

FACILITATING THE NETWORKING PROCESSES OF
A TRANSNATIONAL UNIVERSITY
USING COMPUTER CONFERENCING.

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(Paper prepared for the 2nd Planning Meeting of the
GPID Project of the United Nations University Human
and Social Development Programme, Geneva, Jan.1978)

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INTRODUCTION

The purpose of this report is to attempt to identify how the technique known as computer conferencing (*) could prove of considerable significance to the operations of a transnational, trans-disciplinary university network. There are several examples of such networks. The clearest is the United Nations University which is being deliberately based on a world-wide network of national and regional institutes. A very different example is the network of institutes which make up the International Federation of Institutes of Advanced Studies. And another extreme is represented by the proposed Free International University for Creativity and Inter-disciplinary Research. The above examples are network based and are therefore quite different from the many "international" universities, including the European University Institute (Florence) and the College of Europe (Bruges). The Inter-University Centre of Postgraduate Studies (Dubrovnik) is however an intermediate case in that it is geographically centred but dependent on an international network of university institutes (**) (***)

This report is therefore primarily concerned with the genuinely transnational and transdisciplinary networks and not with geographically centred institutes, nor with national university networks such as Educom in the USA, nor with interesting national experiments such as the Open University in the UK. Of special interest are those networks which attempt the difficult task of balancing, in both

(*) See Transnational Associations, 1977, 10, special issue, 1977, 12, pp.

(**) Another intermediate case of historical interest is the first, although short-lived, International University established in Brussels in 1920 on the initiative of the Union of International Associations. Its peak membership comprised 15 universities with 346 university professors from 23 countries, supported by 13 international associations and the League of Nations which each had special Chairs. Courses were given for three sessions (1920-1922) to permit students "to complete their training through initiation into the international comparative aspects of all great problems".

(***) The use of computer conferencing at a single meeting location is described in a separate report (Enhancing communication at a large conference/festival. Transnational Associations, 1977, 12). Despite its possible interest to a transnational university, it is not discussed in this paper.

their conceptual and operational concerns, the constraints and challenges of the North-South and East-West influences encountered in facing up to the problems of the world.

Problems of transnational, transdisciplinary operations

The special problems of such operations may be grouped as follows (without attempting to establish their relative importance):

1. Problems of geographical distance

- a. Physical distance : The inter-continental dispersion of participating bodies and individuals has a major impact on the operation of the network by inhibiting the movement of people, resources and concepts. Although this may in part be disguised by gathering people together at national or regional centres (or for periodic meetings) this may only represent a change in kind of the problem - for intra-national and intra-regional distances may be very great (and not necessarily less costly in air travel terms, because of peculiarities in ticket pricing).
- b. Time delays : Even when it is only a question of movement of documents or audio-visual materials, the postal delays of up to several months may severely inhibit maintenance of adequate contact within the network.
- c. Finance : Both the preceding problems may be solved by increased funding for air travel and airmail postage. However in practice the cost is prohibitive and can only be justified in the case of certain key individuals and documents (and even then it is questionable whether their movement around the network does more than increase awareness of the conceptual constraints imposed upon those who do not have such privileges).
- d. Time zones : But even when there is no financial constraint on telephone or tele-satellite contact, the mismatch in time zones may make regular use of such real-time solutions impractical.

2. Problems of cultural differences

- a. Language : The assumption that the use of English resolves the language problem is only credible to those whose mother-tongue is English and who are thus insensitive to linguistic imperialism, the conceptual pitfalls of monolingualism, and the problems of concept transfer to and from other languages. These difficulties must be faced in a transnational network, part of whose function is to make use of such diversity.
- b. Shifts in values and priorities : Subtle differences in perspective of this kind around the network may undermine efforts at establishing consensus, at maintaining collaboration, or even at developing communication. Furthermore, it is only too easy to encrust a different conceptual stance with stereotyped perceptions and prejudices concerning people of the culture in question. This inhibits healthy development of the network. Such difficulties are aggravated by the above-mentioned constraints on communication.
- c. Behavioural modes and preferences : The Western academico-administrative style adopted by the international community is associated with certain working habits, meeting processes, attitudes towards the use of time and space (*), and preferred methods of presenting information. There are differences in other cultures whose significance for the operation of a transnational network it can be unwise to neglect.

3. Development-related inequalities

- a. Equipment : The style of academic work possible in industrialized countries, because of ready access to telephones, document reproduction equipment and computers, is not necessarily matched in developing countries or in poorly funded institutes in the network.
- b. Education : It is a function of a transnational university network to be comprised of institutes of differing educational levels and standards. Any assumption concerning the desirability of some uniform standard of excellence raises issues which it is the purpose of the network to resolve.
- c. Funding : the difficulties created by financial constraints, and the differences around the network in the relative budgetary importance of the same items or services, require no comment.

(*) E.J.Hall. The Hidden Dimension. New-York, Doubleday, 1966

- d. Status : Since the image and status of an institute is quickly linked to its equipment, educational level, and funding, special difficulties of communication arise between institutes where there is an awareness of such differences in status.

4. Institutional barriers

- a. Administrative difficulties : The administrative structure and procedures which a particular institute has acquired or inherited may render communication between institutes on substantive and conceptual matters secondary to fulfillment of procedural requirements or other behavioural norms. (It is not unknown for some communications between UN agencies to require approval from 3 or more levels of the bureaucracy - even for long-distance phone calls).
- b. Government monitoring : Government agencies of many countries, in which it is desirable that the network should have an associated institute, expect to have the right to monitor communications (whether directly or indirectly) to and from such an institute. Any attempt to avoid this may result in an increase in the administrative barriers discussed above.
- c. Customs, tax and exchange control : Although apparently trivial, such difficulties can severely inhibit the movement of documents and resource persons.
- d. Professional difficulties : The movement of persons between institutes in the network can be indirectly but severely inhibited by the attitude adopted towards such activity by the professional or faculty group either in the home-country or in the receiving country.

