DOCUMENT RESUME

ED 088 455 IR 000 286

AUTHOR Samuelson, K.; And Others
TITLE Global and Long-Distance Decision-Making, Environmental Issues and Network Potentials.
INSTITUTION International Federation for Documentation, The Hague (Netherlands).; Royal Inst. of Tech., Stockholm (Sweden). Dept. of Information Processing - Computer Science.
REPORT NO FID-493; TRITA-IBADB-5003
PUB DATE 73
NOTE 84p.

EDRS PRICE MF-$0.75 HC-$4.20
DESCRIPTORS *Conference Reports; *Decision Making; *Ecology; *Information Networks; Information Processing; Information Systems; International Programs; *World Problems
IDENTIFIERS International Road Research Documentation System; IRRD

ABSTRACT

FID/TM, an international group concerned with theory and methods of systems cybernetics and information networks, held a panel session at the 34th Annual American Society for Information Science (ASIS) Meeting in November 1971. This report contains the seven papers presented by that panel, concerning issues in global decision-making and the role therein of information networks: "Global Decision-Making, Information Networks and Environmental Quality" by K. Samuelson, "The Nature of Networks" by Harold Borko, "Global and Long-Distance Decision-Making, Problems Regarding Multi-Disciplinarity and Screening" by B. V. Tell, "Global Decision Making Issues-Potentials" by Peter Nador, "Visualizing the Information for Better Decision Making" by Roger Dubon, "The International Road Research Information Network" by P. E. Irick and P. E. Mongar, and "Information Networks-Some Observations on Possible Functions and Structure" by H. F. Dammers. (SL)

THE ROYAL INSTITUTE OF TECHNOLOGY
AND
THE UNIVERSITY OF STOCKHOLM
SWEDEN

DEPARTMENT OF
INFORMATION PROCESSING
COMPUTER SCIENCE

ED 088455

FID-TM: THEORY AND METHODS OF SYSTEMS, CYBERNETICS AND INFORMATION NETWORKS

KJELL SAMUELSON, INFORMATION PROCESSING-ADP

STOCKHOLM UNIVERSITY AND ROYAL INSTITUTE OF TECHNOLOGY

Fiskartorpsvägen 160 F, 104 05 Stockholm 50, Sweden · Tel. 15 01 60/1569

GLOBAL AND LONG-DISTANCE DECISION-MAKING,
Environmental Issues & Network Potentials

by

K Samuelson, H Borko, BV Tell, P Nador,
R Dubon, PE Irick, PE Mongar, HF Dammers

FID/TM Panel at the ASIS Meeting
in Denver, Colorado, 9 November 1971.

FID Publ.No. 493

TRITA-IBADB 5003

CONTENTS

* Presented by M. Lindquist

Foreword

FID/TM is generally known as the specific, international group, that since 1965 is concerned with Theory and Methods of systems, cybernetics and information networks. On several occasions and in context to professional conferences, FID/TM has organized panels or tutorial sessions. Consequently, a number of technical reports have also been released.

The following report is the result of a panel jointly sponsored by FID/TM and ASIS during the 34th Annual Meeting in Denver, Colorado on 9 November, 1971. The theme for the ASIS Meeting was "Communication for Decision-Makers" and the topic for the FID/TM panel session was "Issues in Global and Long-Distance Decision-Making." The invited panelists were information science professionals representing different nations and organizational bodies. After the contributors' individual presentations, a general discussion by the audience followed. It was a pleasure for the session chairman to receive appreciative comments on this particular panel session, that was tape recorded. However, of course, the tape recording turned out to suffer from a technical error, yielding too low volume with next to impossible listening conditions. There is still a very small chance that the tapes may be upgraded through a sound studio procedure. Therefore, the present report might be considered as a preliminary edition with eventual improvements to follow.

FID/TM wishes to thank the ASIS hosts and regional organizers, the panelists, the participating organizations, the conference audience and all others who have contributed to an after all, successful panel session.

K. Samuelson

Chairman of FID/TM

Federation Internationale de Documentation,

Theory of Machine techniques and systems.

GLOBAL DECISION-MAKING, INFORMATION NETWORKS AND ENVIRONMENTAL QUALITY

by

K. Samuelson
Information Processing-ADP,
Stockholm University & Royal Institute of Technology, Sweden.

Introduction

Automated international information networks can be an asset to decision-making as well as global improvement of Environmental Quality (EQ). Benefits would also be achieved through communication networks and teleprocessing as a substitute to physical transport and commuting of personnel and materials. More specifically FID/TM has accepted such challenges to Theory and Methods of systems, cybernetics and information networks. The network potentials have been realized by FID/TM and also by ASIS. This circumstance was verified when ASIS for the second time invited FID/TM to organize in 1971 a panel session as a follow-up on the 1969 panel at the ASIS San Francisco meeting (1). The panel at the 1971 ASIS meeting in Denver was conducted in much the same way as before (2). Thus, a scientific paper was written by the chairman (3), outlining the theoretical background and some of the practical, real-world consequences. A number of key-issues and potentials were brought up for consideration.

Special attention was given to issues relevant to the United Nations conference on the human environment, 1972, in Stockholm, Sweden.

Issues and Potentials

The information science professionals contributing to the panel on "Issues in Global and Long-Distance Decision-Making" were asked to submit their own manuscripts or written comments on the chairman's theme paper (3). We shall review and list some of the original issues which were proposed as foci for the discussion:

- General information and communication networks, providing knowledge support in decision-making situations at global distance.

- Dedicated networks furnishing information on topics such as Environmental Quality, that require international decision-making.

- Improving and maintaining Environmental Quality, by a world-wide use of information and communication networks.

- Decision-making by international parties and national groups regarding the functions, construction and management of information networks jointly.

Aside from those major issues we can distinguish a number of aspects related to the varying criticality of the decision making situation. Each of the questions remain quite a challenge:

- Fast decisions require quick delivery of timely information.

- Vital decisions call for reliable data.

- Final decisions sometimes have to be supported by an exhaustive retrieval of information.

- Combinations of Fast and/or Vital and/or Final decisions represent varying degrees of decision making under pressure.

The two-way, mutual interdependence between information/communication networks and Environmental Quality leads to a full range of recommendations, that are of global and supraurban concern:

- predictive planning through information
- preventive actions through information and communication
- corrective actions through communication
- adverse effects recorded as warning information

- alerting results disseminated through communication
- reduced complexity in congested areas
- avoidance of physical information transport
- adoption of paperless information handling
- meeting the individual's right to be let alone, when he so prefers
- minimizing non-motivated commuting
- increased motivation by variety options and alternative choices

Looking Ahead

In earlier works we have recommended that "the systems approach" (4, 5), be applied to challenges of such a magnitude as indicated above (6). A few warnings should also be spelled out.

There is a big risk that "vast and wasted" activities of fact collection for so called data banks are undertaken, which will never be used since they contain items that are not reliable timely and complete. Such a "data deluge" and "fact congestion" may become enlarged by figures from the simulation of ecological factors, that are not valid within a generalized framework.

Also, in previous works (7) we have emphasized that there is a distinction between information networks and computer-communication networks. As computer generations come and go, the computer-communications would be orderly expanded and superimposed upon the evolutionary growth of information networks, that constitute an irregular web with deep roots among people, community functions, regions and nations.

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THE NATURE OF NETWORKS

by

Harold Borko
Graduate School of Library Service,
University of California, Los Angeles, U S A.

The program annotation describing this panel session begins with the word, "Automated international information networks can be an asset to executive decision makers ... at global and long distance from the informational sources." And the paragraph goes on to mention some potential advantages of networks.

My role as the first and introductory speaker is to help define our topic. What exactly is meant by "network"? Although there is not one authoritative definition, most authorities define a network as a number of elements, spacially dispersed, and connected by intersectioning lines of communications.

The definition alone is not sufficient to grasp the concept of a network or to understand its advantages and its use. For these purposes we must develop an appreciation for the attributes used in describing and differentiating networks and there are: (1) shape, (2) type of connection or communication link, (3) type of elements connected by

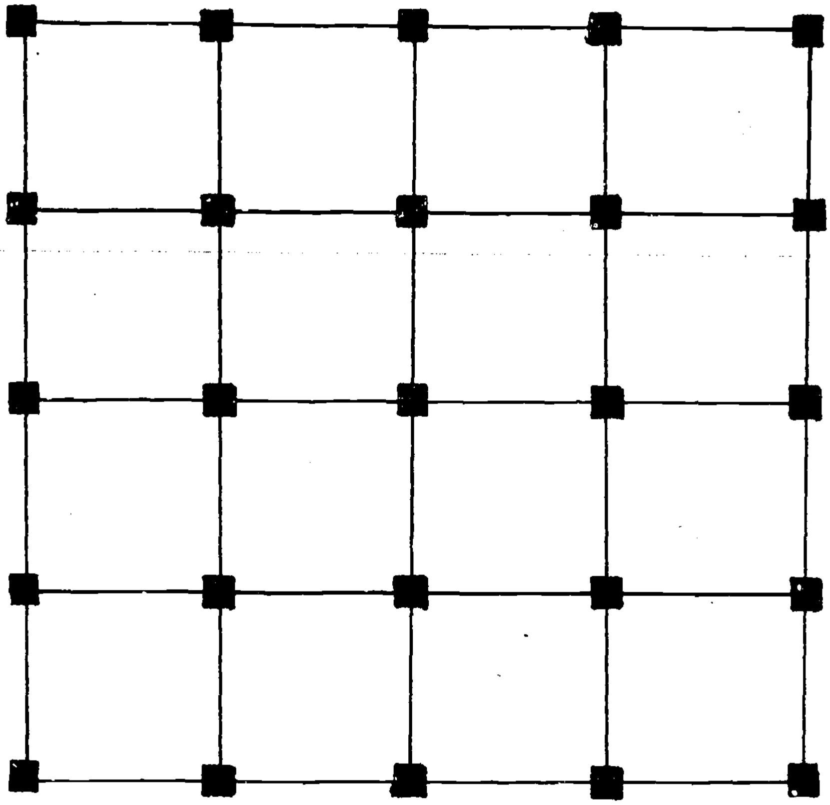

FIG. I. Net-Shaped Network

the network and (4) type of item distributed by the network.

1. The Shape of the Network

The shape of the network, that is to say the manner in which the component elements are distributed and the pattern of the intersectioning communication lines, is a most important variable in describing networks. We will consider it first:

1. Net-Shaped
2. Star
3. Fully Connected
4. Distributed
5. Star-type Distributed.

1.1 The Net-Shaped Network

A net-shaped network (FIG. I) is one in which every node communicates with the next, or adjacent, node, but all nodes do not communicate with all other nodes. I know of no existing network that is of this type. It is perhaps indicative of our subject matter that the word "network" most closely describes a type that is not yet being used.

1.2 The Star Network

The star network (FIG. II) does exist and, is rather common. In this form of network one node is more powerful

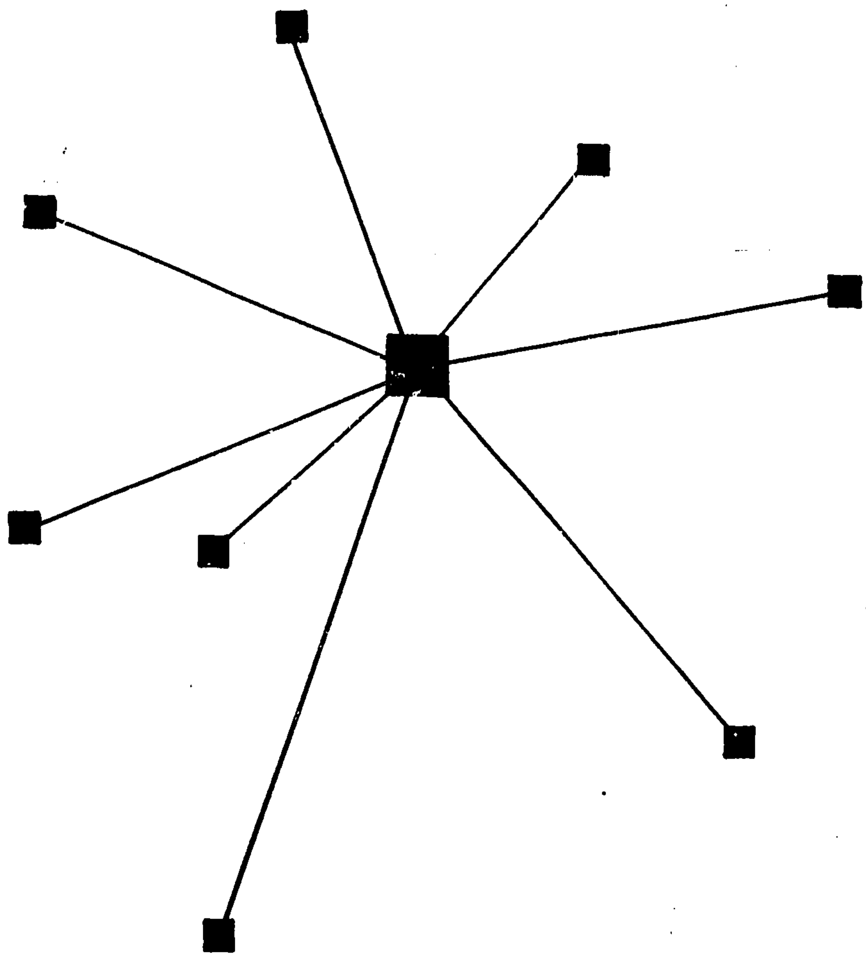

FIG. II. The Star Network

and central than the others. Each of the peripheral nodes is linked to the center, but they are not linked to each other. All communication is channelled through this central node.

