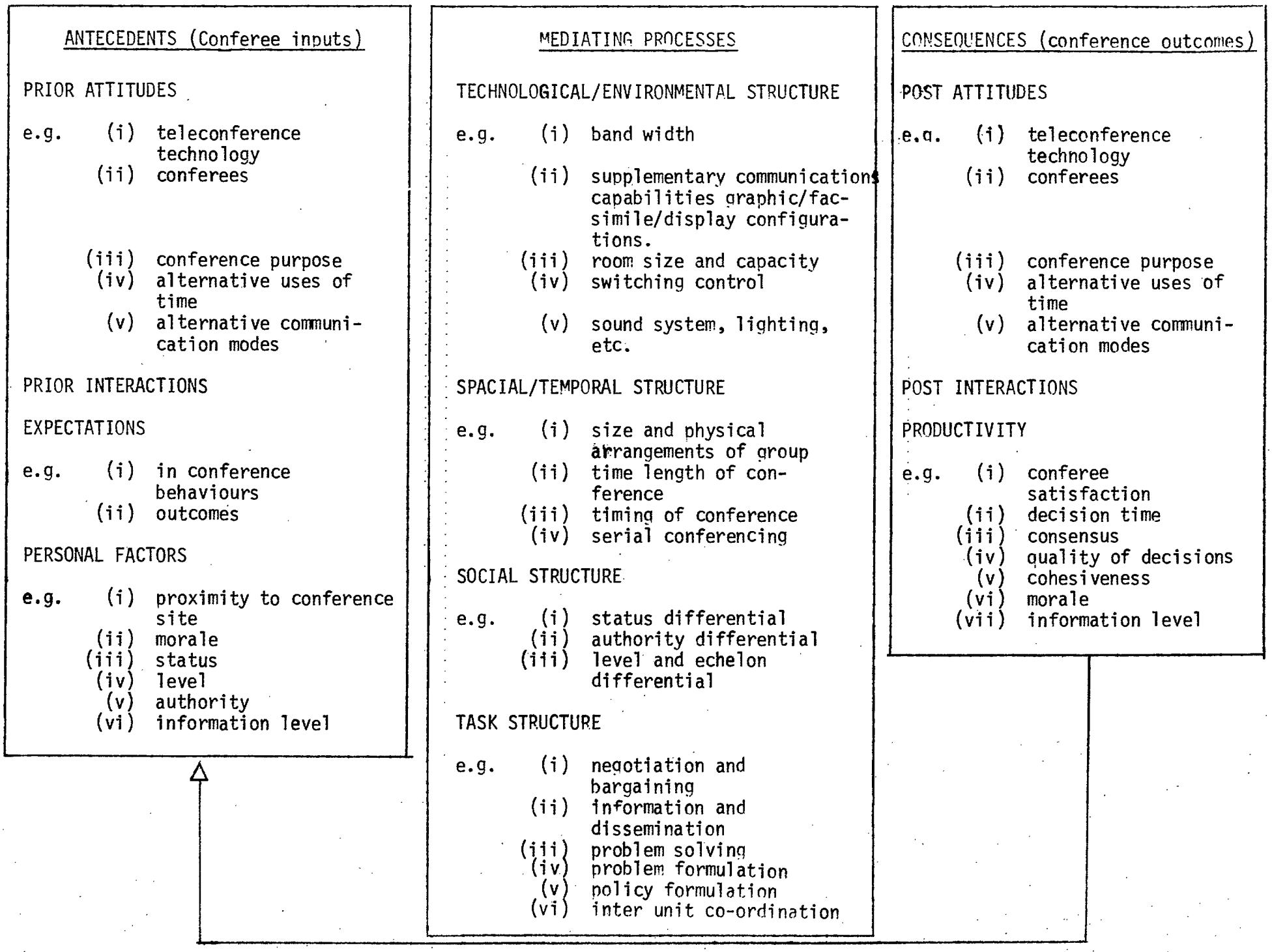
(Figure 1)

THEORETICAL TAXONOMY



factors must be maximized. The methodological implications of this line of reasoning are fairly clear. A substantial proportion of the initial research should be oriented towards the use of natural groups utilizing teleconferencing facilities, for the conduct of affairs generated by their own on-going organizational demands, without experimental disturbance. Ideally, two intact groups would be involved in a series of teleconferencings over a period of time, perhaps one group on the narrow band and the other on the broad band. Data concerning the effects of the systems on the participants would come from (i) pre/post session questionnaires, (ii) in-depth interviews, both structured and unstructured, and (iii) analyses of video tapes.

This case study approach, despite its total lack of experimental control, does have a clear advantage over the controlled experiment. This methodology presumes considerable background evidence concerning the factors effecting the phenomenon. There is little in the way of this background on teleconferencing per se. While it seems clear that there is a staggering amount of related research evidence, unless it can be assumed that teleconferencing has unique characteristics that create their own demands, a comprehensive research program peculiar to teleconferencing hardly would be justified. Developing an awareness of these unique characteristics seems more likely to occur by consciously searching for novel stable patterns than by imposing a fixed set of patterns that define the possibilities by the experimenter's preconceptions.

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When a potentially fruitful pattern does appear to emerge, laboratory or field experiments can be designed to test the hypothesized relationship.

b) Laboratory Experiments

This type of experiment will be used in those situations where the teleconferencing outcomes of concern are likely to be greatly dependent upon either the 'antecedents' (prior attitudes and interactions, expectations, and individual characteristics such as status and level) or the mediating social structure of the conference. For instance, paid subjects would likely be adequate in an experiment that manipulated task or spatial/temporal structures to determine the particular effect such manipulations have upon productivity factors such as time to decision, consensus, information state of conferees, etc. Although the laboratory experiment affords the greatest control, it is the least generalizable, but does contribute powerful data on a limited number of factors in a single experimental situation.

c) Field Experiments

The field experiment, while relinquishing much of the internal control mechanism of the "true" laboratory experiment, disturbs the natural process much less. One or two predictor variables are tightly controlled but extraneous factors that might also account for particular results are beyond the experimenter's control. However, a comprehensive

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understanding and evaluation of the effects of teleconferencing, at all levels of social analysis, will be heavily dependent upon data and information generated through field experimentation.

Of the four basic structural categories affecting processes that mediate between the antecedent conditions and teleconferencing consequences, only task structure is beyond experimental control (as mentioned previously, the laboratory experiment is ideally suited to the investigation of task effects). Technological/environmental structures can be manipulated fairly unobtrusively and their effects observed without otherwise having a biasing effect on other variables. Spatial/temporal structure and social structure alteration are more difficult but certain aspects, with limited conferee awareness can be manipulated. Unlike the laboratory experiment, the full range of antecedents can be coded and/or manipulated and their relationships to both mediating factors and consequences determined with some confidence. Also, the full range or organizational consequences are potentially open to investigation.