5. Multiplication of interlocking perspectives

The operation of the network is considerably complicated by the need to maintain its relevance to those oriented towards :

- pure ("value-free") research
- applied research
- undergraduate education
- postgraduate education
- training / briefing officials
- political relevance as an instrument which through its operations diminishes North-South and East-West inequalities.

- policy significance for action programmes by the international community.

6. Personal idiosyncracies

It is appropriate to note the difficulties in communication which may arise because of a person's relative slowness of thought, verbal habits, physical handicaps, or any other characteristics which may trigger unconscious prejudices.

Problems of interdisciplinarity (*)

Today most scientists are acknowledged as specialists, for whom it is legitimate to know progressively more and more about less and less. As Harold Linstone note (**): "When a group of prestigious future-oriented inter-disciplinary scientists meets, the result usually fits the words of novelist Arthur Koestler :

The moment you put them together in a conference room, they behave like schoolboys performing a solemn play ... each of them possesses a small fragment of the Truth which he believes to be the Whole Truth, which he carries around in his pocket like a tarnished bubble gum, and blows up on solemn occasions to prove that it contains the ultimate mystery of the universe. Discussion ? Interdisciplinary dialogue ? There is no such thing, except on the printed program. When the dialogue is supposed to start each gets his own bubble gum out and blows it into the other's faces. Then they repair, satisfied, to the cocktail room". (The Call Girls. New York, Random House, 1973).

Georges Gusdorf, in an exceptional survey of interdisciplinarity for the French-language Encyclopaedic Universalis comments on the obstacles to interdisciplinary knowledge :

- an apistemological obstacle, arising from the inexorable process of discipline subdivision and divergence ;
- an institutional obstacle, in that teaching and research institutions reinforce the above separation through administrative procedures which tend to eliminate communications with institutions associated with other disciplines ;
- a psycho-sociological obstacle, the division of intellectual space into ever smaller compartments and the multiplication of institutions assuming the management of each such territory results in the formation of a feudal system (he also uses the term epistemological capitalism) which governs the majority of scientific teaching and research enterprises ;
- a cultural obstacle, whereby the separation between disciplines is aggravated by the separation between cultures, languages, traditions and their associated mentalities - to the point that science itself is a typically western phenomenon.

Gusdorf also notes the existence of various kinds of false interdisciplinarity.

(*) Extracts from the introduction to "Integrative, unitary and transdisciplinary concepts "In : Yearbook of World Problems and Human Potential". Brussels, UIA/Mankind 2000, 1976.

(**) Harold Linstone. Communications ; the planner's predicament. (Paper to Rome Special Futures Research Conferences, 1973)

Computer conferencing

It is not possible to give a comprehensive description of computer conferencing in this report. This has been done in a collection of papers (*) which should be read in conjunction with this outline of its relevance to the operation of a transnational university. A brief description given therein by Murray Turoff is as follows :

At its simplest level, computer conferencing is a written form of a conference telephone call. Using a computer terminal, a person can talk to a group of people by typing messages and reading, on a display screen or a printout, what the other people are saying. The computer automatically informs the group when someone joins or leaves the discussion. When a person signs off, the computer marks his location in the discussion and picks up at that point when he rejoins the conference. Computer conferencing differs from verbal communication in some very important ways. People engaged in computer conferencing can be both geographically and chronologically dispersed. In computer conferencing, everyone may « talk » or « listen » at the same time. A person can make his contribution to the discussion at his own convenience, rather than having to wait until other speakers have finished. He can work at his own pace, taking as much or as little time

as he needs to read, contemplate, or reply. He can « leave » the conference at any time, knowing that the computer will store all of the messages that he has missed and show them to him whenever he is ready. Each message is assigned a number and labeled with author, date, and time for easy identification and retrieval. Computer conferencing is a truly self-activating form of communication.

The fact that input can be anonymous leads to more open and uninhibited discussions, particularly in the case of someone who would otherwise be hesitant to disagree with a superior. The results of votes are presented only as distributions and there is no way to determine who voted which way on any particular issue; in addition, a conferee can change his vote at any time. During the computer conference, individuals may « whisper » to one another by exchanging private messages which are not part of the permanent record of the conference; the other conferees are not even aware that these exchanges are taking place. This whispering capability, by making possible timely

subgroup negotiations and discussions, can lead to more rapid resolution of important issues. The printout capability provides a permanent record of the proceedings and insures against someone being misquoted. It is possible to retrieve information without going through the entire text; you might want to see all messages containing key words or the input of a particular person.

Computer conferencing puts unique psychological pressure on a person whose messages tend to be verbose,

irrelevant, or filled with bureaucratic jargon he will soon notice that no one is paying any attention to his messages. In a face-to-face conference, people have to give an appearance of listening to the speaker, but there is no way you can force a guy to read your messages on his computer terminal. One other important point I should make is that computer conferencing is the most efficient way to handle large group discussions involving 25 or more people and should be considered any time more than five people are discussing a subject. A conference telephone call begins to get difficult with more than five people, and face-to-face meetings encounter problems when more than 15 people are involved.