1.3 The Fully Connected Network

The fully connected network (FIG. III) is one in which every node has direct access to every other node. In comparison to the star network, each node in the fully connected network is an equally "central node" with direct connections to all other nodes. The fully connected network requires many, many more lines of communication than does the star network or indeed any of the other forms.

1.4 The Distributed Network

The distributed network (FIG. IV) is a kind of compromize form which embodies some of the characteristics of the net, the star and the fully connected networks. Nodes are connected to adjacent nodes as in the net; Some nodes have more connections than others based on the star, and in a sense the distributed network is the same as the fully connected network except that some of the communication lines have been removed.

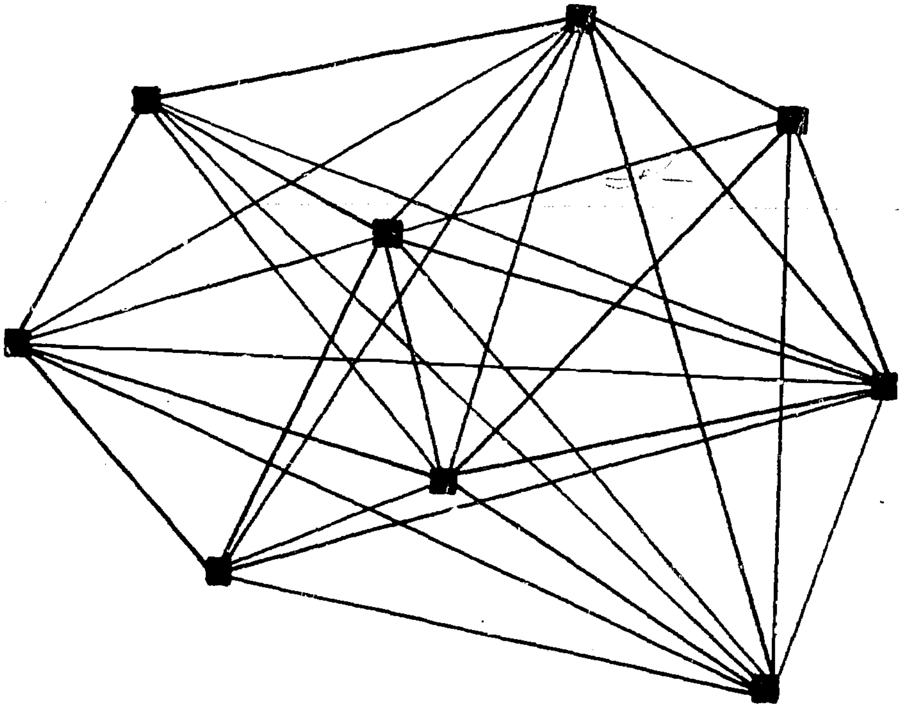

FIG. III. The Fully Connected Network

1.5 The Star Type Distributed Network

The advantages of the distributed network can perhaps best be seen in the star-type distributed network (FIG. V). In this diagram three star shaped networks are postulated. Each smaller node is connected to its adjacent central node and the three central nodes are interconnected. By means of the distributed network, each node could establish communication to every other node. The main advantages of this form of network is that few long communication lines are needed. This holds to a minimum the cost of network communication channels, which we shall see is a major expense.

2. Communication Channels

Let us turn now from the discussion of the various shapes that networks can take to the types of connections and the communication channels that provide the bonds between the nodes. The types of connections are quite varied and at their grossest division could consist of:

1. Human Transport
   - Personal Visits
   - Consultants
2. Mail Transport
   - Printed Material
   - Machine Readable Material
3. Electronic Communication
   - Dial-up
   - Permanent Voice-Grade Lines
   - Permanent Wide-Band Lines

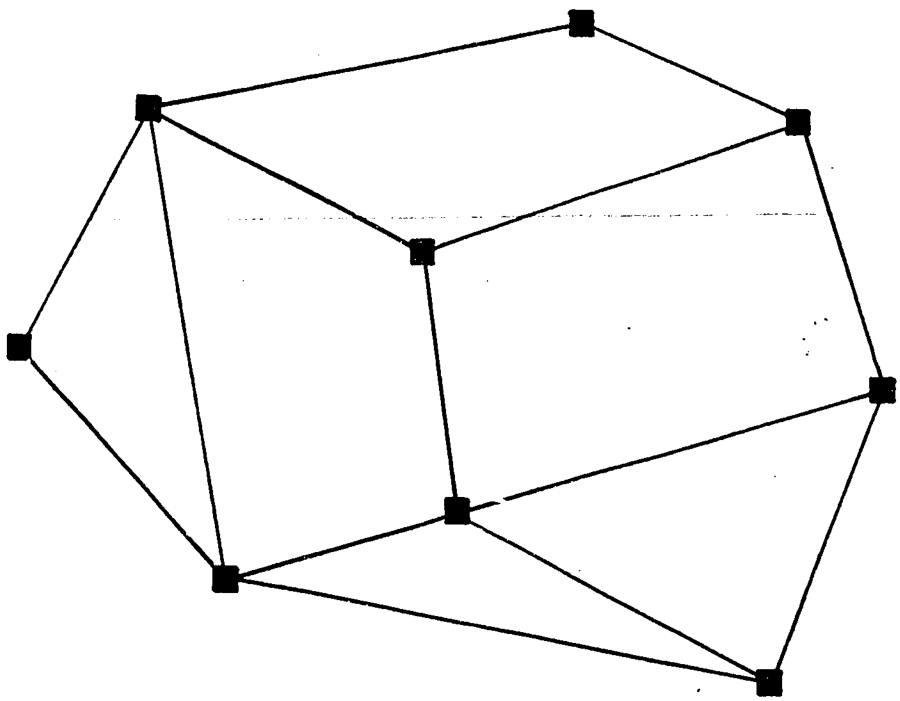

FIG. IV. The Distributed Network

2.1 Human Transport

Some networks operate, which is to say communicate, by exchanging visits among the different computing centers. During these visits, a great deal of information is exchanged and knowledge transferred. Some networks also provide the services of consultants to any nodes that need special help.

2.2 Mail Transport

In addition to flying people from place to place it is obvious that one can send printed material such as letters, manuals and other forms of printed information from node to node. It is also obvious that machine readable information can also be sent through the mails in the form of punched cards and magnetic tapes. Indeed, it is sometimes cheaper to send a magnetic tape by mail than to send the information over telephone lines.

2.3 Electronic Communication

By far the most important form of data transfer between the nodes of a computerized network is through electronic communication. Telephone lines or other forms of electronic communication channels constitute one of the prime modes of connection and the greatest continuing expense item. Electronic communication may consist of simple telephone dial-up which establishes temporary

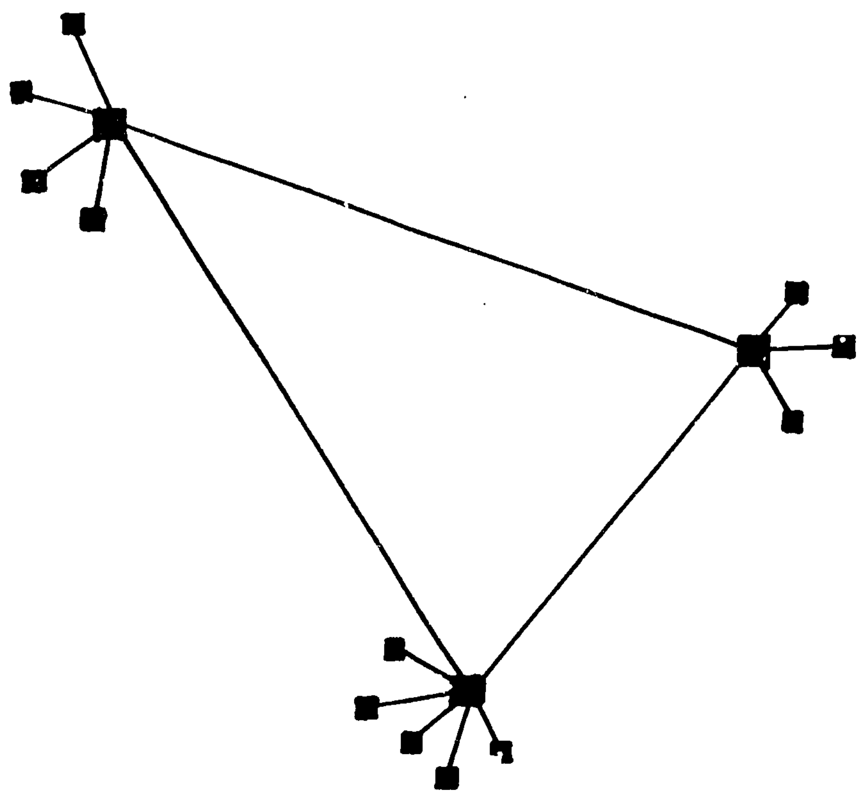

FIG. V. The Star-Type Distributed Network connections as needed. If the volume of communication warrants it, permanent lines can be leased which keeps the nodes connected at all times. Wide band transmission is expensive and is less common, but its many advantages make it likely that this will be the electronic connection of the future.

3. Elements Linked by the Network

Not only do the communication lines vary, but the elements that may be linked by these communication lines also differ. These are terminal to computer networks, computer to computer networks as well as networks linking the computer to operating organizations. Let's look at these very briefly:

1. Terminal to Computer
2. Computer to Computer
3. User Organization to Computer
    - Small College
    - Information Center
    - Physics Department
    - Individual User

3.1 Terminal to Computer Networks

Necessarily in order to use the computer some input terminal must be linked to the main frame. Such a linkage does not have the connotation of a network. A better visual image would be a time-shared computer with perhaps twenty of more input output terminals. Communication takes place between the terminal and the computer and from the computer back to the terminal.

3.2 Computer to Computer Networks

Computer to computer networks are almost equally common. The purpose of linking computers together is to provide more optimal service for the users by sharing of facilities. This concept will be discussed further in the next section.

3.3 Computer to User Organization Networks

Network facilities may be used to link a small college, or a college department, to the computer and thus provide this organization with access to the computer. A college administration may prepare the school's payroll or master class schedule on the computer while the chemistry department might use the facility to search chemical litterature tapes. Some more wealthy professors, those that have supporting grants or contracts, may have their own consoles providing research and communication channels between professors and between disciplines. In this age of interdisciplinary research, this form of communication network takes on new importance.

4. Resourses Shared through Networks

It is clear that networks facilitate communication, but this is not their only or even most important function. Networks exist for the purpose of providing an economical efficient means for sharing resourses. The resourses that need to be shared are:

1. Communication Lines
2. Hardware - Computation Capability
3. Software - Computer Programs
4. Data and Data Bases
5. Information & Consulting Services.