In summary, the three basic methodologies yield different kinds of data and, though their functions are interrelated and do overlap to some extent, these functions are basically different. The case study will provide a continuous record of a "natural" series of conferences. This exploratory data will aid in conceptualizing and reconceptualizing the

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nature of teleconferencing phenomena as well as expanding theoretical awareness of the existing states that variables can take. This should lead to the development of novel hypotheses, testable with laboratory or field experiments. Laboratory experiments will permit the articulation of variable relationships which for differing reasons are unobtainable from either the case study or the field experiment.

Field experiments will provide the kind of information necessary for the development of powerful statements concerning the organizational effects and effectiveness of Teleconference.

d) Controlled Field Experiments

While some Teleconference research will fall into one or the other of the three categories previously outlined, activity is already underway with a view to designing a research series which will hopefully allow the Program to benefit from the advantages of both field and laboratory experiments while keeping to a minimum their respective disadvantages. That is, the design of this one phase will attempt to incorporate the control aspects of laboratory experiments and the reality attributes of field study.

In addition to its obvious advantages of control with realism this technique will allow the conduct of truly innovative research, of a type which is expected to yield important and new data. In a very real sense, this approach

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can be labelled pioneering, as there is no indication that small group research has previously been done, using the format which will be proposed. To accomplish the task, a group of subjects will be obtained from within the Public Service and be asked to discuss a topic of immediate and general interest to them. The proposed subject matter could be for example, "The Changing Role of Women in the Public Service," or "A Discussion of Current Management Development Problems in the Public Service". A central agency having a concern with the subject area (eg. PSC or TB) will be asked to collaborate in obtaining the co-operation of the various government departments with respect to providing participants.

A step-by-step plan for the exercise would read as follows:

(1) Choice of topic and identification of collaborating agency.

(2) Request from central agency for co-operation from departments.

(3) Identification and familiarization of participants (30-45 groups of 3-4 persons each).

(4) Scheduling of experiments.

Failing to gain the collaboration mentioned in (1) would require the development of an alternate method of obtaining participants. This could be accomplished through departmental User Needs co-ordinators, some of whom have been tentatively approached in this regard.

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4. ENVIRONMENTAL DESIGN RESEARCH

As a sub-set of the total behavioural research program, the emerging discipline of environmental design research deals with two issues:

(1) how do the users or participants of the environment affect the environment in question (i.e. what human characteristics ought to inform design) and

(2) how does the environment affect the people in it? A corollary question also becomes evident: how do people perceive (and know) the environment, since, in general terms, one cannot act until one has perceived and known?

Experimental studies in environmental psychology (perception, cognition, etc.) date back many decades. However, much of the academic work done till recently has been either with non-human subjects or, if with human subjects (as the experiments by Hebb in sensory deprivation at McGill), with non-complex, non-real environments.

Nevertheless, a methodology for problem solving methods in design - along with the development of criteria for measuring human responses to complex and novel environments - is rapidly evolving. This whole field has been variously coined: architectural psychology, environmental psychology, environmental perception (more specifically), the study of man-environment relations, environmental behaviour, environmental sociology.

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What is apparent at this point in time is that Teleconferencing is a form of telecommunications in many ways like the telephone system - but in many other ways not at all like it. Both demand a network configuration and terminal devices. However, this is where the similarity ends; for, while the telephone "terminal" is a device or "object" which one can grasp, the teleconference "terminal" is an environment - with all of the characteristics of complex environments. That is, they surround, they are multi-modal, they present peripheral stimulation, and they contain too much information which is simultaneously redundant, inadequate and contradictory - characteristics which objects cannot or usually do not display. Furthermore, environments - as opposed to objects - or environment perception always involves action; they cannot be passively observed. All of these characteristics raise possible questions and areas for investigation in Teleconference environment design and research.

5. COST/BENEFIT/EFFECTIVENESS ANALYSIS

Cost/benefit/effectiveness analysis is a way of setting out the factors which need to be taken into account in determining whether or not a particular teleconferencing system is worthwhile, which is the best of several alternative systems, or when it is advisable to use teleconference.

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The aim of cost/benefit/effectiveness analysis is to maximize the present value of all benefits which can be derived from the use of teleconferencing systems, less that of all costs, subject to specified constraints.

Factors such as efficiency and benefits are often difficult to quantify. Whenever quantities cannot be determined, costs will have to be compared to exhaustive lists of qualitive assessments of the good and adverse effects of the systems, leaving to policy-makers the decision whether the positive qualities of the system outweigh their cost.

The technique for cost/benefit/effectiveness analysis involves drawing from as many sources as possible all costs and benefits relevant to teleconferencing systems and trying to weld these components into a coherent whole. The inputs for analysis will then be drawn from all individual research studies carried out for the Teleconference project:

a) Capital Costs

The costs of setting up a teleconferencing system on an operational basis will be obtained from engineering studies. Such costs will include that of the electronic equipment, modifications to the teleconference rooms and any other expenses which may have to be purchased for the systems.

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b) Operating Costs

In co-operation with GTA, it will be necessary to define the various transmission link costs and the cost of support staff if required. GTA will also be asked to negotiate with telecommunications companies the costs of having them supply the necessary equipment required for teleconference.

c) Effectiveness

The social science research program will study among other things the general effects of teleconferencing systems. Using as much statistical data as can be collected through experiments from both participants and observers, attempts will be made to translate in quantitative terms the relative effectiveness of alternate systems. The analysis should provide information as to the advantages of using teleconferencing systems over other means for conducting routine business, problem-solving, interactive research, bargaining, interviewing, etc.

d) Benefits

User needs research will provide information on potential users of teleconferences. From the list and description of these organizations, the purpose for which they would use the systems, frequency and the importance of the activities conducted, it will be possible to forecast the extent to which benefits may be realized in the long run. User needs will have to be brought in relation to the findings of the social science research to establish whether they can actually be satisfied by teleconferencing systems and to what extent.