Feasibility

The feasibility of using computer conferencing may be usefully examined under the headings of hardware, software, data networks, data bases, facilitative systems, cost and demand.

Hardware : Computer terminals are now increasingly common and it is expected that they will soon become standard office equipment at about the cost of a colour TV set. (Note the sudden rise in the availability of hand computers and the drop in their cost).

Software : A number of software systems have been developed and are in regular use. Examples are : PLANET/FORUM, CONFER, EXIES. A new

(*) Transnational Associations, 1977, 10, special issue.

generation of software is being tested by user groups under a grant from the U.S. National Science Foundation.

Data networks : Intra-continental and inter-continental data networks (required to link terminals) are now multiplying. Examples of government sponsored networks are : EURONET, SCANNET, ESANET. Examples of commercial networks are : TYMNET, TELENET. Many networks are in operation world-wide for specialized services : finance, meteorological data, technological know-how, etc.

Data bases : By mid-1978, it has been estimated that around 100 data bases will be available on line through EURONET. The Lockheed data base service currently provides several thousand customers world-wide with instant access to 15 million abstracts of reports and journal articles in science, technology, social science and business. A number of UN Specialized Agencies have developed, singly or jointly data bases : INIS, AGRIS, DEVSIS, SPINES, ASFIS. Access to such data bases is important to the operations of a transnational university. Over 400 already exist in Europe.

Facilitative systems : The UNESCO-based World Science Information System (UNISIST) has been created to facilitate access to information, especially via computer-based systems.

Cost : There are a number of distinct cost elements to be considered. A recent overall estimate gave the cost of operating a multi-conference computer system on a nation-wide data network in the USA as :

- \$ 8.00 per hour per person (with 300 participants)
- \$ 5.00 per hour per person (with 1000 participants).

Some of the cost elements are expected to decrease. Others can be avoided under certain circumstances (*)

Demand : Examples of the use of computer conferencing by international organizations have been given (*). Taking the demand for on-line access to data bases as an indication of an orientation towards computer conferencing, the rate of on-line queries increased by a factor of 10 in the USA in a recent 3-year period to 1 million per year. It is estimated that by 1980 there would be a user demand in the European Community for 2 million queries per year, doubling to 4 million by 1985.

The above points suggest that the necessary information infrastructure for a transnational university exists. The only difficulty arises with the need to ensure appropriate interfaces for those without the more technologically sophisticated forms of access.

(*) See : Transnational Associations, 1977, 10, pp. 446 and 447.

CATEGORIZATION OF INTERNATIONAL
INFORMATION SYSTEMS AND PROGRAMMES

Table 1

SCOPE FUNCTIONS	SECTORAL SYSTEMS	MULTIDIS- CIPLINARY SYSTEMS	MANAGEMENT CO-ORDINA- TION SYSTEMS
- STORAGE	AGRIS ASFIS * INIS ISONET	DEVISIS * (I) IRS DARE	ISDS *
- RETRIEVAL	ARKISYST * CARIS * (I) INDIS ISIS (ILO)	DEVISIS * (II) GEMS * MEDI * POPINS *	CORE WDRS *
- ANALYSIS AND SELECT- IVE DISSEM- INATION	AOE CARIS (II) INPADOC SDI WHIS WWW	SPINES * DRS	ISIS * (CES) WISI *
- CONCEPTUAL FUNCTIONS	CIS IIS	CLADES IDCHEC	UNISIST

* Systems being planned or under development.

We have presented above a large number of international information systems, classified into types from the pure specialized type system (e.g. INIS) to the multi-disciplinary cross-sectoral type systems (e.g. SPINES) and the management co-ordination type systems such as CORE. However, it must have been apparent to the reader that the systems described are highly heterogeneous, both in respect of their mode of operation and in their level of development and their degree of achievement or success. Some systems are largely computerized or are planned to be for example CARIS and INDIS, while others are plain documentation services using traditional methods of storage and dissemination for example CLADES. Even the fact that systems are computerized does not tell much, because they might be using computing methods at different levels of sophistication. For instance INIS is accomplishing a quite straight forward storage, updating and editing of abstracts in the nuclear field, while the ISIS project of the CES is becoming a quite sophisticated system, incorporating data analysis and modelling functions. Thus, it seems important to try to differentiate systems in some way along a dimension going from a simple storage function to a sophisticated set of functions, including conceptual tasks, such as complex documentary search. Along these lines, we have attempted to break down the systems into four levels of systems sophistication. We have also added a few other international systems, such as the ISIS system of the International Labour Office and the WHO Information System (WHIS), as illustrative and pertinent examples.