4.1 Communication Lines

Communication lines and their cost have been mentioned on a number of occasions already. The advantage of networks is that they can provide more communication facilities at less cost than individual users could buy. Visualize the star-type distributed network (FIG. V). The individual node needs only to pay for local telephone service to the central facility. Relatively inexpensive (per unit cost) leased lines will connect a user to any other node in the network. By sharing the expensive long distance lines, unit costs per service is substantially decreased.

4.2 Hardware- Computational Capability

Certainly one of the main purposes of building computer networks is to share computational capabilities. As has now become painfully obvious, it is very expensive to maintain and operate a computing center. A number of smaller schools have had to close their own facilities and to use service centers or other organizations for both administrative and classroom uses of computers. The developing trend seems to be in the direction of having a few large computing centers connected in a network and serving many organizations and individuals.

Even if the school had its own computer, it may at times become overloaded, or a larger core would be needed to do certain jobs. A network provides the solutions and this form of sharing may become even more important in the future, for the time of the very large billion-bit laser memory is here. One such memory has already been ordered and is being built, and although the initial cost is about one million dollars, the per unit cost of storage is 200 times cheaper than tape storage - Yes, I said tape storage and not core storage. A network could provide for the sharing of this specialized hardware facility.

4.3 Software - Computer Programs

Not only is it expensive to maintain computer hardware, it is also expensive to write and maintain the necessary computer programs. A cooperative venture, such as a network, would enable member nodes to use specialized programs that have been developed or are being maintained by other organizational units. Again, each individual user will thus have available a much greater range of capabilities than the local computational center could possibly afford.

4.4 Data and Data Bases

Large data bases such as MARC, the Census Tapes, Chemical Abstracts, etc, are prepared centrally. However, it is also expensive to process these tapes. In a network the processing costs may be distributed by having one node responsible for MARC, another for Chemistry, etc. When we have the laser memory and the very, very large data bases such as the world-wide weather data, these bases will have to be shared and their processing partially centralized. Proprietary use may be better controlled if the data base was maintained and processed centrally.

4.5 Information and Consulting Services

No one is an expert in all fields, and not one organization can maintain a sufficient corps of experts on all subjects, Networks can provide information, advise and consulting services. Indeed documents or notices can be stored in the computer which can also serve as a message center. A user may ask, through his computer, whether anyone in the network has left any message or documents for his attention. This type of information service is a complimentary type of SDI service. The originator of the document simply provides the computer with a machine readable copy and a distribution list. The computer network does the rest.

5. Concluding Remarks

By way of conclusion, let me refer again to the topic of this panel, "Global and Long Distance Decision Making." Retrieval decision making is dependent upon adequate analysis, and for complex problems, this requires the use of data processing capabilities for both information transfer and computation. Long distance problem solving requires the use of communication lines to connect the information processing nodes. This combination results in the computer based network. In the United States there are at least two large scale national networks - EDUCOM and ARPA. My remarks on the nature of networks are based largely upon the reported experience of these two networks. More particularily it is based upon the report of an EDUCOM Council Meeting Seminar (as recorded in Behavioral Science. Vol. 16, Number 5, September 1971, pp 490-510) and information gathered at the UCLA node of the ARPA network.

GLOBAL AND LONG-DISTANCE DECISION MAKING PROBLEMS REGARDING MULTI-DISCIPLINARITY AND SCREENING

by

Björn V. Tell
Royal Institute of Technology Library, Stockholm, Sweden

Abstract

The need for reformulation of the query when going from one discipline to another is discussed. The system must continuously perform juxtaposition of disciplines and extablish association links over the discipline barriers in reaction to new information. Successful answers to queries should also be included and adapted as new information in the system.

The screening function of the system is even discussed, describing the role of the information analysis centers, and how part of their work can be computer-aided. Some of the characteristics of automated "intelligent" filters are disclosed. The role of OECD in the network area is mentioned.

In his introductory paper K. Samuelson (1) has raised many issues about the setting up of automated international information networks, especially in view of the potentialities such networks open up for decision makers. Decision making takes place on all levels of the hierarchical ladder in an organisation, public or private, and the main interest here concentrates upon the assistance a network can give to decision makers for setting policy and exercising managerial functions.

Accepting that the systems design parameters like speed, exactness and volume are critical, the processing in the system should shift them into parameters like timeliness, credibility and comprehensiveness, if the system intends to give the knowledge back-up needed for decision making. In the following we should like to deal with two specific capabilities which we think are essential for the network development, namely the reformulation capability in a multi-disciplinary environment and the screening or filtering function which ought to precede the presentation of alternatives before the final choice.

Assuming that automated networks, irrespective if being general or dedicated networks, give full access to the world's knowledge, and that the decision maker has the practical means to tap this source of knowledge during the decision-making process, the utilization he can make of the source will still depend upon solving the specific problems of managing on-line information in response to the very crude first query formulation he puts to the system. Then, the incoming information will be the focus for his attention. The decision maker has to determine which incoming information is of most importance to be attended to. Recent progress in brain research (2) shows that his attention depends upon the storage of earlier reactions to such information, and the set of relations involved. The set of relations or comparisons between incoming and stored information adds also to the complexity of the storage function of the system.

While the decision maker can pay attention to only one kind of information at a time - man is a one-at-a-time device - the system can attend to a vast number of units of incoming scientific information, compare and establish complex association links, and this process will go on passively in the system when accumulating new information. We assume also that every valuable answer to queries put to the system is introduced in the machine storage as new information together with its associative links.

Reducing the amount of information that has to be related to a minimum, would facilitate the work of the decision maker to act as a comparison machine in a deterministic manner. One way of reducing the amount of information is by a more narrow and specialized reformulation of the problem under consideration as expressed in the very first question to the system. Another is by the insertion of a screening or filtering mechanism. Computer-aided reformulation or an automated reformulation capability for solving problems of multidisciplinary character like that of the environment (EQ), or to mention some other fields, brain and behaviour, the oceans, new materials, computers, space etc., requires the access to more than one traditional scientific discipline. Account has to be taken of the use of the language (scientific "jargon"), the theoretical constructs and the experimental techniques of each discipline involved, that would indicate the need for a juxtaposition of the various disciplines before a valid reformulation of the query can take place (3).

The study of EQ-problems has shown, however, that a juxtaposition of traditional disciplines is not sufficient, because of the complexity of the problems. It is also necessary that there be a relationship established between existing scientific disciplines. Thus, a linkage must be developed between existing scientific disciplines, if multidisciplinary problems are to be attacked which makes a difference to solving questions within a traditional discipline. At present the reformulation of a query directed to bibliographic reference or abstract systems takes place in the dialogue with the computer focusing on one database at a time. When more than one database is interrogated the system should be able to make logical sums or products over the database barriers, and the text material should be extended to include more than just references or abstracts.

The overall system must, thus, comprise a switching mechanism, which for the specific problem areas which have been identified, e.g. the EQ-area, makes it possible to access the various disciplines which have to be applied simultaneously and linked in a manner that the whole EQ-area can be examined. How this switching mechanism should be constructed is in itself a difficult problem since we lack an adequate science for the management of complex interacting systems, and a rationale for breaking them down into sufficiently isolable sub-systems so that we can analyse and propose means and ends to be used in dealing with the system as a whole.

One method would be to develop a communication and a translation system between the various scientific disciplines comprising the machine generation of vocabularies, concordances and thesauri, and as an interim stage utilize a metalanguage which might eventually result in a common language for all sciences. Equally important is the transformation of query logic and the standardization of query formulation, allowing for different degrees of complexity. EQ lends itself for setting up an experiment that makes use of the various disciplines involved by integrating the vocabularies of these by a free text analysis technique. Such an approach would lead to an understanding of how the juxtaposition and lin[illegible]ge should be established in a multi-disciplinary environment.

Some viewpoints should also be given on the function of the screening or filtering mechanism in an information network.

Assuming that the volume of information assures enough comprehensiveness, which in itself not always is neither an important nor a desirable goal for the decision-making process, the function of the network should be to pull out information relevant to a subject area like EQ, i.e. facts and figures about the EQ-indicators which ultimately have to be agreed upon, so that they can be used for projecting trends and designing actions. The structure of the information in the network - which we hope has undergone a strict formalisation thus, resulting in a drastic cut in the quantity of machine-stored information compared with the printed matter proliferating at the moment in scientific journals - should be ordered by a feed-back mechanism depending upon the use that researchers have previously made of it and the results received in that process whereby the juxtaposition and the linkage between the various disciplines involved have been established, including stereotype associations.

However, even after a researcher has located relevant information, a major problem still remains that of knowing how good the information actually is. Much information in the literature has been superseded by newer information. Much is actually misleading or contains errors. Even when the user is a specialist in the field himself, he may have difficulty deciding whether the information is of high quality. In any case, he may not want to take the time and energy to evaluate the available information.

Recently, numerous authorities have pointed out that a greatly increased output of compilations and reviews is needed in order to make efficient use of the world literature. Systematic evaluation is a quality control mechanism for all of science. A critical review that points out sources of uncertainty and limitations in the experimental methodology, as well as uncertainties and errors in interpretation, is necessary to build up confidence and credibility.

The need for systematic review and evaluation had led to the appearance of "information analysis centers" (IAC). An IAC consists of a group of subject matter specialists, together with information processing specialists, who gather together the world output of information in a well-defined field, organize and store it for ready retrieval, and then systematically produce critical reviews, data compilations, correlations and codifications, and other intellectual contributions to new knowledge. The IAC concept is perhaps most advanced in the United States, but has been taken up by OECD which tries to identify similar centers in other countries, although they may not be identified by the name IAC (4).

Comtemporary computer systems can efficiently handle large volumes of information with great speed. Much of the compilation work could be handed over to the computer. The desire of decision makers to call up original data could now be met without the necessity of relying exclusively on experts at hand to gather, filter, and interpret the data. Their screening process puts emphasis on the quality control mechanism in the information system to ensure credibility and that it is not misleading without extensive interpretation.

Various kinds of information analysis, consolidation, evaluation and repackaging is necessary here, and different kinds of IAC have a vital role to play in improving the filtering mechanism in the information network. What then, would be the characteristics of automated filters which could act as "intelligent filters"? We could distinguish some characteristics, namely the ability 1) to recognize a kind of target, 2) to keep the attention on the target, 3) to interprete available information in view of the target, 4) to present alternatives, 5) to carry out dialogue, and 6) to have a built-in feed-back.

The abilities expressed in 1) and 2) above indicate that the filter function should assure logical reliability, and the data compilation process should be of a statistical character (5), which supports Samuelson's idea of avoiding "vast (and wasted) activities of fact collection for so called data banks". The filters must also have memories suitable for juxtaposition and linkage in order to fulfil 4). One step to facilitate work of that kind would be to establish a standardized form for reporting experiments and obtained results. One such form has been developed for the nuclear cross-section data-field, the so called EXFOR-format. This format contains three parts; the bibliographic description, the experimental set-up, and the data obtained. This format is not completely compatible with the MARC II format or, as it now should be referred to, the ISO-format for bibliographic information interchange on magnetic tape, but it could be brought in line with it. A standardized reporting form will make the work of all IAC easier, and hopefully in many cases automate the compilation procedure.

In the discussions which are taking place in the OECD framework the above will be a minor point, but essential to arrive at a clearer understanding of networking concepts as applied to information systems, the capabilities of the tools that are available and the ways in which these may be expected to interact with other systems based on the new technologies and the existing information network based on more traditional methods. Policy implications for national governments both in determining national needs and in shaping the pattern of future international interaction will be identified during this exercise. Hopefully, the OECD activity will take care of Samuelson's consideration about the socio-cultural effects of information networks including the right of the individual, where already a fundamental study has been published (6).

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GLOBAL DECISION MAKING ISSUES - POTENTIALS

by

Peter Nador
Information Systems Department,
Bell Northern Research, Ottawa, Canada.

Introduction

Issues that require global decision making are connected with the control of some aspects of the human environment (e.g. pollution, arms, population, etc.).

The most significant factors that affect the quality of decision making in such a global environment are associated with the understanding of the behaviour of the system to be controlled. Thus, the emphasis is put on the usage of information (for selecting the control action which will result in the desired response), and not on the problems related to the collection and distribution of information.

It is impractical, however, to suggest that until a proper decision model is constructed, systems for collection and dissemination of information should not be considered.

Given an understanding of the basic properties that are unique to the global decision making process, a practical and useful start can be made by identifying some areas where specialized information networks can be developed.