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Methodology

a) The first step is to establish the costs for each system; initial capital cost, operating costs, depreciation, maintenance. Costs to include equipment, furniture, space, personnel, telephone lines rental charges and any other expenditures.

b) Capital and running costs constraints will be defined both from the Government point of view and also from the price individual agencies are prepared to pay for using the systems.

c) Systems which fall outside the constraints boundaries will then be eliminated. This may call for the study of the system under constrained optimization, using the Lagrange-multiplier method or linear programming.

d) An evaluation of benefits and a list of qualitative results will be prepared. Attempts can then be made to establish a more accurate relation between the various elements of teleconferencing using various mathematical tools.

e) The costs and benefits of each system can be compared after having discounted all values to present values. This is required in order to bring all systems to a common time-cost frame basis, especially if the systems cannot be implemented during the same period of time and have a different life span.

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6. TECHNOLOGICAL FACTORS

It should be pointed out at the outset that technological capabilities for teleconferencing systems are constrained more by cost factors than by technological limitations.

It is neither desirable nor possible, to pay to replicate every feature of face-to-face communication electronically with 100 percent fidelity to the original experience. In fact, there are few certainties as to which attributes of face-to-face encounter are essential and/or desirable for effective interpersonal communication - including both verbal and non-verbal (gestural) characteristics. What is known is that in most conferences, there is much 'human communication noise' - i.e., undesirable energy transfer: while a certain amount of redundancy is necessary for optimum comprehension, too much is present in most conferences. If a goal of teleconference systems is that they be capable of replicating those aspects of face-to-face encounter that are most desirable to replicate - as well as providing other services, facilities, and foci of attention of face-to-face situations then one phase of the Teleconference Program ought to be the development of a 'taxonomy of interpersonal communication attributes'.

Is the technological challenge, that of developing a teleconference system such that one environment and the conferees in it are replicated in the other tele-environment, and vice versa, so that - under ideal conditions - the conferees in one room cannot distinguish where their table ends and where the visual display (replicating the other environment) begins? Also, aurally,

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should the spatial geometry (i.e. the directionality, both laterally and longitudinally) of one environment be replicated in the other to 100 percent fidelity? If the answers to both of these questions are in the affirmative, note must be taken of the fact it is possible, to a degree, to create such a system, but the cost of doing it today is exhorbitant. Thus, a 10-foot radius spherical room has been developed and is in use by the Navy Training Devices Center in the U.S.A. for high reality visual simulation of events. The visual system is of such a sophistication that the visual field of a person in the center of the room is totally filled (with linear distortion imperceptible). Furthermore, the brilliance of the projected television image on the inside of the spherical room approaches reality. The field of view of the specially-designed optical lens system approaches the human limits (180^{o} x 70^{o}). System resolution is 1000 lines although the optical system is capable of far in excess of this range. Yet the cost of such a system, except for technological research aimed at advancing the state of the art, would prohibit its use for operational teleconference systems.

At the other end of the spectrum of technical possibilities, a minimal cost teleconference system study facility can be created which uses practically no electronic or other complex technologies at all, yet which permits the conduct of a range of experiments involving the conference participants.

The walls, floors, ceiling, tables are painted black. The two groups of conferees in each room are told that in front of them is a very sophisticated 3-D color large screen TV display

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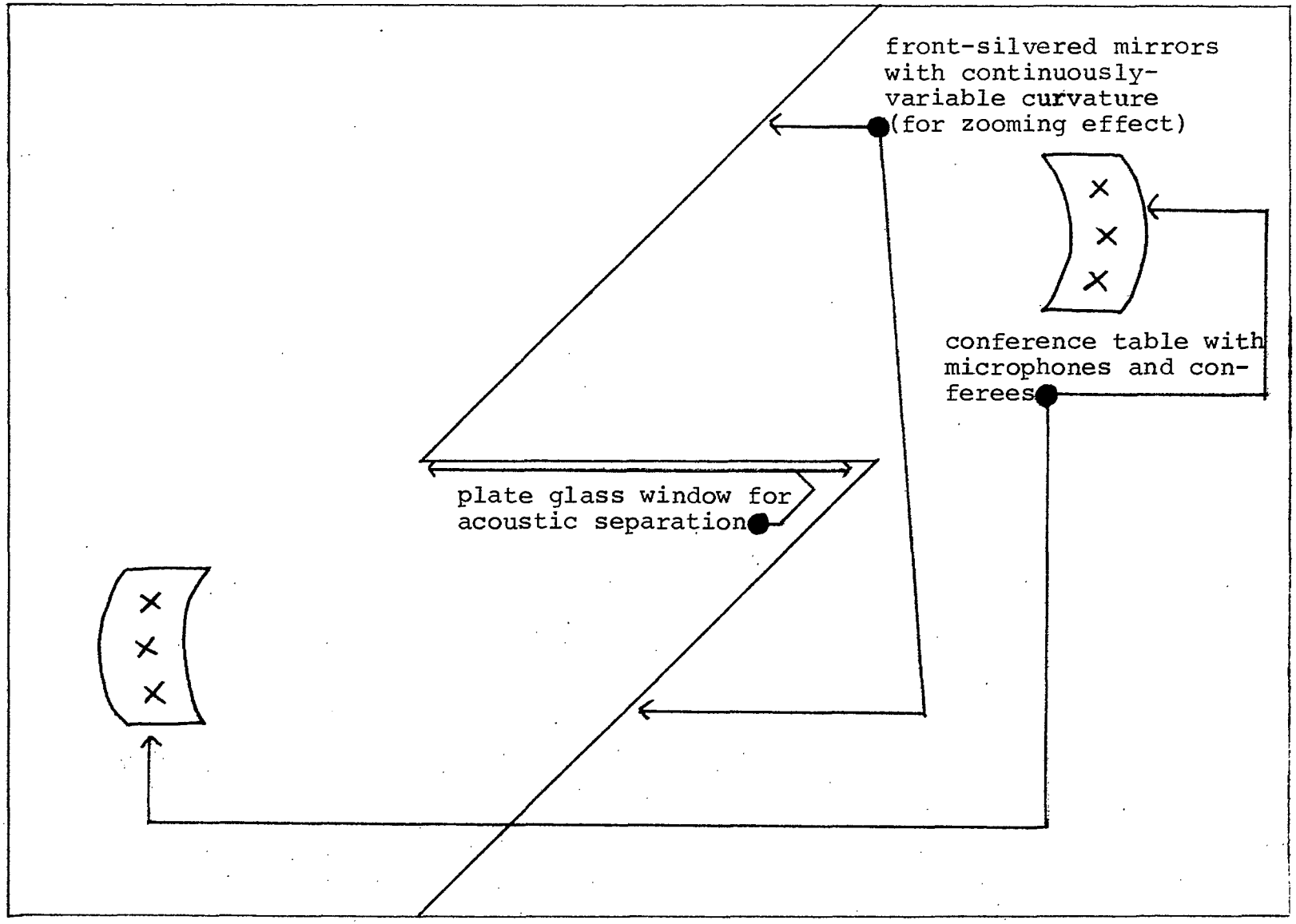
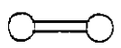
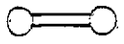
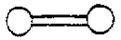
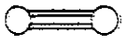
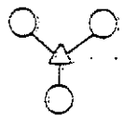
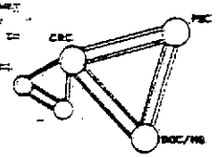
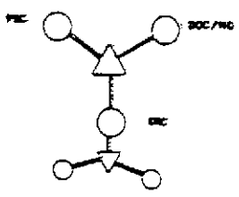

front-silvered mirrors with continuously-variable curvature (for zooming effect)
conference table with microphones and conferees
plate glass window for acoustic separation