- AGRIS Int. Inf. System for Agricultural Sciences and Technology (FAO)
- ASFIS Aquatic Science and Fisheries Inf. System (FAO)
- INIS Int. Nuclear Inf. System (IAEA)
- ISONET Int. Organization for Standardization Inf. Network (ISO)
- ARKISYST Int. Inf. System for Architecture (UNESCO)
- CARIS Current Agricultural Research Inf. System (FAO)
- INDIS Industrial Abstract Inf. Service (UNIDO)
- ISIS Integrated Scientific Inf. System (ILO)
- AOE Inf. Service on Industrial Equipment and Technologies (UNIDO)
- INPADOC Int. Patent Documentation Centre (WIPO)
- SDI Selective Dissemination of Inf. Service (UNIDO)
- WHIS World Health Inf. System (WHO)
- WWW World Weather Watch (WMO)
- CIS Int. Occupational Safety and Health Inf. Center (ILO)
- IIS Industrial Inquiry Service (UNIDO)
- DEVISIS Int. Inf. System for the Development Sciences (IDRC)
- IRS Int. Referral Service (UNEP)
- DARE Data Retrieval System : Doc. in Social and Human Sciences (UNESCO)
- GEMS Global Environmental Monitoring System (UNEP)
- MEDI Marine Environmental Data and Inf. Referral Service (UNESCO/UNEP)
- POPINS Population Inf. System (Population Division of the U.N. Secretariat)
- SPINES Science and Technology Policies Inf. Exchange System (UNESCO)
- DRS Development Referral Service (SID-OECD)
- CLADES Latin American Center for Economic and Social Documentation (ECLA)
- IDCHEC Intergov. Doc. Centre on Housing and Environment (ECE)
- ISDS Int. Serial Data System (UNESCO-UNISIST)
- CORE Common Register of Development Activities (IOB)
- WDRS World Data Referral Service (UNISIST)
- ISIS Integrated Statistical Inf. System (CES)
- WISI World Inf. System on Informatics (UNESCO/IBI)
- UNISIST World Science Inf. System (UNESCO)

(*) Extracted from : Data for Development Newsletter, Oct. 1977. (Special issue : Information systems and international organizations)

Intermediate communication interfaces

Whilst there is little doubt that computer conferencing hardware and software will be available in many locations over the next few years, it is important to face the fact that they will not be available in many developing country locations. Nor, for that matter, will they be available in some desirable locations in industrialized countries. And, even when they are available to a particular institute, the administrative procedures and physical location of a terminal may be such as to reduce the desirable feeling of "hands-on" accessibility to those in the institute.

Compromises can however be made to overcome some of these difficulties. The compromises are quite unsatisfactory to purists - and a number of advantages are indeed lost - but they do represent a considerable improvement on the current situation.

Essentially the compromises take the form of successive limitations on full intercontinental, round-the-clock, on-line access. There are many possible intermediate stages and combinations which could best be presented as a table, but they can be summarized here :

Intercontinental : Instead of an inter-continental link-up, a less costly intra-continental link-up is possible. Exchange of data between continents could be accomplished periodically, whether by high-speed temporary links or by physical transfer of tapes. If the intra-continental link-up is not feasible, a national (or even a sub-national) link-up could be needed, with periodic international transfers of data.

Round-the-clock : Instead of maintaining the computer conferencing files on-line over the 24-hour period, this could be done for as many hours per day or per week, as was justified. (This procedure is already adopted for intercontinental access to certain data bases).

On-line : If on-line operations were not practical, batch operations could be instituted with an appropriate periodicity. To reduce the time (and thus the cost) of long-distance link-ups, greater use could be made of the option in computer conferencing software of switching large amounts of information onto a nearby high-speed line printer. Indeed, it might be better for a user to request via his terminal that distant files (or file updates) be transferred to a local computer with which he can then interact at lower cost (and at the end of his interaction, or more infrequently, any updates could be transferred back from the local computer into the intercontinental network). Analogous cost saving can be achieved with terminals which

have some storage capacity.

Inter-active : It may not always be possible for a particular user to engage in inter-active dialogue via a terminal, particularly if some of the more restrictive compromises are selected. Nevertheless a user could still employ the computer conferencing system to search for information corresponding to his interests (like searching a data base). And if that were not feasible, he could automatically be sent (whether through computer terminal, telex, or by post) information corresponding to a permanent profile of his interests.

Personal access : Instead of a personal (desk-top) terminal, the terminal could be shared by a department or, failing that, by a whole institute. If that were not possible, an individual could go every day or week to a service bureau or institution in the same city from which he could link in to the network for the necessary period of time. If that were not feasible, messages to or from one or more persons at a particular institute (or in a particular country) could be processed at the nearest available computer - the final link with the person being made by mail.

Summary : Clearly there are many possible compromise combinations from which the most appropriate could be selected for a particular case. Indeed different options could be selected depending on the amount or urgency of work with which the user was faced at any particular time. It is also possible to envisage the use of focal points whose function it was to act as interface between the computer based network and those dependant on post, telex and telephone.

Computer conferencing network facilities

A whole range of interdependent facilities is available to those involved in the computer-supported transnational university.

Focal topics : An important concern at all levels of participation in the network is to determine what topics are currently a focus of attention, whether as a research project concern, or as content in an educational programme, or in an information collection programme, or as a problem requiring contributions from many disciplines, or as the special concern of a particular individual, or as the theme of any of a variety of computer-based conferences. Such information can be obtained either from a current list of topics or by a specially activated search.

Messaging : Any individual in the network can send a message to any other and it will be stored until he cares to examine it. This facility is the basis for effective formal and informal interaction. Messages may range from depersonalized comment on topics of mutual interest to jokes and greetings. They may be anonymous and/or shared with selected people.

Personal notes : Messages to oneself may also be recorded as notes. Such a "notebook" is currently used to build up material, as a persons thinking on a topic develops, until it is appropriate to share some of the items with selected other people or to restructure them into an edited report for general access/distribution throughout the network.

Collective notes : A self-defined but usually unstructured group of people in the network may contribute to and modify a common file of notes on a selected group of topics over a period of weeks or months. At some stage these notes may be restructured into an edited report for wider access and distribution. One or more such files may be used as a "bulletin" or "newsletter" to store messages of interest to a large number of participants. This might list new topics, new participants, new mini-conferences, calls for contributions or comment, etc.

Seminars I : Where there are time constraints and a degree of group structure, participants may be required to intervene and comment on the interventions of others in order to arrive at a consensus statement which can be structured into a report on the focal topic for wider distribution. The frequency and intensity of exchanges, in the case of a research seminar for example, is much greater than in the previous case.