What is Global Decision Making?

Those decisions that are of world-wide importance to mankind will be called "global decisions" in the following presentation. The process by which these decisions are arrived at will be labelled "global decision making".

Using this interpretation, the decision process within a multinational company (although it might extend to all continents) is not considered to be global decision making.

Decisions related to the control of environment, population or armament are, on the other hand, examples of global decisions.

Systems with Compound Decision Process (SCDP)

FIG.I illustrates the simplest configuration for a process that derives control signals to make the object system respond according to defined objectives. In this model, there is a single Decision Process (DP) which uses the model of the object system, the data representing

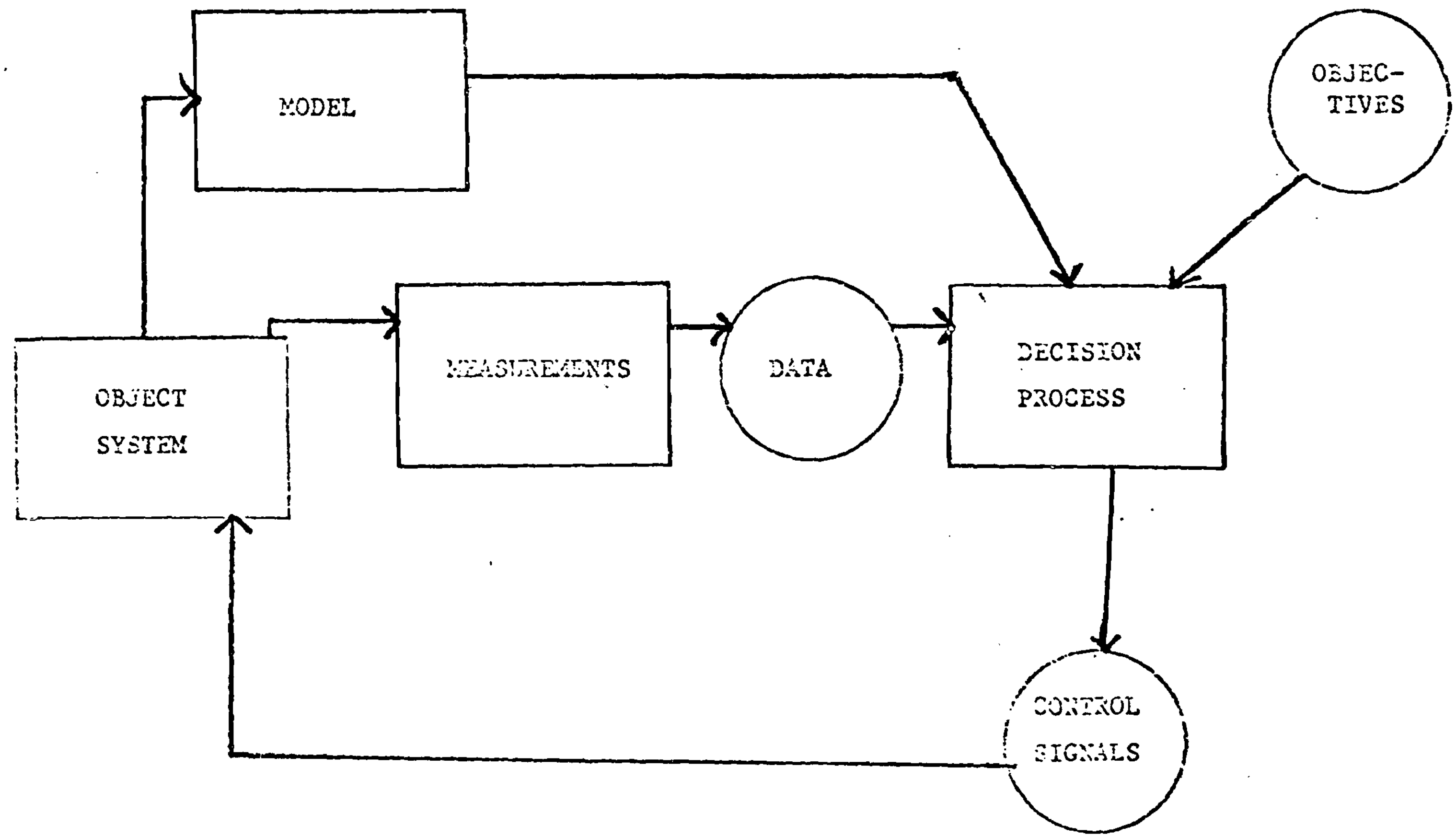

MODEL
OBJEC-
TIVES
OBJECT
SYSTEM
MEASUREMENTS
DATA
DECISION
PROCESS
CONTROL
SIGNALS

FIG. I

the state of the object system collected via measurements and a statement of objectives as input. The output of the DP is a set of signals which act on control points within the object system.

In real life, and especially in the case of global systems, the simple diagram of FIG.I is unacceptable, and one must consider a configuration where many independent DP's act simultaneously on disjunct sets of control points of the same object system. We shall refer to any system of this type as a "System with Compound Decision Process" (SCDP). [Note that the notation SCDP's will be used for more than one of such systems.}

Classification of SCDP's

The simplest form of a SCDP is shown in FIG.II. There are many control points, each independently controlled by a DP. All DP's, however, use the same model of the object system, have access to the same set of information and aim for the same objectives.

The model of FIG.II can be extended by assuming that the information available to the individual DP's is not the same. Thus, although each DP works for the same objectives and uses the same conceptual model

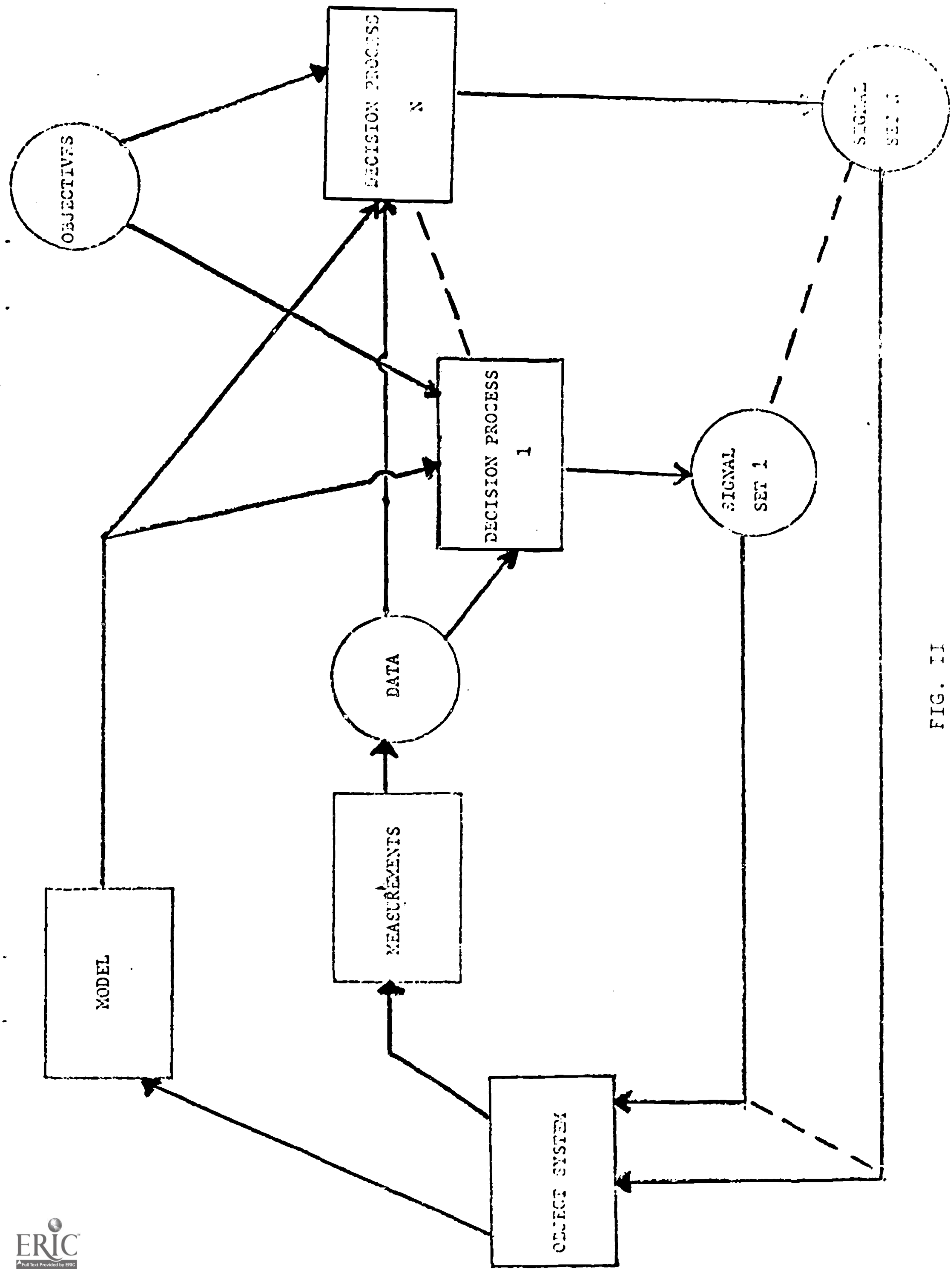

OBJECTIVES
DECISION PROCESS N
SIGNAL SET N
DECISION PROCESS 1
SIGNAL SET 1
DATA
MEASUREMENTS
MODEL
OBJECT SYSTEM

FIG. II

of the object system, their view of the current and past states of the object system differs.

More complex system configurations arise as the commonality of objectives between DP's is destroyed and as one considers situations where each DP uses a different conceptual model of the object system.

It follows from what has been said above that SCDP's can be classified according to the commonality that exists between the objectives (O), models (M) and information (I) between DP's within the system.

This classification process leads to eight possible classes, as follows:

Class	Common Element		
	O	M	I
0			
1			X
2		X	
3		X	X
4	X		
5	X		X
6	X	X	
7	X	X	X

By intuition, it seems reasonable to state that a SCDP of a certain class is better structured and more goal oriented than any SCDP of a lower class. Thus, the quality and effectiveness of any SCDP improves as its class number increases.

It should be noted that while commercial SCDP's tend to fall into classes 4 - 7, global SCDP's are mostly in classes 0 - 3.

Possible Transition Patterns Between Classes of SCDP's

FIG.III illustrates the possible paths for any system of class 0 to reach the level of class 7.

It is assumed that enforcing common objectives is in the realm of management (M) (or politics), establishing a common model is the responsibility of science (S) and providing a common information base belongs to the field of technology (T), On FIG.III, the transitions are labelled according to the field that has the major role in the particular change. The two general properties of this diagram are:

a. All three disciplines are needed for a full transition.

b. Technology always precedes science in the sequence.