ALTERNATIVE "TELECONFERENCE ENVIRONMENT" CONFIGURATIONS WITH COSTS (in thousands $) (man-years excluded)

DESCRIPTION		VIDEO SOURCES (incl. cameras, std. size TV monitors (23"), studio lighting, (in b-f), video switching/special effects console (in c-f). Figures are for all modes totalled.)	AUDIO	TRANSMISSION LINK (microwave)	SPATIAL TREATMENT	SPECIAL DISPLAY EQUIPMENT (can be optionally added to any of b)ii) and f)). Computer graphics display excluded.			TOTALS			
						Large screen TV projection (up to 9'x12' image) color, 2D ($45,000 per location; may be rented daily at $2,000/unit)	Multi-screen slide and film presentation equipment. $5,000 per node.	Video-tape recording (VTR) equipment	Without special display equipment	With multi-screen slide/film equipment and VTR added	With large screen TV projection display added	With large screen TV projection and multi-screen slide/film presentation eqpt. & VTR
a	two-way, single-channel, Black & White cameras & monitors. This system includes one camera & monitor at each tele-environment, connected via micro-wave link. No special lighting or acoustical treatment is provided at either node.		2	2	60	-	-	-	-	64	-	-	-
b)	(i) two-way, single-channel with color cameras & monitors (up to 23")		40	3	60	-	-	-	-	103	-	-	-
	(ii) two-way, single-channel, color, plus large screen (up to about 20 feet) display at each node, one color VTR at each node.		40	3	60	-	90	10	4	103	117	193	207
c	two-way, two-channel (duplex), color system. Allows for two cameras & two monitors at each of the nodes (CRC & DOC/HQ) - one camera can be used on conferees, & the other to illustrate graphics, charts, etc. Both cameras & monitors are color, one color VTR at each node.		82	10	100	80	90	10	4	272	286	362	376
d)	two back-to-back teleconference nodes or environments independent of any other facility. Equipped & designed for experimentation in psycho-social behavioural fields as well as technical (configurations) areas; two color cameras/monitors & two color VTR's at each node.		165	10	-	90	90	5	8	245	258	335	348
e	three back-to-back teleconference nodes designed for teleconferencing between any one, all of the three nodes - an optimal configuration for experimentation in technical and behavioural (interpersonal) network communication systems; color cameras & monitors & two VTR's at each node.		228	15	-	130	225	5	12	365	382	590	607
f)	DOC/CRC/PSC (drop off point) - two-way link back-to-back nodes at CRC. The 2 B-B nodes at CRC can be connected to the CRC "service" studio to give 4 three B-B experimental configurations; color cameras & monitors; two color VTR's at each node.	 OR 	250	20	206	130	225	15	20	606	641	831	866

system, which enables them to see the conferees in the other room.

In fact, the large displays are not large TV screens, but optical mirrors that reflect the image of one group into the environment of the other group, yet create the illusion of TV display screens. Microphones pick up and transmit the audio of each room to the other room.

7. TELECONFERENCE NETWORKS

The table overleat attempts to describe, with associated costs, some of the main audio and audio/video teleconference systems. From an economy standpoint the key variable affing system cost is that of video.

An essential goal of the teleconference program will be to determine whether high-quality audio systems (supplemented with graphic transmission capability) can accomplish most, if not all tasks wich can be performed over audio/video systems.

Because of the inherent cost of developing video systems, it is assumed (at least in the initial stage) that audio/video teleconference is likely to be practicable only under specific circumstances; for example:

A) low transmission cost (because a spare wideband channel is available at minimal cost).

B) high intensity of communications traffic.

C) use in crisis situations.

As is well-known, as the utilization of the telephone system increases, individual user costs decrease, further

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encouraging increased usage, which again results in lower costs. The obvious advantage of high volume use of a system such as the telephone is directly applicable to teleconference systems. There are however several considerations which must be introduced before development of a "teleconference system" can became a reality.

The most immediately apparent and indeed self-evident benefit to be derived from teleconference is improved communication. The limiting factor here however, is what a natural assumption can be made which will effectively limit the degree to which this major benefit is enjoyed.

For example agency "A" will establish a teleconference link between headquarters and its regional offices with the goal of improving communication within the organization. What the agency may not initially be sensitive to, is the need or potential need for improved communications with other agencies, some of whom may also have established teleconference networks. Since the bulk of teleconference system costs reside in the terminals (studios), capacity for a dedicated system to accent other systems will reduse significantly the per unit costs of each use. (1)

(1) Another useful method improving cost effectiveness be to establish several uses for a teleconference studio, for example as a meeting room. training room and so on.

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Teleconferencing should, therefore, be developed as a "system" rather that as a multitude of discrete two-node networks. The system potential for teleconferencing is potentially as great as for the telephone. Inrespect of the teleconference Canada program, it is to be noted that the potential for a system approach is greatly facilitated when a single user (the federal government) could lay down standards to govern all systems within its administrative jurisdiction.

The telephone systme and teleconferencing possess similar charateristics in that both consist of a telecommunications network connecting terminals, but here the similarity ends. For while the telephone system terminals as complex as they are, are simply objects, the teleconference terminal is a complex, special purpose, specifically designed environment. The potential number of different configurations for terminal design are almost limitless. While recognizing this fact, and accepting that each environment will by its design, reflect the needs of its users care must be taken to ensure that conceptual consistency and cross-system compatibility are maintained.

To best accomplish this, it is suggested that modular concept be developed, whereby the various possible "building bloks" of the system are outlined and can be plugged into any terminal environment in almost any conbination. Consistency and compatibility can be ensured through careful design and development of the "building blocks."