Seminars II : As a variation on the previous case, and of particular interest in an educational mode, one participant (the "educator") may, over a period of days or weeks, transfer successive "pages" of material from his personal file to the seminar file as course material on which the other participants (the "students") are invited to comment. The educator may have privileged access to the personal note files of each student and may then send them individual messages on the basis of what he sees.

Assemblies : In the case of a complex topic (possibly involving hundreds of participants) which can be usefully broken down into sub-topics each sub-topic may be made the focus of a seminar and/or a collective

note file. There could then be many seminars in parallel, although a particular individual could participate (actively or passively) in as many as he wished (possibly depending on his qualifications). Rapporteurs can monitor the progress of each seminar and formulate inputs (questions, constraints, etc) relevant to other seminars. The cross-linkages between seminar/sub-topics can be made as complex as is required by the structure of the macro-topic on which a consensus is required.

Encounters : The seminar-type environment can be modified to permit very intensive synchronous interaction over a period of hours. These conditions correspond to those already used in international relations simulation and gaming.

Questionnaires : A highly structured form of interaction between one individual (or group) and other participants in the network is the electronic questionnaire which can be used to facilitate surveys, complex votes and Delphi procedures, and subsequent data processing.

Voting / Flagging : Interventions or contributions of any individual are each numbered. Others can of course comment on previous interventions by number. Such comments can take the form of simple votes, usually anonymous. Interventions may also be ranked or flagged in terms of some criteria or as a basis for subsequent searches (e.g. by keyword).

Anonymity / Control : Participants may choose the degree of privacy of any intervention they make. This may range from "open to all in the network", through "open to all those in a specific seminar", and "open to named individuals", to completely private. Comments may be made anonymously or under pseudonyms. This may be very important where it is suspected that the interpretation given to interventions would be influenced by the culture, background, or other characteristics of participants. The convenor/organizer of a particular seminar may have formal control over who participates in the seminar (although particular cases might be put to a vote, for example). He may also have the right to scan the messages of those participating in the seminar, which may be very appropriate in the case of an educator/student relationship. Maintaining the distinction between a multitude of parallel seminars is not a problem, and links between some of them can be established when necessary (seminars can also be "nested" within one another).

Translation : Some participants may have a special function to provide translations for messages to or from particular languages. An individual can express his comment in his own language, transfer the comment to the translator who sends the translated version in return. (A record would be kept for budgetary purposes). This is then released to those using that language. Alternatively, selected untranslated interventions may be switched on request to a translator who then returns the translated version. Presumably some of this translation work could be done with machine assistance.

Explanation / Assistance : Some participants may have a special function either to assist those having problems in using the network or to provide explanations regarding substantive or procedural matters associated with a particular seminar. This can be done anonymously which may be of considerable advantage to those who would otherwise not feel free to ask such questions for fear of "loss of face". In the case of standard questions, the participant might be given an entry point into a programmed instruction package within which he can maneuver according to the background knowledge he needs to acquire. (User guides are usually built into computer conferencing software and manuals are not necessary).

Resource lists : Where it is justified, a collective note file may be opened to build up a bibliography of relevant articles, or a directory of relevant contacts, etc. This may at any time be edited into a report for hardcopy reproduction and distribution.

Data access, exchange and manipulation : A major use of computer terminals is to gain access to distant data bases, possibly outside the computer conferencing network. Data bases may be exchanged through the network. The data may also be manipulated and re-presented (e.g. as a graph) as an aid to the discussion in a particular seminar. The latest conferencing software also allows individuals to send data or retrieval messages to a "computer-simulated" participant which replies with the re-ordered data or the results of a search.

Report editing and production : As noted at various points above, editing facilities are built into the software to enable the text of interventions to be restructured into a report, with appropriate bibliographical and numerical data. Comments and modifications may be made to successive drafts of a report before it is "released" within the network or converted to hardcopy for offset reproduction. The same facilities can be employed by an individual in preparing a paper.

Use of time : A major advantage of computer conferencing is the ability of each participant to manage his own time according to his convenience. It is not necessary to waste time in gestures of politeness to speakers. It is not necessary to read items considered of little interest. Replies can be delayed. Comments can be made on early interventions and replies without being subject to arbitrary cut-offs by the president of a meeting anxious to adjourn for cocktails. This encourages considered reflexion and does not penalize slow thinkers or poor speakers, if their comments are of interest.

Flexible funding and resource management

Subsidized usage : Computer terminals may be rented and it is clearly possibly for this to be partially or completely covered by a subsidy in a particular case. Of greater interest, however, is the possibility that funding bodies are able to enhance communication in a variety of circumstances. Subsidies (other than for hardware rental) might be made for :

- any computer use, in order to reduce the effective unit rates of computer use to any participants in the network
- computer use by specific individuals or groups, possibly because of their qualifications, the topics with which they are normally associated, or the resource limitations of the institutes in which they are located (whether in developing or industrialized countries)
- computer use by any individuals or groups concerned with a specific topic or group of topics whose development requires encouragement. This might even be restricted to funding communication concerning the relationship between specific topics.
- computer use by any (or specified) individuals for communication with a specified individual or group whose contribution to the network needs to be encouraged.