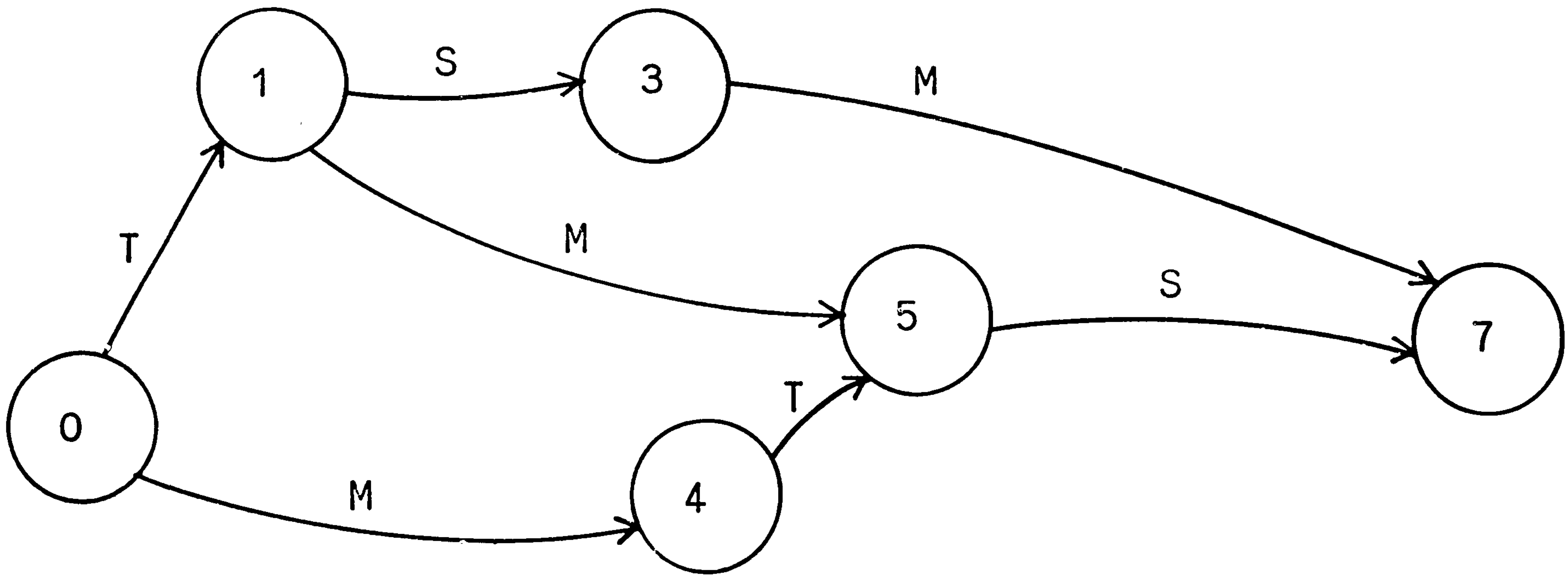


FIG. III

Importance of Common Information Networks in Improving the Quality of Global Decision Making

As mentioned in the introduction, the common belief in designing Information Systems is that no useful work can be done until objectives are stated and a decision model specified. This assumption is surely the result of experience with commercial organizations that must be well structured to survive (thus, the most likely transition path will be: 0 - 4 - 5 - 7). On the global level, however, the most promising path starts with the introduction of a common information base which, in time, will be the best catalyst to promote the acceptance of uniform models and the definition of common objectives. The most promising path here is 0 - 1 - 3 - 7, although most global systems are not expected to develop beyond class 3.

Main Issues in Developing Global Information Networks

In the previous sections, we have established the role and effect of common information in global communities which are associated with a unique object system. The question now arises as to the main problem areas where activities can be successfully defined and organized by the interested communities.

The following is a partial list of such problem areas:

1. Availability of information.

   These problems relate to the issues concerning secrecy (unwillingness to release valuable information), and to priorities (unwillingness to assign the resources to collect and make available information).

2. Storage and retrieval of information.

   These issues are concerned with introducing compatible systems on a global scale, such that regional data banks can be interrogated by outside users.

   Here, the main problems relate to standardization of data organization, retrieval languages and hardware.

3. Data transmission.

   Due to the nature of the problem, data storage will be remote from the indivudual DP's. Thus, globally compatible communication networks must be used to transmit data over long distances.

   In special cases, dedicated networks might be used, but this obviously cannot be the general pattern.

In addition to these problems, the two main issues that must be addressed before any activity can start are:

i., Identification of the community of DP's that will form the SCDP for which the information network is to be designed.

ii., Decision at an international level to provide resources for the required activities.

Summary

The analysis of systems with compound decision making processes undertaken in this paper clearly shows the need for the realization of common information networks in global communities, even in those situations when the groups accessing the information differ in their objectives.

The establishment of common information networks provides for better understanding of the object system, and leads to the acceptance of a single model of the system. In the best case, it also promotes commonality in objectives, and thus helps their realization. At the very least, however, it betters the understanding between associations of peoples of the world.

VISUALIZING THE INFORMATION FOR BETTER DECISION MAKING

by

Roger Dubon
Centre d'Études et de Recherches
Compagnie IBM France, La Gaude

Presenting data and other kinds of information to Decision Makers (DM) should be done in better ways than those to which we are accustomed today. Talks related to the implementation of International Information Networks will underline both the magnitude and nature of the expanding use of remote data terminals. It is obvious that man's ability to generate, collect, store and retrieve information, of which data is an important component, is far exceeding our ability to assimilate and use it effectively in our decision making process. There is a growing danger that vast amount of information already on hand which could have a very important bearing on Environmental Quality projects, on Pollution Control and world wide related corrective actions in general is being wasted.

An optimistic reaction to this situation is to think of better ways in which to present information to the best computer we have, namely the one between our ears. To do this, we must first appreciate what a tremendous difference there is between the input requirements of man-made computers and the human brain. We could easily demonstrate this by verbally describing a specific climatic situation and asking the listeners to try to conjure up a picture of this climatic situation in their mind. We could go on for hours giving the audience endless serial information, and the pictures the recipients would conjure in their mind will still be different from reality.

Now this is precisely the dilemma which faces DM. In order to optimize their decision, they want to form a complete and accurate picture in their mind of the complex systems (like environmental quality) or complex situations (like industrial pollution) about which they must make plans and quick decisions. But the bulk of the information on which they have to rely to form such a picture is supplied by means of the written or spoken word, i.e. in serial form.

Let us consider a table of figures describing some important features of the state of a very complex, but certainly well defined system: the air contamination over a large city. These columns of figures represent the local air pollution by combustion products of houshold heating, automobile exhausts, and industrial processes. They indicate the quantity of unburned hydrocarbons, oxides of nitrogen, carbon monoxide, sulfure dioxide, ozone, air temperature at different altitudes, humidity, etc ... The information about a changing state likely to generate a decision to call a smog alert for example is contained not so much in the figures themselves as in the relation of one figure to the others. If we want to appreciate the information contained in the figures, we have to make lots of small experiments between groups of figures, and with very much data of this kind it becomes extremely difficult to appreciate the trends with time or combination of factors using this form of presentation. The evident reason for this seems to be that we only have the capacity to read or scan a few figures at a time and we have no equivalent to the large memory of a computer in which a representation of the table of figures can be built up.

Display these figures in an alternative and quite familiar way by means of graphs, many of the trends and relationships become quite obvious at virtually a single glance and we can now perceive the whole pattern of changes at once, as on FIG.I, showing the evolution of air pollution in relation to automobile traffic.

However, we can do better than this. FIG.II for example is another, probably very unfamiliar form of

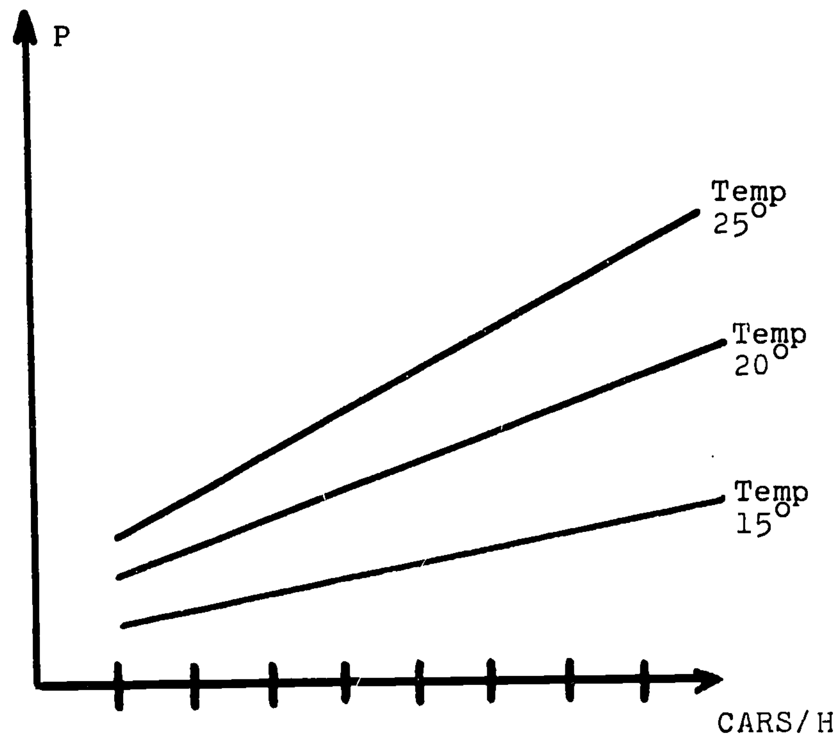


FIG. I

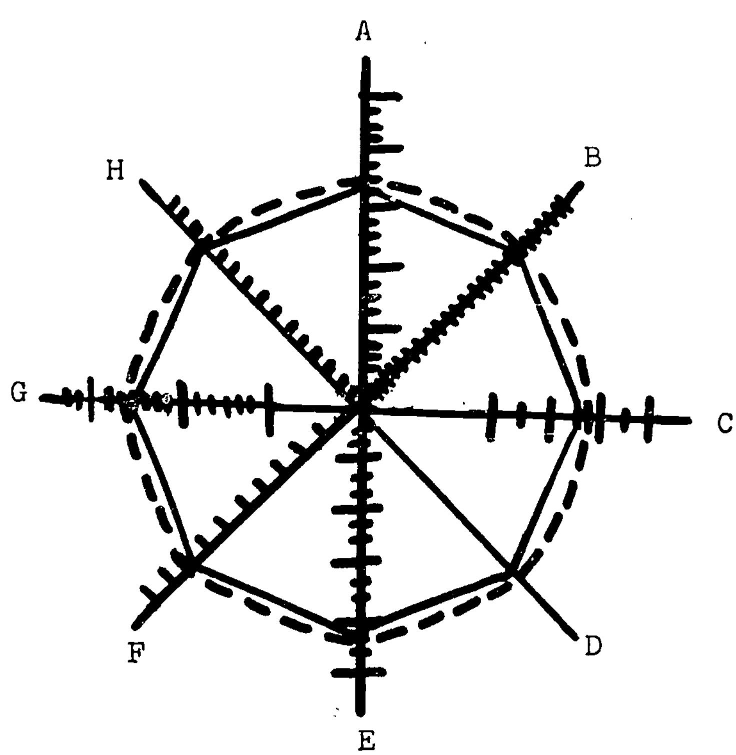


FIG. II

representation of this kind of data. It is a radial representation of a normal air situation over a given city at a given time. In this form of representation, each of the axes is a scale for one parameter, and the divisions on the scale are arranged in such a way that if the points representing the normal healthy state of the situation are joined, a regular figure results. If the situation gets out of balance or unhealthy, the regular figure becomes distorded as on FIG.III.

The decision maker in charge of pollution control can immediately see what is wrong and take appropriate corrective action. This example (FIG.III) is taken from the field of city air pollution, but all decision makers rely in effect on a diagnosis of the available measurable (one way or another) data or information.

We can therefore imagine the radials in this sort of representation, representing various parameters that characterize population growth in relation to available food supply, housing, employment opportunities,... The scales of the various radials can be of quite different kinds: linear, log, etc ... and of quite different sensitivities: zeros on the scales need not necessarily coincide with the center of the circle.