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VIV. RESEARCH PROGRAM

1. Program Structure

A comprehensive, operational research program will be developed by September 15, 1972. The principal work steps which will be taken to fulfill this objective are:

a) Preparation of a Research Plan Draft, July 5, 1972.

b) Detailed discussion of Research Plan Draft with 'principal consultants' - Communications Studies Group; Human Sciences Research - July 5-8.

c) Modification of Research Plan in light of these discussions, July 10-15.

d) Preparation of draft Research Program, August 10, including discussion with potential co-sponsors of Research Program (i.e. Public Service Commission) and with system operators (i.e. Bell Canada).

At this stage, only an outline of the Research Program can and need be given.

The program will be undertaken by a multi-disciplinary Project Team, of which the present organizational structure and personnel are:

Project Coordinator

Behavioral Research	User Needs	Cost/Benefit Analysis	Technical Analysis
J. Weston	M. Averill	J. Brisson	D. Leonard
D. Leonard (Environmental Research)	Government Telecommunications Agency	Communications Studies Group	Communications Research Centre
C. Kristen (Laboratory Experiments)	Human Sciences Research		
D. Cameron			
Communications Study Group			

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It is anticipated that this project team will be supplemented by consultants with backgrounds in psychology and the management sciences.

The Critical Path attached provides an overview of the research program. The full program will extend over two-to-three years; detailed planning at this time will extend to March 31, 1973.

As indicated on the Critical Path diagram, teleconference systems available for research purposes will be sub-divided into the broad categories of 'field' and 'laboratory'. Systems labelled as 'available' include both those developed in-house (CRC) and non-DOC systems.

The following is a list of research systems that will be considered for use in the Research Program:

System	Type	Operational Date	Location In House	Location Out
CRC-DOC narrowband	audio; facsimile	October, 1972	X	
CRC experimental studios	a/v, man/machine rooms	May, 1973	X	
Carleton Univ. Wired City	a/v simulation; computer	?	X	
Bell Canada	a/v, inter-city	current		X
CTS Program	audio, a/v remote	1975	X	
CBC	a/v - TV network	?		X
CSG (parallel studies)	audio; a/v	current		X

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Current plans envisage priority attention upon three systems:

1. CRC-DOC narrowband, field and laboratory experiments;
2. CRC experimental studios, laboratory experiments;
3. Bell-Canada Ottawa-Montreal link, field experiments.

The subjects of these experiments will be both civil servants and paid conferees (students). In the structuring of specific experiments, particular attention will be paid to data generated by the survey of user needs, of which the first, planning, phase is scheduled to be completed (October, 1972) to coincide with the initiation of experiments. In addition, structuring of experiments will be dependent upon advice provided by the Communications Studies Group.

Parallel research, of interest to the Teleconference Program, will be carried out at the University of Montreal as part of the planned laboratory experiments on 'Information Overload'. It is intended also that a close coordination of research will be carried on with the Carleton University 'Wired Scientific City' group.

In addition, the government's bilingual policy and its implications with respect to Teleconference will be closely examined, possibly to the extent of conducting experiments in a two-language mode, and the study of User Need and Attitude regarding the conduct of Teleconference sessions using both Official Languages.

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2. User Needs Survey Program

The initial approach to User Needs study planning will follow a relatively simple, straightforward format, aimed at identifying those areas of a sample of departments which the departments themselves feel are high probability users. Emphasis then, is on the potential user organization's perceived need for Teleconference. In establishing this perceived need, departments will be aided by a minimal generic description of Teleconference as previously mentioned in this paper. The intention here is, as far as possible, without conditioning potential users to give predetermined responses - to allow for some limited familiarization with Teleconference in order to enable departments to orient their thinking in such a way as to see possible application for Teleconference with respect to their communications processes. The approach then, will be as follows:

a) Identification of departments seen as potential high intensity users.

b) Project possible uses of Teleconference to serve as a discussion base.

c) Identification within each department of an individual who is capable, by virtue of his or her position within the organization of isolating those components of the department which are judged to be high probability users.

d) Derivation of a list of probable users from the co-ordinator in each department.

e) Interviews (group and individual) with those people identified by the co-ordinator, for purposes of bringing to light possible uses for Teleconference, and more specifically, to test out a preliminary interrogative format.

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f) Obtaining from these departmental people, lists of individuals within their respective organizations to whom can be applied a short questionnaire on communication patterns.

g) Review by HSR and the Branch of the first results of the process mentioned in (e).

h) Development of a revised interrogative format as per data collected, and preparation of the questionnaire mentioned in (f).

i) Application of the revised interrogative format and questionnaire on a new sample.

j) Review by HSR and the Branch of data collected in (i).

k) Development of survey plan.

3. Behavioural Research Program Implementation

Questions which the overall research will answer include:

1. How feasible is Teleconference with respect to the external factors such as Cost/Benefit and User Needs.

2. How well does Teleconference work with respect to the achievement of organizational objectives.

3. Empirically inseparable from (2), but analytically distinct, how satisfied are the users.

It is clear that the first question antedates usage and/or experimentation; that the second question involves in vivo research and that the third is an assessment following usage which may condition further usage.

As described in the Behavioural Research Plan, the principal focus of study will be the observation and analysis of quasi-realistic conferences held over teleconference systems. These conferences, over different teleconference systems (audio - audio/video) can be compared with each other and with face-to-face encounters.

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It will be necessary then, to observe the results of various types of conferences objectives and satisfactions which are viewed as outcomes. Thus we require a set of variables that measure outcome.

Outcome I - Accomplishment of Objectives

Some sample (dependent) variables probably would include:

i) Success of task(s)

ii) Length of time of meeting

iii) Dispersion/centralization of participation

iv) Information level of participants

v) Etc.

Outcome II - User Satisfaction

i) Users' opinions as to accomplishment of objectives, participation

ii) Users' attitudes towards the medium per se.

Below is outlined one method of assessing such, the Laboratory Model:

Independent Variables				Method of Measurement
Some Samples of Dependent Variables	Audio/Video	FtoF	Audio	
Objectives (hi, lo, med)				Interview
Participation (hi, lo)				Observe
Time (hi, lo)				Observe
Information Level				Interview
Satisfaction				Interview

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The laboratory model above is a classical approach in which a sample of a described population is randomly assigned to one of three conditions (independent variables). The disadvantage is the unnatural basis of the population selection (paid volunteers, students, individuals with time to spare, etc.) as well as the contrived and irrelevant nature of the task to be performed. Where the population is not a "natural" one - potential users located within a discrete organization - then measurement of organizational contributions to variation, an important potential independent variable, is precluded. However, the Laboratory Experiment with Field Simulation (LEFS) described in the introduction satisfied to some extent such objections.