In each case the detection of appropriate fund recipients and the accounting problems in managing the subsidies can be handled almost entirely by computer - possibly to the point that neither donor nor recipient would be known to each other, if this was so desired. In the case of much-solicited individuals faced with an overload of incoming messages it would even be possible to credit their accounts if they receive (or respond) to messages addressed to them. (cf the "reply paid" telegram)

Non-financial resources : The last point illustrates one possibility of making flexible use of the most scarce resource, namely the attention of key individuals who are much in demand. Clearly the computer conferencing approach makes it possible for such an individual to relate effectively with far more people (as consultant, educator, research adviser, seminar leader, report editor, etc). He can format texts addressed to specific groups, respond to specific questions from such groups or from individuals, scan comments made by (selected) individuals, in each case choosing how much time (if any) to devote to a reply - which could in some cases be a standard message or in others a referral to a more qualified person or to a programmed instruction routine. He thus avoids the time-consuming obligations of face-to-face contacts he would necessarily be unable to meet. Use of a translator as an intermediary (see above) also considerably increases the number of those with whom he can communicate. It must be stressed that such a key individual can contribute effectively to the university network whether from a fixed location (possibly in a non-network institute from which the major portion of his income is derived), or during travel to other countries (whether for the university or not), or on holiday (if he so wishes).

Other possibilities : As an illustration of the many other individually unimportant possibilities for cost reduction in a communication network, a book purchasing file could be opened to facilitate bulk purchase of key books at discount rates (possibly further reduced by subsidies as above).

Interrelating divergent perspectives

As noted above, a transnational university network can beneficially serve different functions for different categories of user. The challenge is to blend their respective requirements at whatever points they are shared and to separate them wherever they are considered to be distinct whilst at the same time providing a context for any evolution in the relationship between user concerns and minimizing the normal tendency to resist such flexibility. An indication of how this is achieved is given below under somewhat arbitrary sub-headings.

Education mode : Typically this arises when a number of individuals with access to the network indicate that they wish to benefit from interaction with one or more resource persons also in the network. Emergence of course themes, if they are not imposed, may be facilitated by prior interaction between the participants, potential resource persons, and possibly with the encouragement of funding bodies. The

interaction between "educator" and "student", or between students, is not constrained by time, distance or language - except when rapid interaction is required (in the "encounter" mode). Course material can be transferred by release of selected files by the educator - possibly supported by audio-visual materials distributed in conventional form. The advantage of the approach clearly lies in permitting interaction between people who would not otherwise have contact, in facilitating the best use of the interaction time at the convenience of both parties, and in the possibility of obtaining complementary information or perspectives from others in the network possibly only incidentally concerned with education. This applies in the case of undergraduate and postgraduate seminar situations as well as the "staff college" mode appropriate to briefing delegates or officials.

Research mode : Here the concern of the participating individuals or institutes is to use the network to test out ideas on each other, obtain assistance or comments on difficulties they are experiencing, obtain bibliographical and quantitative data (using the search and computation power of possibly distant computers), and collaborate on comparative surveys and other projects. In addition any particular research activity is intimately linked to the project funding and project management processes which are vital to its commencement and continuation. The continuity of the network in fact provides a context which nurtures the conception of new research activity rather than subjecting the creative period to the vagaries of grantsmanship and a project-by-project orientation. The network also ensures appropriate continuity between the research mode and the education mode. Clearly wherever research data bases can be used in the education mode, either directly or via some "complexity filter", then this is a valuable means of ensuring that both modes focus on the same reality and that one is not out of phase with the other, as can often occur particularly in isolated institutes.

Project management mode : Research on complex topics, as well as application of existing research to them, requires organization and management. Nesting much of the communications within the network can considerably facilitate the management process - particularly where it is a question of linking many individuals or institutes concerned to a varying degree with many different sub-topics (themselves linked

in a complex pattern of relationships). This matrix management process was first fully used by NASA on the Apollo Project. Such transdisciplinary, multi-modal projects depend for their effectiveness on communications not only to and from the project leader, but also between the collaborating bodies who need to respond to each others insights/needs and compensate for each others excesses and weaknesses.

Funding mode : As noted above the access of funding bodies to the network, and of participants to such bodies, facilitates the whole process whereby projects are proposed, peer-reviewed, monitored and finally evaluated. In addition, negotiating joint proposals and joint funding involving many bodies concerned with different phases or objectives of a project becomes much easier.

Administration mode : The whole process of resource allocation, accounting and review in a complex environment is carried out with considerable precision and without loss of flexibility. Computer conferencing could facilitate a transition from programme - budgets pre-defined in detail (a year or more prior to implementation) to flexible negotiation of funds in response to ongoing reconception of needs and opportunities.

Institutional mode : An associate institute acquires, through the network, access to counterparts (data and resources) around the world which can assist in the advancement of work in its priority areas. A greater operational reality is given to the sense of participation in the "knowledge community". Whilst this is a stimulus to the institute itself, it also ensures that others are aware of its attitude to the relevance of their work to its priorities. Clearly there is less stimulus for an individual to move from one institute to another to reduce any personal feelings of intellectual isolation. As noted above, the process of funding individuals or projects based on one or a combination of institutes should be much facilitated, with valuable reinforcement of institutional identity.

Documentation mode : Access to the network, and consequently to the bibliographical and other data bases to which it can be linked, will considerably strengthen an institute's library or documentation function. (In fact, irrespective of whether a university network is established, library networks will continue to expand. Clearly it is desirable that appropriate cross-linkages should be explored to avoid unnecessary costs and duplication).