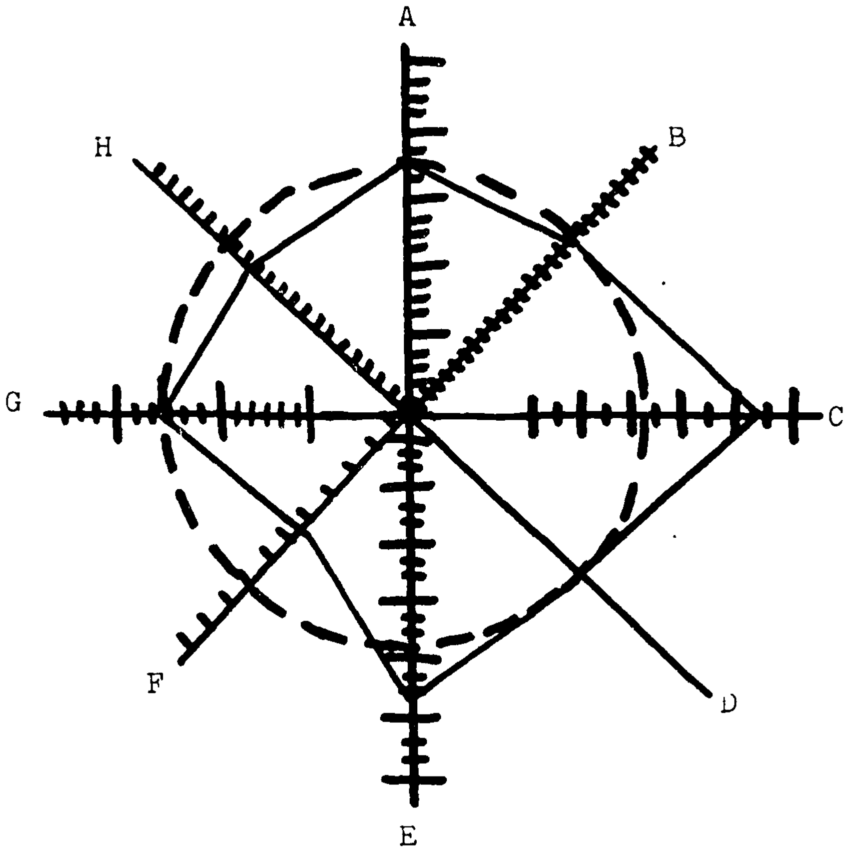
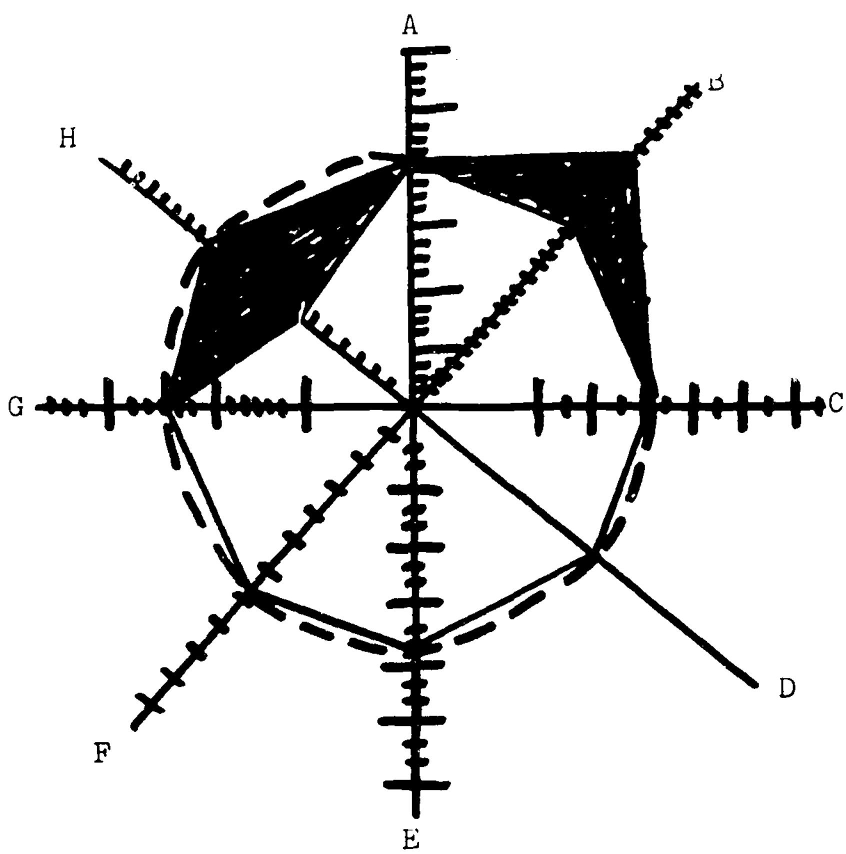


FIG. III



There are other interesting possibilities in the use of this kind of Analytical Visual Display Terminal. For what is often of more interest than a static picture of a given situation is an appreciation of how the state of the situation changes as a function of time. A representation of this kind will best be made on a Cathode Ray Tube with the display equipment connected directly to the computerized data/information banks or other sources supplying the input for the various radials. Then the time dimension could be introduced by switching rapidly between one state of the situation and another, when the persistance properties of both CRT and the human eye result in apparent thickening of the lines joining various parameters. FIG.IV.

This demonstrates in principle how we might realize a more effective communication interface between the vast amounts of information becoming available to us, and the minds that must use this information to make decisions and plans. We must simply try to extend human mental performance with our computers. The way to realize an effective international communication interface is to devise suitable representations of the information contained in the computer which take advantage of the unique capability of the human mind to receive multi-variate information through parallel inputs such as audio-visual and other sensory inputs.

It is a safe projection into the future to say that DM of the next generation or so will be equipped with such Analytical Display Terminals on their very own desks. Direct voice input, by which a man speaks to the machine in his natural voice is not a too remote reality. Written input (both printed and hand written) belongs to existing technology. And so is graphic input. The time is not so remote when three-dimensional holographic-type display will be accessible to every decision maker on a world wide basis. We can already imagine DM of the future flashing the picture of a new urban development in the middle of their office, and view all its sides by simply moving around the display ...

THE INTERNATIONAL ROAD RESEARCH INFORMATION NETWORK

by

P. E. Irick, Highway Research Board,
National Research Council, Washington, D.C., U S A.

and

P. E. Mongar, Road Research Laboratory,
Department of the Environment, Crowthorne, Berks, U K.*

This paper is mainly concerned with decision making by international parties and national groups in connection with the joint development, management and automation of an international information network and its associates - the International Road Research Documentation System (IRRD).

The IRRD system within the OECD Road Research Program is based on the sharing of the selection, abstracting, indexing and processing of published reports and articles in the field of road research and on the collection of information on world-wide ongoing research in these fields. The information contributed by a member country is made available to all member countries - Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Japan, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom. By a co-operative agreement with the International Road Federation in Washington, on-going

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research in non-member countries is made available to IRRD and vice versa. The IRRD network of 14 countries is linked through the British Road Research Laboratory (the English-language center in IRRD) to the Highway Research Information Service (HRIS) of the U.S. Highway Research Board. Within the IRRD network each center has prime responsibility for the collection of information within a specialized field and geographical region so that information is collected and analyzed only once. (FIG.I)

The IRRD aims to provide by this co-operative effort an effective system for meeting the information needs of the road research community. Two basic requirements are that IRRD works with other international and national information services and that technical advances made in the fields of communication and information science are incorporated into the system.

The responsibility for the operation and development of the scheme is in the hands of an Operational Committee consisting of a chairman and representatives from the French-language center in Paris, the English-language center in Crowthorne, U.K., the German-language center in Cologne, with two associate members representing the co-operating bodies in the U.S.A., namely the Highway Research Board and the International Road Federation.

IRRD/IRF/HRB NETWORK

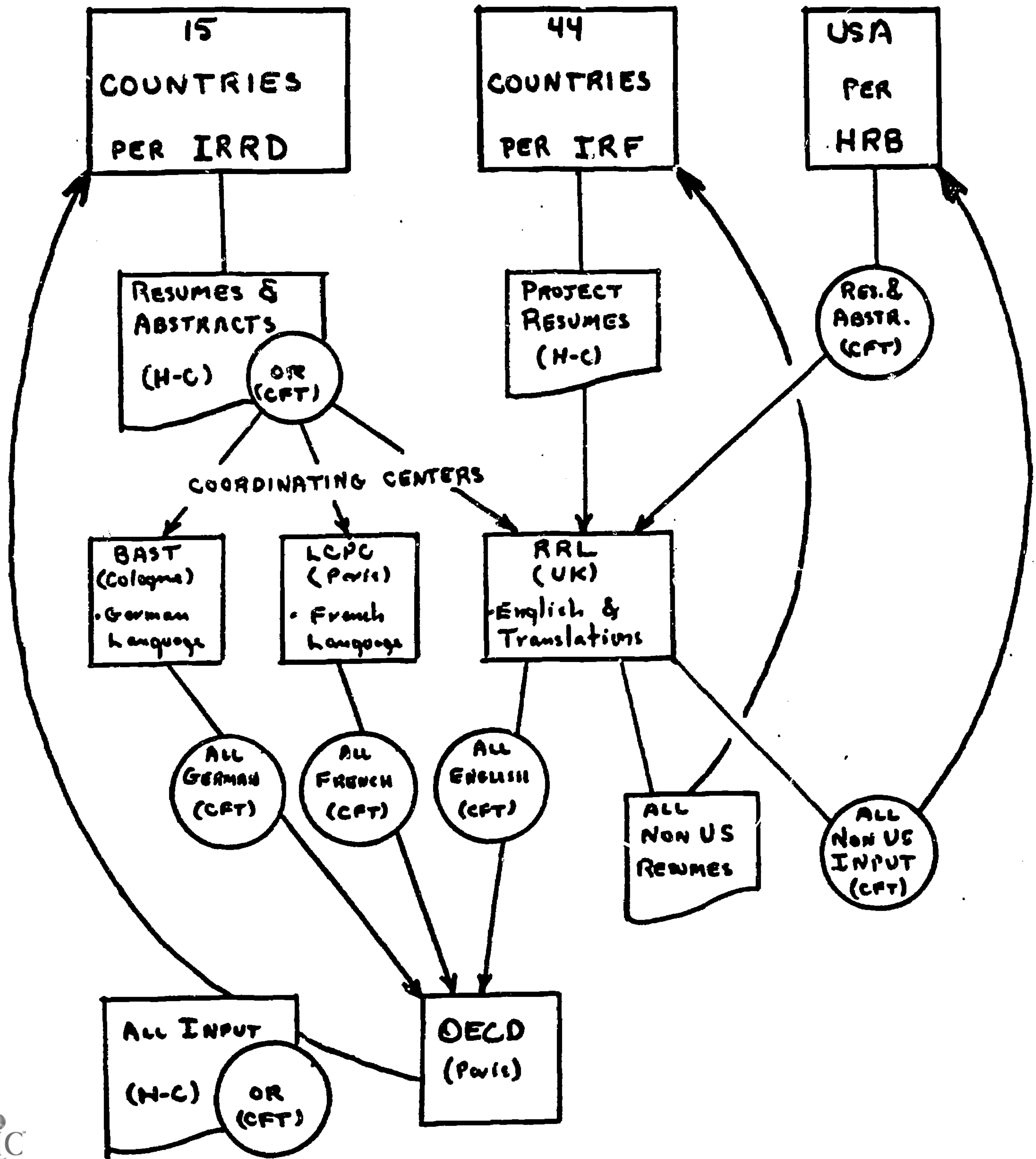

FIG. I

For an international co-operative effort of this nature to function satisfactorily, particularly from the users' point of view, it has been found necessary to define the scope of road research information both as regards subject coverage and type and level of the information to be included and to what depth. The establishment of links with similar or related networks and the requirements for these links is fundamental. In order to do this, a knowledge of the scope, capabilities and linkages of various centers and related centers is needed. In addition, it is necessary to ascertain user needs at the various network nodes.

One of the major tasks in a network such as the IRRD/HRB/IRF system is to continually bring about improvements by increased efficiency within a center - reliable selection, abstracting, classification and indexing - all accomplished within an acceptable time span.

Another effective way of improving the efficiency of the network is by increased use of communication of information in digital form, accompanied by improved communications standards. This need was addressed in early 1970 when an IRRD subcommittee consisting of the authors of this communication and Mr. W. Uhlmann of Sweden was formed.

- to assess the computer capabilities and usage of each IRRD member and associate

- to recommend an unambiguous format for the IRRD exchange medium and to provide well-defined data elements within a precise data structure

- to design an experiment to test these recommendations under operating conditions

- to recommend a procedure for the exchange of machine-readable records.

The requirements and capabilities of the centers within the network were ascertained from a questionnaire which included such questions as what data elements will be stored on computer, keyboarding procedures used, what tape files will be created, the number of retrospective searches, and details of SDI services, bulletins, indexes or other output planned from the files. The replies provided the background against which the subcommittee made its recommendations. (FIG. II).