THE LEFS

The LEFS controls the task, makes it relevant and makes it possible to utilize the actual population in which we are interested, rather than paid or student volunteers or biased samples from "off the street". The projected experiment, LEFS, would be laid out in the following fashion:

THE LEFS MODEL

Sample: 30-45 groups of 5 individuals each drawn from a number of relevant govt. agencies, preferably 10 different agencies with 3 groups derived from each (i.e. 150 to 225 individuals).

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Independent Variables				Method of Observation
	Audio	Audio/Video	Face to Face	
Objectives *				Interview Participants
Participation *				Observe
Time Attitudes * etc.				Interview Participants
Information Level				Interview Participants
Satisfaction				Interview Participants

* High, Low, Medium or Surrogate

It is clear from the above design that we will test for two independent variables: i) The medium utilized (A/V, F to F or Audio)

ii) The Organization (DOC, NHW, etc.)

The dependent variables sketched in here and which need further discussion and outlining are Objectives, Participation, and Time.

A detailed work program for a LEFS project is now in preparation. Before it can be implemented, agreement will have to be reached with a 'parent' agency - Treasury Board or the Public Service Commission.

Planning of other elements of the research program is also underway. These include:

- longitudinal studies of the CRC/DOC narrowband system.
- longitudinal studies of the Bell Canada system.
- possible 'parallel' research at Montreal University (Information Overload) and Carleton University (Wired Scientific City)

APPENDIX 'A'

Operational Teleconference Systems

Only a limited number of teleconference systems are operating throughout the world today. This 'number', however, is critically dependent upon how one defines teleconferencing. Excluded from the list given below are numerous 'quasi-teleconference' systems such as closed-circuit TV systems installed in schools and universities and inter-city program hookups by television networks.

The list below is incomplete. Not all teleconference systems are yet known; other systems are being planned. The list does provide, however, an overview of the range of systems used by different types of organizations for different purposes, such of which will be studied as part of the Teleconference Canada Program.

1. Bell Canada

This system inaugurated by Bell in March, 1972 is a two-way interactive audio-video system linking up Toronto, Montreal and Ottawa. (Quebec City may be added to the network at a later date). The system at present is being used for internal company conferences only. It is intended shortly to offer the service on a commercial basis; no rate schedule has been set.

While the system bears great similarity to the Bell Labs version, according to its designers, it was not created in concert with the Bell Labs Teleconference System in New Jersey, (see below).

The system comprises 4 video cameras at each node (any two nodes can be interconnected at a time) in addition to a graphics camera.

Monitors at each node display the visual information of the other node in addition to providing a visual feedback to each participant of himself. All video information is provided in black-and-white and uses the protection circuits of the CBC for transmission of same. The audio is single channel 5 Kc telephone circuit quality.

The cameras are voice-actuated in the automatic mode, which can manually be overriden by the chairman of the meeting group at each end.

Up to 9 conferees can be seated at the crescent-shaped table facing the cameras, which are invisible to the conferees. However, it has been found that for many reasons five is the suggested maximum number of conferees at each terminal.

2. Bell Labs

This system connects the Holmdel and Murray Hill, N.J. Labs of Bell Labs in much the same way as the Bell Canada system. In the 'Normal' mode, the attendees see the picture being received from the other location on all three commercial television monitors in front of the table. The picture being transmitted is shown on the overview monitor. When a person speaks, the microphone nearest to him, acting on the volume and duration of the speaker's voice, turns on the camera that includes the speaker in

its field of view. The last speaker remains on-camera for several seconds unless someone at another position talks. If no one else talks, the system switches to the overview camera and shows the entire group at that location. User satisfaction has been claimed as good to excellent in 95% of teleconferences. The advantage of the automatic switching is claimed to be that larger numbers of participants can take part than with more conventional systems.

3. Confravision

This is a single camera (except for graphics viewing) black-and-white small monitor viewing system. This system was implemented between 1969 and 1970 as a commercial venture by the British GPO, and to date has failed to live up to expectations in terms of volume of usage, except on a trial basis for $50 per hour. The commercial rate varies from $300 to $500 per hour of usage depending on the distance between the terminals used. Any two of five cities are inter-connectable at a time in the system, among them London, Edinborough, Birmingham, ...

4. Remote Meeting Table (RMT)

This audio-only system is designed to enable groups of up to eight persons at each of two locations to engage in effective 'round-the-table' conferences. The system, a development of the Communications Studies Group uses a two-way audio circuitry of the telephone company, in England. The system provides, through a system of indicator lamps and directionalized

loudspeakers, a continuous and automatic identification of conferees at the remote location. It is being used on a regular basis between government offices in London and Edinborough.

5. Metropolitain Regional Council

The Metropolitain Regional Council, headquartered in New York City's World Trade Center, has just completed construction of its tri-state multi-government teleconference system. Serving local governments, it will employ a two-way microwave, audio-visual system "to bring together public officials and other groups for teleconferencing information exchange, and training purposes." The three states concerned are: New York, New Jersey and Connecticut.

6. Teleconsultation and Telediagnosis

The Massachusetts General Hospital contains terminals for each of the two systems. The remote nodes of each are respectively located at the Bedford, Mass. Veterans Administration Hospital and at the Logan International Airport. Both are similar in operation and consist of black-and-white, two-way with associated telemedicine facilities. Using video, audio and telemetry to link the two nodes, the clinical relationship of doctor and patient in same room is approximated. Diagnostic procedures can be undertaken including interview, visual assessment, stethoscope, respiration, pulse and cardiagram examinations, chest X-rays, white cell count.

7. Command Performance Network (GE)

Although not strictly speaking a teleconference system,

it should be mentioned here because of some of the innovative approaches used, in particular, the use of full color using large screen (up to 20 feet wide) television projection interconnecting up to 43 cities at a time with interactive audio-only feedback (although, if the client is willing to pay for it, Command Performance Network will supply an interactive video capability also). CPN teleconferences are set up as one-shot, one-day deals using Sheraton Hotels as terminal spaces, and Tommorows Entertainment as the program producers. The next major teleconference will be September 21, 1972 (nearest node to Ottawa is Toronto); subject of conference: Productivity and Profit - a high level government and industry venture connecting up 20 cities.