Media-oriented mode : A network of institutes whose purpose is partly to improve response to world problems has a responsibility to be able to furnish the media (including government agency information offices) with appropriate data, background references and considered comment. Failing this the media are obliged to fabricate and disseminate an image of reality which is out of phase with current thinking on the same problems. Such lack of contact reduces the credibility of initiatives originated within the network and makes it more difficult to fund them. The computer conferencing process could be very helpful

in ensuring appropriate communication to avoid such difficulties. (The media mode is in fact a stage of data dé-complexification beyond that required for the education mode, but the importance of maintaining a correspondence between the data used in research, education and the media remains).

Policy mode : Clearly an effective transnational university network is of considerable potential value to the policy formulation process in response to world problems (as studied within the network). The pool of data-supported expertise constituted by the network in its research mode can also be tapped on a continuing basis in an advisory mode - even in emergency situations. (It should not be forgotten that the first computer conferencing system was developed for the U.S. Office of Emergency Preparedness). In fact the continuing use of the network to facilitate interaction between research and policy perspectives is of considerable advantage in tightening up a communication process often characterized as slow, if not of little relevance to both parties.

Other modes : It is highly probable that other users will emerge or link into the university network from other networks. Some may benefit simply by passively monitoring seminars, as would be the case with academic institutes not wishing to participate actively in the network. Some of these users may even be willing to contribute financially for the privilege of such access.

Facilitating transdisciplinary processes

Use of computer conferencing to facilitate an individual's creative work and to nurture the processes by which he interacts with his colleagues has already been seen as sufficiently important to warrant extensive National Science Foundation funding in the USA. Considerable practical experience has already been gained over the past decade through work at the Center for Augmenting Human Intellect (Stanford Research Institute). It is clear that computer conferencing provides a very exciting intellectual environment in which individuals can maintain "thinking momentum". Although implicit in the process, it would seem that no specific effort has been made to determine how it can be used to augment transdisciplinary and cross-category research and the formulation of more integrative concepts. Already, however, any participant may conduct searches for contributions into the network containing specific keywords. The keywords could themselves be linked in sequences or networks across conventional categories. Computer conferencing could have a major impact in this area when deliberate efforts are made to provide users with a range of classification schemes to guide such searches by grouping and interlinking concepts in a variety of ways.

"... it is highly probable that such environments will be developed for creative thinkers in key research disciplines and policy environments and for the conferences and institutions in which they interact. The key to the attractiveness for them of such (micro)environments is the manner in which the processes of thinking and communication are blended with those of storage, retrieval, classification and reclassification. In fact it is the intimate relationship between shared creative thinking and exploratory integrative reclassification in the light of new insights which is the chief feature of such environments. Of special interest is the manner in which the processes of analysis, conceptual innovation (and its verbal representation), explanatory comment, linkage to related initiatives, abstracting, classification, dissemination, and peer-group assessment effectively blur together into a new and more dynamic process whose nature remains to be explored and for which the current division of labour is inadequate." ().

Not only should this lead to improvements in interdisciplinary communication, it should also lead to the development of better ways to restructure a network of concepts to facilitate comprehension at a lower level of complexity whilst maintaining (educational) pathways bet-

ween the lower and the higher levels of complexity. Such an environment is also ideal for the processes required to explore and alleviate the serious problems of conceptual and terminological ambiguity characteristic of the social sciences which have been extensively documented by the Committee for Conceptual and Terminological Analysis (). This Committee is currently collaborating with the Social Science Division of Unesco which has established the DARE system for information on current social science research. As part of DARE, an additional file, called INTERCONCEPT, is to be set up to handle conceptual and terminological information which will both improve retrieval capabilities of DARE and facilitate ongoing analytical work on concepts and terms (The project is also linked to a Unesco/International Social Science Council initiative on clarifying concepts in the social sciences). If the analytical work can be combined with experiments in classification, tools should emerge to facilitate transdisciplinary intellectual process - particularly in the computer-supported environment advocated here.

The contrast between this approach and the conventional one has been explored in separate papers ().

Of special value is the ability of computer conferencing to provide an environment for the interactions between different schools of thought. This is important because the current procedure, in an effort to protect what is distinct in each approach, leads to behaviour which isolates and condemns groups which hold minority viewpoints. Computer conferencing ensures protective isolation but it encourages exchanges wherever they may prove fruitful. The most recent study of "interdisciplinarity" () does not however do more than indicate guidelines for thinking about the matter. The question of how to facilitate conceptual convergence on transdisciplinary conceptual focii by appropriate and specific software options remains to be explored.

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- () G. Sartori, F.W.Riggs, H.Teune. Tower of Babel ; on the definition and analysis of concepts in the social sciences. Pittsburgh, International Studies Association, 1976.
 - () G. Sartori. Interconnected information and knowledge representation in the social sciences. Pittsburg, International Studies Association, 1974 (COCTA WP. 24)
 - () A.J.N. Judge. Knowledge-representation in a computer-supported environment. International Classification, 4, 1977, n° 2.
 - () A.J.N. Judge. Relationship between elements of knowledge. Pittsburgh, International Studies Associations, 1972 (COCTA WP. 3) subsequently abridged as COCTA WP. 9.
 - () Centre for Educational Research and Innovation. Interdisciplinarity ; problems of teaching and research in universities. Paris, OECD, 1972, 321 p.

Network overview

The term "network" is in increasing use as in some way holding the clue to a more desirable and more appropriate method of organization or modelling organization - whether in the case of individuals, of groups or organizational units, of information distribution, or of concepts (*). Despite this acceptability, it is not yet clear just what makes up a network, how it should "function", or how it is in fact different from a "system" (*). Some very interesting work remains to be done. There is a danger, however, in becoming trapped by the suggestive power of the metaphor and in failing to explore the possible operational realities which it suggests.