The result of the questionnaire indicated that the facility to acquire, in digital form, material from documentation centers outside IRRD was essential, as was

IRRD CFT EXPERIMENT

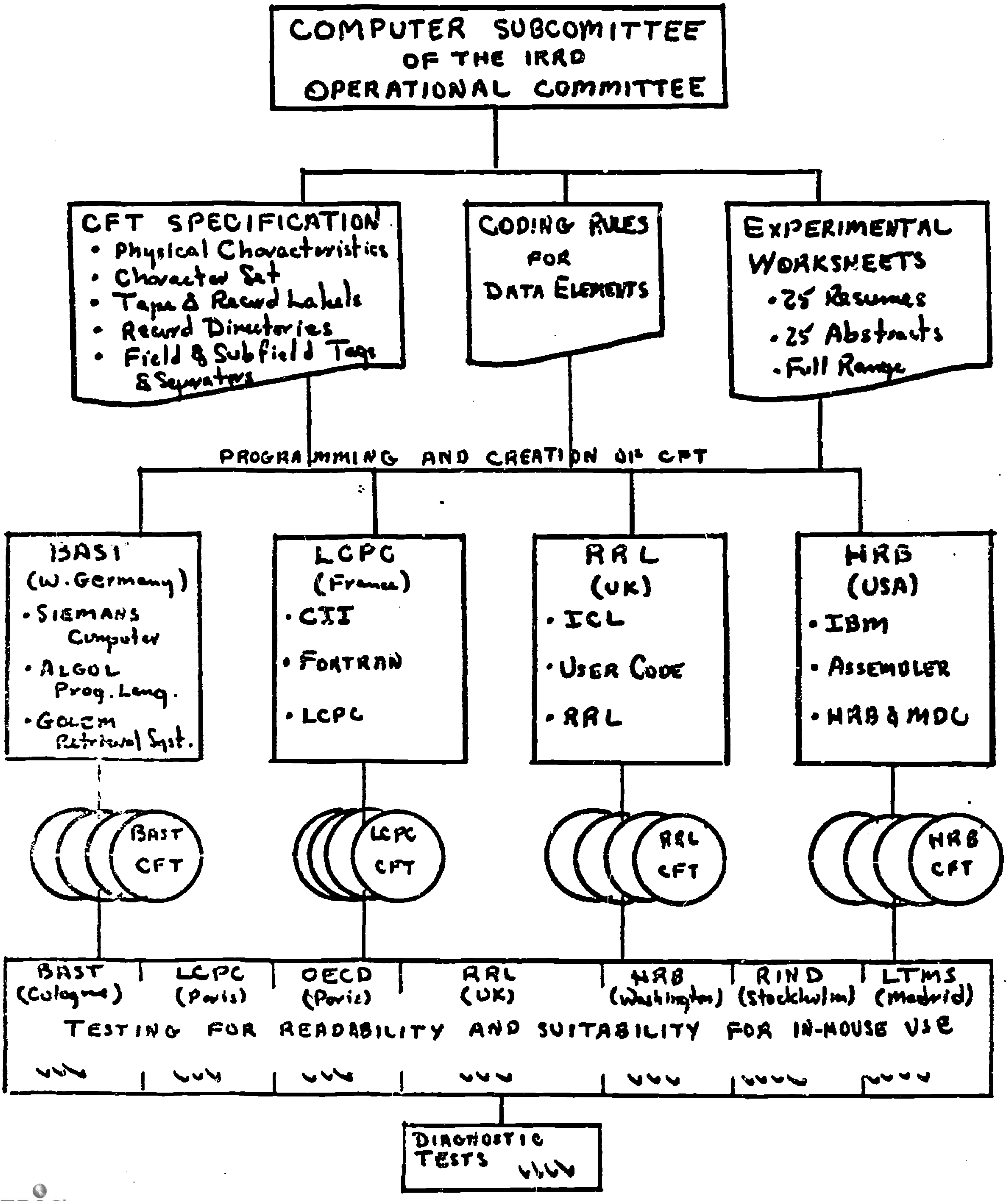

FIG. II

the need to provide easy and unambiguous access to each single data element in order to facilitate the conversion of the communications format tape into the internal processing format of each individual organization participating in the IRRD network.

To meet these needs the generalized communications format as laid down in the draft ISO standard and in BS4-74-8 has been implemented for IRRD; the implementation defines:

(i) the number of channels on the magnetic tape to be used for the information transfer

(ii) the character density on this tape

(iii) the binary code used

(iv) the character set in the representation

(v) the tape section and the meaning of each tag and indicator used

(vi) the specification of data elements, fields and subfields to which the tags and indicators refer.

The detailed specification is due to be published shortly by the Organization for Economic Cooperation and Development in Paris.

The specification was tested by four international centers (Germany, France, United Kingdom and United States) in the following way (FIG. II):

(i) fifty completed test worksheets covering the whole range of IRRD records were prepared using the IRRD coding rules specified

(ii) each center keyboarded all the test worksheets into machine-readable format

(iii) each center wrote a program to convert the machine-readable format into the IRRD cft

(iv) each center sent a copy of the cft it had prepared to the other three centers. In addition, copies of all the cfts were sent to three other centers in the network which had the facility to read the tapes

(v) each center printed out the cft received from all other centers in the form of a simple dump which was sent, with comments, to the subcommittee chairman who co-ordinated the experiment.

(vi) all four cfts were then printed out using a specially written program, in a convenient format for checking. The information was checked manually from this printout.

Although four different computers and programming languages were involved, the result showed no center had any difficulty in reading the cfts from other centers. As a result of the experiment a few modifications were incorporated in the final IRRD tape specification, in particular, the maximum block size and the procedure to be used for handling oversize blocks.

Before the tape exchange procedures, scheduled to start in January 1972, come into operation, a 4-day meeting of both information personnel and computer personnel from all IRRD member countries and associates was held. The aim of this meeting was to ensure that those responsible for information handling in the centers operating in the IRRD/HRB/IRF network understand the new procedures and the reasons for them. Training in

INTERNATIONAL ENQUIRY ON TRANSPORTATION RESEARCH INFORMATION TRANSFER

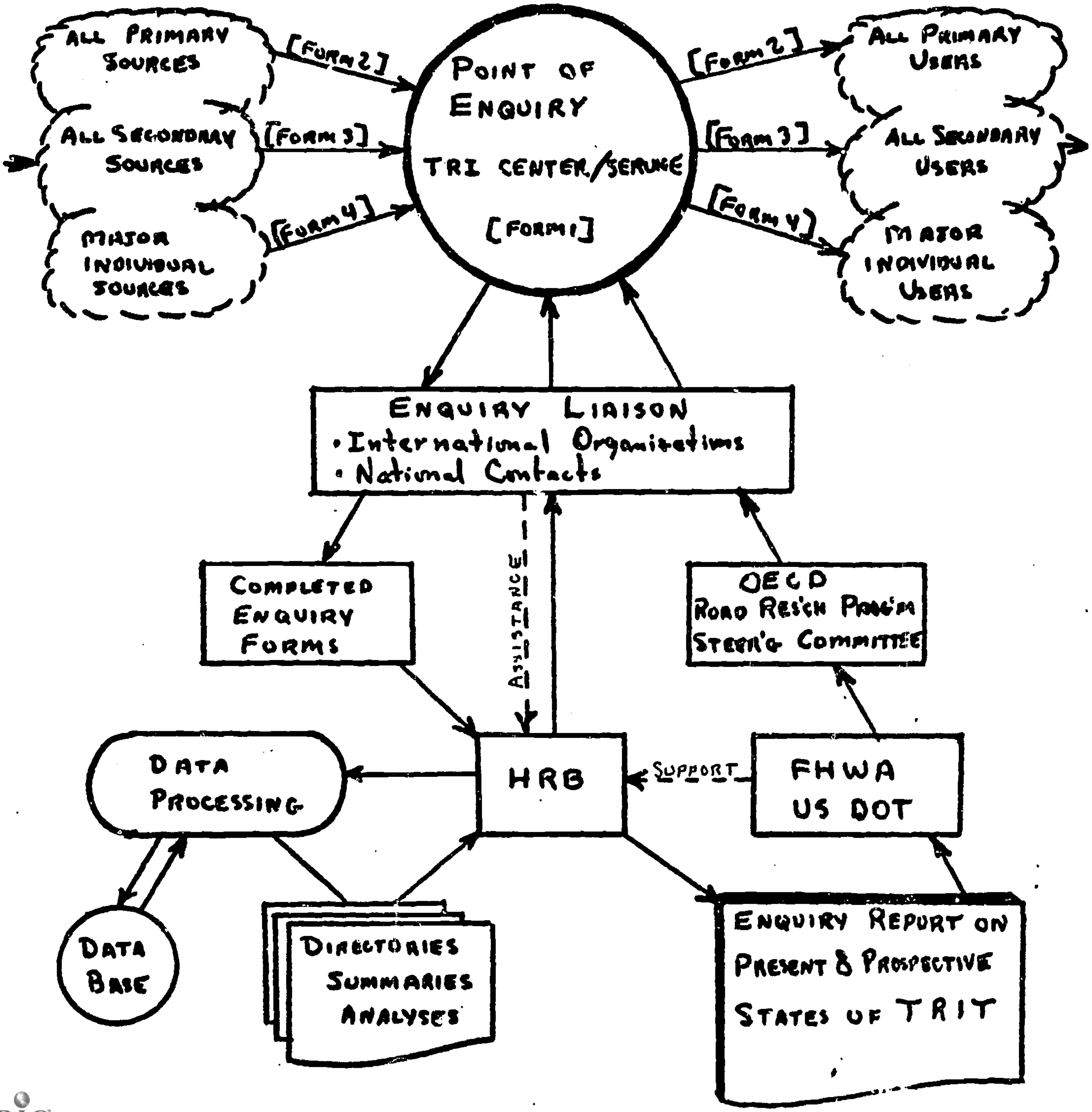

FIG. III

filling out worksheets and correctly interpreting the coding rules was included. Keyboarding requirements, programming requirements to prepare an IRRD cft, reformatting the cft for in-house retrieval systems and the generalized use of cfts were all discussed. Such sessions would seem to be essential if a specialized international network is to be an effective node in a more general information network.

The Future

The future can only be conjecture. The comments given here are the personal views of the authors on the future of the road research information network and are an expression of their personal hopes for the place that the network will play, for example, in a transportation information network linking all transport modes - maritime, railroad, air, pipelines, etc., - for example, in an environmental quality information network certain aspects of which (e.g., air pollution, noise, urban congestion) are covered by a road research information system. We would hope that the road research data base was of sufficient quality and completeness, and sufficiently standardized to provide useful two-way communication with other components of whatever transportation research information network may evolve. Those who plan, develop and evaluate transportation systems need to draw upon research information in all modes and

[illegible]ISON CONTACTS FOR THE ENQUIRY

NAME	POSITION	ORGANIZATION	LOCATION	COMMENTS *
Dr. Hermann Knoflacher	Head of the Traffic Engineering Department	KfV: Kuratorium fuer Verkehrssicherheit	AUSTRIA: Vienna III Olteltasse 3	Austrian Delegation to OECD
Mr. Szondi	Deputy Advisor	Ministere des Communications et des Postes, Telegraphs et Telephones	BELGIUM: 62, rue de la Loi, Brussels, 4	RRPSC
Mrs. Ceulemans	Head of Documentation Service	Fonds d'Etudes et de Recherches sur la Securite Routiere	BELGIUM: rue du Government, Provisoins 14, 1000 Brussels	Nominated by RRPSC
Mr. R.W. Boyes	Research Engineer	RTAC: Roads and Transportation Association of Canada	CANADA: 875 Carling Ave., Ottawa, Ontario	Nominated by RRPSC Member G.D. Campbell
Prof. U. Severi Valtion	Director	Teknillinen Tutkimoslaitos Teilaboratorio	FINLAND: 02150 Otaniem	Nominated by RRPSC
Mr. Pietri	Secretary General	IRT: Institute for Transportation Research	FRANCE: B.P.28, Arcueil - 94	Nominated by RRSPC member M. Frybourg (IRT)
Dr. Ing. [illegible] Kubler	Deputy Director	BAST: Bundesanstalt fuer Strassenwesen	GERMAN FEDERAL REPUBLIC: 5 Cologne 51, Bruehler Strasse 1	Member of RRPSC
Mr. J. [illegible]	Research Officer, Road Traffic Section	An Foras Forbartha	IRELAND: St. Martin's House, Waterloo Road, Dublin 4	Nominated by RRPSC
Dr. [illegible]	Head of the Department of Documentation	Netherlands Foundation for Transport Sciences	NETHERLANDS: Koningin Emmaplein 6, Rotterdam	Nominated by RRPSC
Mr. [illegible] Johannessen	Director	Institute for Transport Economy	NORWAY: Stasjensveien 4, Slemdal, Oslo 3	Nominated by RRPSC
Mrs. [illegible] Aida [illegible]	Technician	Cabinet for Studies and Planning of Ground Transportation	PORTUGAL: c/o La Delegation du Portugal, La Commission Interministerielle de Coop. Economique Exterieure, Lisbonne	
Mr. Nils Bruzelius	Director	Statensvaginstitut	SWEDEN: Drottning Kristinas, Vag 25, Stockholm	Member of RRPSC
Dr. [illegible]	Director	Planning Section, Federal Office of Transportation	SWITZERLAND: Bundeshaus Nord, 3003 Berne	Swiss Delegation to OECD
Mrs. [illegible]	Head of Library and Technical Information Service	RRL: Road Research Laboratory, Department of Environment (DOE)	UNITED KINGDOM: Crowthorne, Berks, RG11 6AU	Nominated by RRPSC (Chm. J.D. Lyons (DOE)
Dr. [illegible] Cleven	Associate Administrator for Research & Development	Federal Highway Administration, U.S. Department of Transportation	UNITED STATES: Washington, D. C. 20590	Member of RRPSC, Sponsor of International Enquiry
Mr. [illegible]	Secretary General	ECMT: European Conference of Ministers of Transport	35 rue de Franqueville Paris 16e, France	Contact for ECMT assistance
Mr. R. O. Swain	President	IRF: International Road Federation	1023 Washington Building Washington, D. C. 20005	
Mrs. [illegible]	Head, Road Research Secretariat	OECD: Organization for Economic Cooperation & Development	2 rue Andre Pascal Paris 16e, France	Contact for RRPSC assistance
Mr. [illegible]	IRRD Administrator	OECD: Organization for Economic Cooperation & Development	2 rue Andre Pascal Paris 16e, France	Contact for IRRD assistance
		PIARC: Permanent International Association of Road Congresses		
Mr. [illegible]	Director, Documentation Bureau	UIC: International Union of Railways	27 Rue de Londre Paris 9e, France	
Mr. Andre J. Jacobs	Secretary General	UITP: International Union of Public Transportation	19 Avenue de l'Uruguay B-1050 Brussels, Belgium	