8. TAGER (The Association for Graduate Education and Research)

Among a large number of 'Tele-Lecture' systems, this system consists of three microwave channels interconnecting seven private universities and colleges and 12 industrial sites in the Northern Texas area, for the purpose of providing common resources for advanced education and research. Included in this system is video and audio live transmission from originating classrooms and studios with two-way talk-back from all receiving stations. Experimentation with two-way live video is also being considered. Other 'Tele-Lecture' systems include Penn State University which has a two-way microwave used for instruction and staff training and meetings. Telefacsimile and remote computer terminals are also being considered; the University of Wisconsin

has been running tele-lectures and information retrieval sessions, among 21 participating hospitals. An extensive 'Teleconference' bibliography is available from them.

9. Lister Hill National Center for Biomedical Communications

In August 1971, a two-way audio telemedicine facility utilizing the NASA ATS-1 satellite was implemented under the auspices of HEW. The system is designed to provide voice-only communications between medically advanced centers and the remote Alaskan communities inadequately served with health services.

10. Boeing Corp.

This system was designed by Boeing and used by Boeing and NASA to hook up seven nodes through the U.S.A. in order to oversee the Apollo Manned Space Program. The terminals (in Hunsville, Cape Kennedy, Houston, Washington, D.C., Seattle, Wash., Alaska and New Orleans were set up) save otherwise wasted time in travelling and to increase speed of transfer of information between the centres). Hunsville is the switching centre for the TC system using 4-wire circuits and Telpak A (48 KHz) data circuits. The conferees voices are transmitted over Speakerphone type devices within the system. Microphones scattered around the room are controlled by the chairmen in each room. Graphic data can be transmitted through the Xerox LDX (Long Distance Xerox) system. No video display of the conferees is available for any of the other environments.

11. Bankers Trust

This system, connecting branches of Bankers Trust throughout Manhattan, has been in successful operation for nearly a decade, with an audio/video capability. For the past year or so, the video equipment has been breaking down regularly and instead of providing video in the updated system, only audio will be provided. One point of significance in this system is the use of a stereophonic audio system. Although the second channel was designed as a protection circuit,it can be and is being used in the true stereo mode for auditory localization of conferees at the other location. The system is used by top level executives of the Bank.

12. New York Telephone Company

This proposed system is hoped to become a four-way audio/video interactive system for use by offices of N.Y. Telephone. Further details are being obtained.

13. TICCIT (Time-Shared Interactive Computer-Controlled Information Television)

This system being developed by the MITRE Corporation in Washington, D.C. is an attempt to design an interactive responsive television cable system using modified currently available electronic components at an economically viable level, for a small-town community (in Reston, Va.)

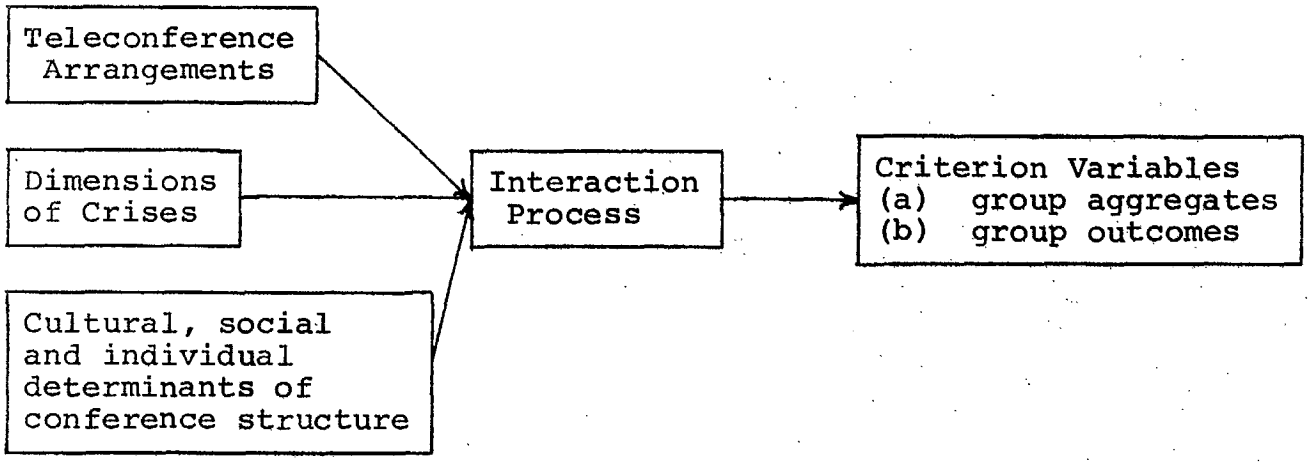
14. Other Systems

Among other systems on which additional data is being collected are those of the First National City Bank in New York,

the audio-teleconference system connecting the offices of the Department of Commerce, Telecommunications Bureau, in Washington and Bolder, Colorado, and the two-way audio/video system to be installed as part of Peter Goldmark's 'Rural Communications' Project in Connecticut.