The description of computer conferencing indicates the nature of an environment which encourages "networking". This process seemingly involves ^{individuals} who tend to exchange information and ideas, who form groups, who are (individually or via such groups) linked to other groups or institutions. Such bodies themselves exchange information, funds, etc. The topics or concepts about which information is exchanged are themselves interlinked in complex networks. None of these interwoven networks is static. They grow in terms of a variety of established patterns. Conceptual networks are paralleled by interpersonal and intergroup networks. The established patterns are continually replaced by new forms of varying duration. Such changes may be catalyzed by events such as meetings (perhaps via computer) which provide focal points through which new links are momentarily made and then possibly given permanence through the establishment of working relationships or even formal organizations - whether of concepts or of social groupings. Clearly new concepts (or concept relationships), values or problems give rise to new meetings, new projects, new organizations, new information systems and new regulations. These in turn catalyze the emergence of further concepts, values or perceived problems. There are many shifts and waves in the changing pattern of relationships - many are short-lived and do not provide a basis for organization of any permanence. "Sympathetic" changes may occur out of phase with one another and provoke "degeneration" to a more "primitive" level of orga-

(*) Transnational Associations 1977, 9 (articles reporting on these issues)

- Organizational systems vs. network organization
- System/network complementarity
- The network alternative.

nization. The structure of any of these networks is not only a matter of detached observation. Much energy is devoted by individuals and organizations associated with these networks to re-ordering them. ~~Domains of influence and hierarchies are established around focal points~~ specific problems, values and concepts are given territorial characteristics and stimulate appropriate behaviour. (*)

Clearly participants must adopt strategies to further projects corresponding to their viewpoints and values. Such projects give rise to a degree of coordination encompassing certain domains - although the networking process provides continuity over time and a context to "nest" or link various levels or stages of coordination/centralization - autonomy/decentralization. The possible complexity is great, and were it not for the ability to facilitate, track and display this process by computer, its dynamism and flexibility could not be incorporated in an option which would be viable operationally or administratively.

Although the expertise, software and hardware are all available, they have not yet been applied to the task of facilitating operation of such networks and actualizing their potential. How can a complex of concepts values, individuals and institutions catalyze itself into a pattern of convergence from which will emerge the appropriate insights and breakthroughs - before it reorients itself in response to new circumstances, in a new configuration, and with a different set of elements? What can be done to facilitate coalition formation and reformation in such a context?

Clues to the directions which merit exploration include : the new principles of "structured design" for computer software, the principles of structural analysis and synthesis embodied in operational information systems for chemical structures (**), the possibilities of designing new conceptual and organizational structures which follow from a generalization of tensegrity principles (***), and the ability to handle such complexity in comprehensible form on computer display screens and computer generated network maps (****)

(*) Paragraphs adapted from : A.J.N.Judge. International organization networks ; a complementary perspective. In : P.Taylor and AJR Groom. International Organization. London, 1978, pp. 392-3.

(**) R.E.Carhart et al. Applications of artificial intelligence for chemical inference ; an approach to computer-assisted elucidation of molecular structure. J.Amer.Chem.Soc.97 (1975) pp. 5755-5762.

(***) R.Buckminster Fuller. Synergetics ; explorations in the geometry of thinking. New-York, Macmillan, 1975, 876 p.

(****) Yearbook of World Problems and Human Potential. Brussels, Union of International Associations/Mankind 2000, 1976 (annexes).

The need for such new models and operational "scaffolding" at this time is obvious from the terms in which Johan Galtung is obliged to couch his understanding of how the UN University project on Goals, Processes and Indicators of Development needs to evolve : "What is needed is an organic compromise between the two extremes (laissez-faire versus directed approach), using the fact that a network of research institutions is being created, neither an unrelated set, nor a vertically integrated research organization. Characteristic of a network is great flexibility and dynamism. Some central coordination does not preclude sub-sets from forming their own sub-centres, developing their own lines of research geared to their particular condition ... Where the balance point will be remains, to some extent, to be seen, as part of the process". He concludes with the suggestion to "let the matrix play", encouraging a maximum of activity (a) by each institution on its preferred topics, (b) between institutions and (c) between topics. Computer conferencing has a role to play in providing an environment in which this flexibility is protected and taken for granted, rather than being an operating condition which can only be maintained with continuous effort.

Conclusion

Computer conferencing provides a very powerful environment through which to overcome many of the obstacles to : trans-nationality, trans-disciplinarity, trans-cultural contact, and trans-organizational collaboration. One can but speculate on the synergy resulting from a many-fold increase in networking possibilities. It is appropriate to note that it is genuinely non-territorial in organization and operation and as such is an appropriate vehicle for a transnational university network. It should also be remarked that conventional notions of "organization", "meeting", "project", and "information system" are blended together with in a new operational reality which encompasses them all, and more besides.

To the extent that the accepted structural principles governing the organization of concepts and models are influenced by the principles governing the structures of the organizations within which they are conceived, then the concepts emerging from the advocated network environment are likely to be much more flexibly responsive to the complex society in which we live. In this sense the operation of the network provides more appropriate clues to understanding the society which it is the purpose of the network to reflect upon. And in the case of the UN University project on Goals, Processes and Indicators of Development, the networking process in many ways models develop-

mental processes occurring in society which the project hopes to elucidate and track with appropriate indicators.

Finally, even if computer conferencing cannot be used to support transnational university operations, consideration (or simulation) of how it might work, and affect concept formation and associated interpersonal and inter-group behaviour, is an instructive exercise in its own right.