* RRPSC = OECD Road Research Program Steering Committee

FIG. IV

would, therefore, benefit from such a network. It has been said that transportation systems can be no more effective than are the information systems upon which their development and operations must depend.

At the present time an international enquiry is being conducted towards determining the current and prospective status of transportation information transfer throughout the world. It is expected that the results of the survey will be available by the end of 1972, and that they will help point the way to improved global transfer of research information over the entire field of transportation (FIG. III and FIG. IV).

It is our view, however, that the organized and sustained cooperation of people is the crucial element for successful networking. We believe the road research experience has shown that this element is both necessary and sufficient for bringing about improved information transfer.

INFORMATION NETWORKS - SOME OBSERVATIONS ON POSSIBLE FUNCTION AND STRUCTURE

by

H. F. Dammers
Shell Research Ltd, Sittingbourne Laboratories,
Sittingbourne, Kent, England

The following comments are based mainly on experience relating to information use/transfer in an industrial research environment. Although this might be considered a rather restricted vantage point it is felt that the relevance of the views presented is likely to extend well beyond the area, which provided the incentive to generate them.

1. The Magnitude of the Network Problem

1.1 In proposals/discussions concerning the development of information networks perhaps too much emphasis tends to be placed on the problems involved in handling/searching very large databases. In fact if one looks at the function of information and its supply in real life situations it does not seem likely that we will need greatly increased access to very large databases. We are more likely to see systems operating in the manner of "distributed networks", in which the predominant part of information searched will be dealt with in peripheral nodes.

1.2 The assumption of information networks requiring heavy transmission loads and frequent access to very large databases has also made it appear doubtful whether computer operated systems will be operationally and economically feasible in the near future. Again this view does not appear to be justified if one considers the possibilities available now to implement distributed network facilities.

1.3 In fact the present paper attempts to argue that effective networks might be developed in an evolutionary manner and with an economically acceptable effort from facilities which are basically available now.

2. The Role of Information

2.1 One might take as basic premise, the one outlined by Emery, that information is only of value if it leads to useful action. Storage and retrieval per sé is of relative minor importance. It is what one can do with the information, its relevance to decisions/actions required, that matters.

2.2 The great majority of decisions can be made on basis of information readily available locally (local might mean e.g. in the case of an international organisation its headquarter and associated facilities/offices) i.e. the decisions/actions are governed in essence by 'ad hoc' interpretation of information collected and digested (e.g. in reports) within the organisation.

2.3 At the point of decision-making extraneous novel information perhaps only rarely plays a dominant role. Important decisions probably depend mainly on conjecture regarding likely future trends. One might perhaps say that they arise from the interaction of clusters of relevant topical information.

2.4 It is also worth noting that specific information, not readily accessible at the point of decision, can more often than not be generated, inferred from information that is readily available.

Related to this is the observation, made by Kitson in connection with military intelligence, that a significant collection of information even if of relative low direct relevance can, given suitable means of evaluation, often have a much greater value in prediction and decision making than a few items of high relevance.

2.5 New information, such as current published literature in the case of a research laboratory, in its formalised presentation, is by and large perhaps only of peripheral importance in action/decision making, except, may be, in the dissemination industry (news media) itself.

2.6 The role of current awareness facilities is perhaps mainly to reduce uncertainty (the user feels more confident that he knows what is going on in his field of interest) and much less to act as an incentive to action.

The slender evidence available also tends to suggest that improved current awareness facilities (SDI) tend to reduce the need for retrospective searches. The latter might be seen, in part, as a response to perceived uncertainty.

2.7 Where instant information is vital (e.g. in the case of military defence systems, stock market operations, police action, air line reservation), one tends to have special-purpose information systems. One might suggest though that even in the area of emergency events potential predictability tends to be rather high i.e. one is likely to be faced with a limited set of choices for which one can organise oneself and be prepared for action.

2.8 By and large then it would seem justified to conclude that information used for action tends to be drawn from rather specific sets of data/information held at and relevant to the actions/decisions taken at the location concerned.

3. Information Supply

3.1 The above suggests that at each decision point (location where decisions are taken) one is likely to need (and have) a continuous input of information relating to the part of real life events that is relevant to the type of decisions taken at the location concerned. The information may be arranged in packages (files) each clustering around a given topic. The number of clusters involved in, relevant to, a decision will tend to increase with the importance of the decision.

3.2 Each of the clusters will need pre-processing, pre-digestion to a varying degree to be really of use in meaningful decisions. To take a simple case: in order to arrive at a well-considered decision on e.g. the choice as regards salary level for a new employee, one might like to know, not only what the current salaries are for employees in the same grade and age group, but also how the salary level has shifted with time and may shift in the future, what deviations there are at present from the norm, how the salary level compares with that in other companies etc. The information files held by the personnel department at a specific location should allow such type of enquiry to be dealt with. This need to provide relevant information in a cluster of related and/or derived information would appear to be essential in virtually every instant except perhaps in very simple control situations.

3.3 Taking as example of a modest size organisation e.g. a research laboratory, with a staff say in the range 500 to 700, one might find perhaps 200 to 300 topical files (often in the shape of private indexing and filing systems) to exist. The size of files of this type is likely to be of the order of $1\text{-}5.10^6$ char. Each of them could be maintained as a magnetic tape file and updated among others via screened SDI output. The total volume of information held in such files might amount to around 1.10^9 char. (including significant redundancy due to overlap between files).

3.4 The laboratory, if it were to deal with e.g. research on agricultural chemicals, would also have a large collection of subject-oriented files dealing with e.g. agricultural chemical literature, with collections of data on chemical structures examined, test data, spectra collection, files on relevant patent information etc., etc. Each of these would be regularly updated with information either screened from large databases, available extramurally, and with information generated via the research activities within the organisation.

The information in such files collectively might again amount to ca. 1.10^9 char.

3.5 It is of interest to compare the size of the collections mentioned with that of a conventional library which for an organisation of the type in question might amount to $1\text{-}5.10^{10}$ char. The highly relevant part in such a library (ca. 10%) would appear to amount to roughly the same volume as the file collections mentioned under 3.3 and 3.4.

3.6 The above suggests that one can make valid assessments of the volume and type of information relevant to and frequently used by a given organisation.

4. Network Function, Structure

On basis of the foregoing observations one might outline the possible structure of a computer-operated information network.

4.1 The network is likely to contain global subject- and mission-oriented information centres (of which the the Chemical Abstracts system may be a valid example); they are likely to be associated with national or regional sub-centres, each of which may be less comprehensive than the global centre. Updating of the sub-centres might take place periodically via direct transmission because the economy and convenience of this will eventually lead to replacement of the present use of information carriers such as magnetic tapes.

4.2 In addition there will be in the network a number of specific information/data centres e.g. in the case of chemistry dealing with crystallographic data, spectrographic data etc. Others may deal with economic data, legal information, educational information, business statistics etc.

4.3 At the level of the specific organisation, specific decision points, one would have files of the type indicated under 3.3 and 3.4 which we might call "user" or "location" files. They would be linked with e.g. a wider company information network as well as with the various national information networks (and via this with the global systems). They would be regularly updated by incorporating:

4.3.1 relevant information from main databases generated and maintained at a higher level (selection of relevant information e.g. via SDI)

4.3.2 internally generated information
(e.g. research data, business data)

4.3.3 user information.

4.4 The user/location files are seen as the major databases for local decision making and associated information needs. They need to be organised such that they can readily be reordered, indexed to suit changing user needs, thus providing a source of information pre-selected and continuously adjusted to meet local information/decision needs.

Most of the need for retrospective queries might be met by such files and perhaps only 1-2% of the total volume of queries needs to be passed on to a higher level in the network.

4.5 Current awareness might mainly be satisfied via SDI operations using externally supplied databases; the screened output thus obtained would serve as input into the user/location files.

4.6 In more ways than one the network bears a fairly close resemblance to the type of distributed computer network now coming to the fore in the case of e.g. data processing associated with laboratory instruments.

In this case one may have e.g. a spectrometer linked with and controlled by a small dedicated computer, which in turn is linked to a larger laboratory/data acquisition computer (for additional control & processing), this again linked to a local computer (mainly for storage/file processing purposes) and thence to a large computer (for some of the number-crunching required). Each part would play an essential role in the total process, the various tasks being distributed such that for each optimum cost/performance can be achieved. It is worth noting though, that most interaction/traffic is likely to be at the lowest level i.e. between instrument and dedicated computer.

5. Technology Needed

5.1 For the gradual implementation of a distributed network along the lines indicated the basic hardware, albeit not ideal, appears to be readily available at an acceptable cost.

In most cases magnetic tape storage, although cumbersome, should be adequate at least to start with, permitting a very low cost, as far as storage medium is concerned, per user served (ca. £10).

Computer networks enabling the type of networking outlined are operational and proven, if not ideal.

5.2 The situation is perhaps less promising with regard to the "software" required. A necessary corollary to the system outlined are suitable economically viable automated methods of information analysis, performing functions similar to those we apply in the case of numeric processing. (statistical analysis, simulation, pattern recognition etc). It would seem essential that the analysis of the information maintained in the user/location files, be done on a continuous basis and not 'ad hoc' when a decision is required.

5.3 The need to provide direct access to very large centralised facilities may well prove to be modest, hence operational implementation problems may be less severe than generally believed.

Overall it would seem that a distributed network approach of the type outlined should be capable of implementation in a manner economically competitive with existing systems.

5.4 It does not appear too difficult to work out concrete, quantified examples with reference to specific situations.

6. Conclusion

6.1 The distributed network approach outlined is one in which use/traffic tends to be predominantly associated with the peripheral (lower-level) nodes. At the periphery it will have large numbers of user/location databases, each of which is continually updated, enriched, modified and analysed/evaluated in interaction with the decision situation pertaining, or, if the topic is no longer alive, abandoned.

6.2 It is likely to be a very dynamic system, characterised by a high degree of decentralisation but also by continuous interaction at the periphery with users on the one hand and the more central nodes on the other.

6.3 Perhaps such an information system might eventually shape events i.e. decisions would naturally follow from information available rather than emerge on an 'ad hoc' basis. However, given human nature this may and perhaps should remain a pipe-dream.

frog making a global decision. {i.e. "Do I kick it, or do I prick it?"}

Global Decision Making, informally interpreted
by one of the true pioneers of information science,
Robert A. Fairthorne.