APPENDIX B

TABLE I.
INTERRELATIONSHIPS OF TELECONFERENCE VARIABLES *



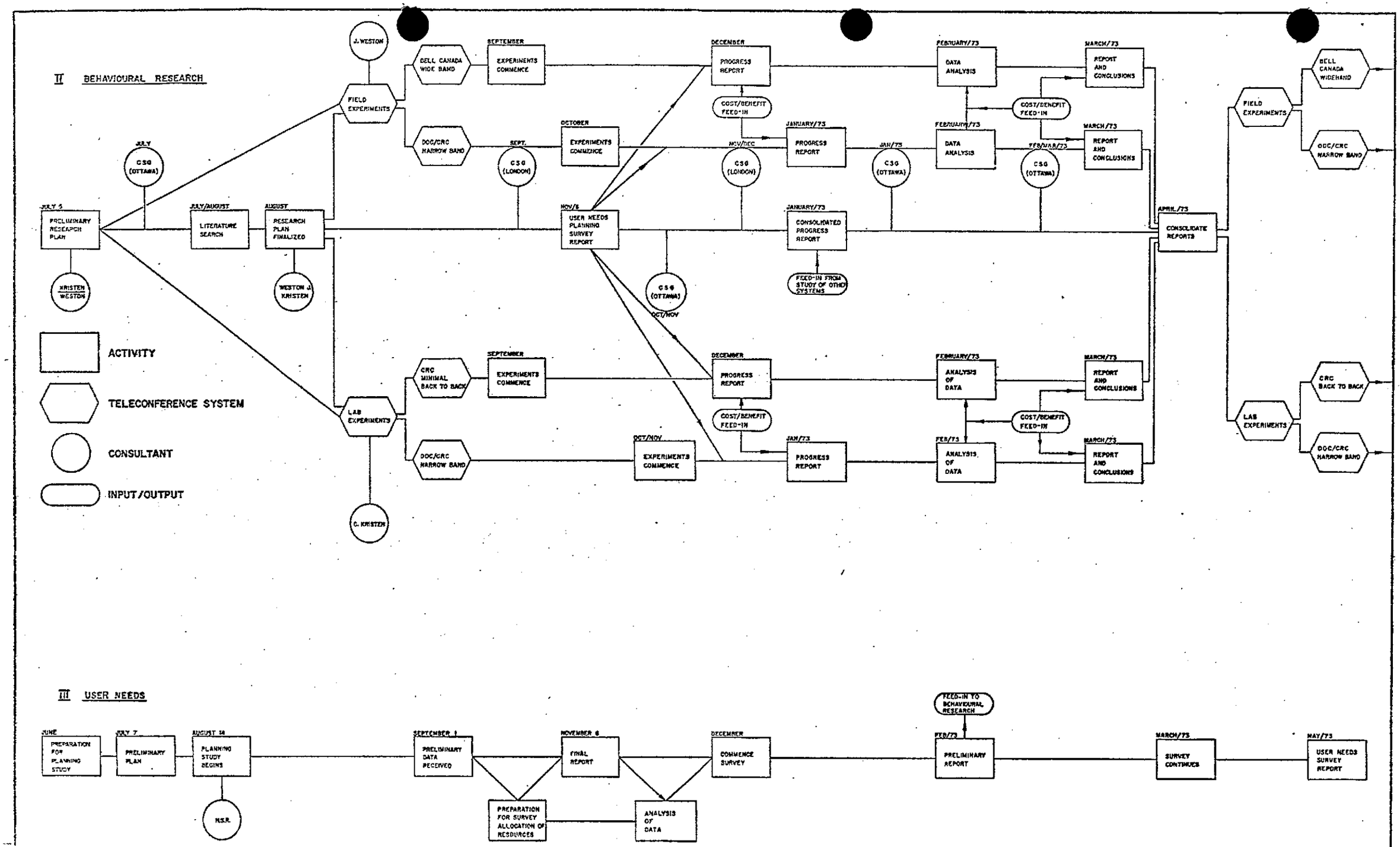
* from HSR's Working Papers on Teleconferencing, 1963.

TABLE II - Appendix B. VARIABLES IN TELECONFERENCING

(for negotiating, decision-making, problem-solving, information exchange) *

Independent Variables			Intervening Variables	Criterion Variables	
Teleconference arrangements	Dimensions of Crises	Cultural, Social and Individual Determinants of Conference Structure	Interaction Process	Group Aggregate	Group Outcome
Media -Cue reduction -Reliability -Operating procedures -Hard copy Network Configurations Supplementary Communications Capabilities Procedures for Interpretation -Simultaneous -Consecutive -Mixed Facilities -Conference support -Environment Security Procedures	Threat to Goals of Conferees Time Stress Program Availability Serial Meetings	Cultural Variables -Number and combination of languages -Supracultural value consensus Social Variables -Conferee status -Conference size -Differential influence resources -Role structure Individual Variables -Attitudes -Cognitive structure -Organic attributes	Interaction Behavior -Information exchange -Influence attempts -Affect expression -Group maintenance acts Cognitive changes -Information state -Specificity -Organization -Association Attitudinal Changes Toward Other Conferees -Communication arrangements	Accuracy of Perception -Problem -Alternatives Similarity of Perception -Problem -Alternatives Agreement on Outcome Satisfaction with Outcome Knowledge of Other's Values and Expectations	Quality Time

* from HSR's Working Papers on Teleconferencing, 1963.


II BEHAVIOURAL RESEARCH
J. WESTON
FIELD EXPERIMENTS
BELL CANADA WIDE BAND
SEPTEMBER
EXPERIMENTS COMMENCE
DOC/CRC NARROW BAND
SEPT.
OCTOBER
EXPERIMENTS COMMENCE
JULY
CSG (OTTAWA)
CSG (LONDON)
JULY 5
PRELIMINARY RESEARCH PLAN
JULY/AUGUST
LITERATURE SEARCH
AUGUST
RESEARCH PLAN FINALIZED
KRISTEN WESTON
WESTON J. KRISTEN
NOV/5
USER NEEDS PLANNING SURVEY REPORT
CSG (OTTAWA)
OCT/NOV
DECEMBER
PROGRESS REPORT
COST/BENEFIT FEED-IN
NOV/DEC
CSG (LONDON)
JANUARY/73
PROGRESS REPORT
JAN/73
CSG (OTTAWA)
JANUARY/73
CONSOLIDATED PROGRESS REPORT
FEED-IN FROM STUDY OF OTHER SYSTEMS
FEBRUARY/73
DATA ANALYSIS
COST/BENEFIT FEED-IN
FEB/MAR/73
CSG (OTTAWA)
MARCH/73
REPORT AND CONCLUSIONS
APRIL/73
CONSOLIDATE REPORTS
LAB EXPERIMENTS
CRC MINIMAL BACK TO BACK
SEPTEMBER
EXPERIMENTS COMMENCE
DOC/CRC NARROW BAND
OCT/NOV
EXPERIMENTS COMMENCE
C. KRISTEN
DECEMBER
PROGRESS REPORT
COST/BENEFIT FEED-IN
JAN/73
PROGRESS REPORT
FEBRUARY/73
ANALYSIS OF DATA
FEB/73
ANALYSIS OF DATA
COST/BENEFIT FEED-IN
MARCH/73
REPORT AND CONCLUSIONS
MARCH/73
REPORT AND CONCLUSIONS
ACTIVITY
TELECONFERENCE SYSTEM
CONSULTANT
INPUT/OUTPUT
FIELD EXPERIMENTS
BELL CANADA WIDEBAND
DOC/CRC NARROW BAND
LAB EXPERIMENTS
CRC BACK TO BACK
DOC/CRC NARROW BAND
III USER NEEDS
JUNE
PREPARATION FOR PLANNING STUDY
JULY 7
PRELIMINARY PLAN
AUGUST 16
PLANNING STUDY BEGINS
M.S.R.
SEPTEMBER 1
PRELIMINARY DATA RECEIVED
NOVEMBER 6
FINAL REPORT
PREPARATION FOR SURVEY ALLOCATION OF RESOURCES
ANALYSIS OF DATA
DECEMBER
COMMENCE SURVEY
FEED-IN TO BEHAVIOURAL RESEARCH
FEB/73
PRELIMINARY REPORT
MARCH/73
SURVEY CONTINUES
MAY/73
USER NEEDS SURVEY REPORT

I TELECONFERENCE CANADA