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About the Book

Electronic communications technology and services permeate every aspect of national life. This book examines the current and expected states of the technology and considers the societal impact and policy issues arising from new technological developments. Particular attention is paid to evaluation of computerized conferencing for enhanced communication among researchers in specialized and interdisciplinary fields and to technology assessments of criminal justice and tax administration systems.

About the Series

The *AAAS Selected Symposia Series* was begun in 1977 to provide a means for more permanently recording and more widely disseminating some of the valuable material which is discussed at the AAAS Annual National Meetings. The volumes in this *Series* are based on symposia held at the Meetings which address topics of current and continuing significance, both within and among the sciences, and in the areas in which science and technology impact on public policy. The *Series* format is designed to provide for rapid dissemination of information, so the papers are not typeset but are reproduced directly from the camera-copy submitted by the authors. The papers are organized and edited by the symposium arrangers who then become the editors of the various volumes. Most papers published in this *Series* are original contributions which have not been previously published, although in some cases additional papers from other sources have been added by an editor to provide a more comprehensive view of a particular topic. Symposia may be reports of new research or reviews of established work, particularly work of an interdisciplinary nature, since the AAAS Annual Meetings typically embrace the full range of the sciences and their societal implications.

WILLIAM D. CAREY
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Introduction

Recent years have seen a revolution in information production and processing in our national economy. The complexity of our society has increased demands for timely and relevant information for management of organizations and institutions, for provision of education and entertainment, for conduct of governmental and social services. These demands are being met, in large part, by innovative technological developments in computers and electronic communications.

Computers are of course an integral part of everyday life in this country: computers write our paychecks and benefit checks, then speed their use through electronic funds transfer systems, automated checkout counters at the supermarket and point-of-sale terminals in retail outlets. Computers provide access to large data bases of specialized and general information for researchers and legislators, law-enforcement officials and laboratory scientists, students and administrators alike.

But computers alone can be isolated; electronic communications capabilities make a vast difference. Communications links put us in instant touch with colleagues around the country and with services at widely-scattered locations. The electronic funds transfer systems just mentioned link banks and clearinghouses across the nation; checkout counters and point-of-sale terminals for chains and federations of stores transmit data for centralized inventory and management control; specialized data banks, as in the law enforcement area, extend the capabilities of local facilities to nation-wide scope; large information files are coupled in library and information networks and made available through interactive terminals in home or office.

But decentralized operations and increased information transmission or communication can cause problems of their own - problems which include protection of the data being transmitted, allocation of available transmission channels, training and effective use of people. We can project less face-to-face communication even as the technology enhances overall communication via computer terminals, home computers, satellite transmission, and similar developments.

Moreover, there is potential for abuse in the ever-increasing use of computers coupled with electronic communications - privacy can be invaded, for example. And we can see increased regulation as a requirement for the burgeoning field and its industry. Large-scale national, even international, computer-based information systems will be - are being! - used to make very important decisions, sometimes without clear indication of the validity of the original data in the systems. Also, such facilities are more easily available to those with requisite resources - the rich and powerful organizations in our country have the advantage of increased information and communication systems, which in turn enhance power.

Recognizing these various components of a national resource and a national concern, members of Section T (Information, Computing and Communications) of the American Association for the Advancement of Science organized a symposium on the subject for the annual meeting of the AAAS in Houston, Texas on January 6, 1979. The symposium, entitled the Future of Electronic Communications, was co-sponsored by the American Society of Information Science, The Society of Exploration Geophysicists, and AAAS Sections E (Geology and Geography) and M (Engineering).

The symposium examined the current and expected states of the technology of electronic communications, as well as the societal impacts and policy issues arising from these technological developments. The electronic communications technology and services considered include interactive computer-based information and data systems, systems for handling large masses of data, electronic mail and message services, and systems linking computers, telephones and television in home or office.

In particular, the symposium and this volume started from a baseline overview of the current status and trends in electronic communications. Technological improvements in data transmission and message switching are reviewed, and a brief overview given of the policy and regulatory decisions which have been made or are yet to be made. The beginner in telecommunications use is given useful hints on getting started.

This overview is followed by examples of current and emerging applications of the technologies of computers and communications. In particular, developments in transmission and reduction of the large amounts of data generated in geophysical exploration for energy resources are recounted. And at the other end of the spectrum, so to speak, experiments with transmission and reception of science news on home television sets are described. Such experiments, underway in England for over a year, are just getting started in the United States and Canada.

Another process for electronic information transfer is computerized conferencing. Geographically-dispersed individuals can interact via computer terminals and communication links; each person enters material and/or comments into the computer store and retrieves others' comments and material as convenient. In the symposium, a panel was convened for the purpose of discussing the impact of computerized conferencing on the communication patterns and productivity of two specialized research communities. Panel members included representatives of the research groups, the designer of the Electronic Information Exchange System (EIES) which the research groups were trying, and the principal investigator of a study, sponsored by the National Science Foundation, of impacts of electronic information exchange, during operational trials, on a number of specialized research communities. The two communities participating in the panel discussion at the symposium had more experience to share with the symposium attendees than other communities participating in the EIES trials. In this volume, though, it has been possible to include information from most of the participants, representing a variety of research groups, as well as from the designer of EIES and the principal investigator of the evaluation study. The EIES is one example of a computerized conferencing and electronic information exchange facility; the lessons to be learned from its experimental use will be valuable to other such systems and their users.

Having reviewed the technologies of electronic communications and their various applications, the symposium and this volume turned attention to the societal impacts and policy implications attendant upon those applications. It is obvious to many of us that the technologies do not solve all problems and in fact cause several. The latter include, for example, questions of economic growth and distribution of benefits so that services will be universally available rather than developed only for the very rich. The issue as to whether competitive services should be encouraged so as to lead to lower prices and to stimulate productivity gains is debated. But policy dilemmas in this area are compounded by the relation

between such competitive services and the existing monopoly services, e.g. telephone services: lower prices in the one could result in higher prices in the other. National leadership is needed to tackle such matters.

Congressional concerns with these and other policy issues are reflected in the number and variety of committees involved with questions relating to electronic communications. The then-current identity of such committees and their particular concerns were enumerated at the symposium; however, since the pattern changes rapidly and frequently, it was deemed inadvisable to attempt an updated version of that discussion for this volume. But the general problems those Congressional groups wrestle with are discussed, as they were at the symposium, in the last papers of the volume: accountability for the content and management of large data bases containing personal data, the effects on organizations and social institutions caused by introduction of computers and electronic communications technologies, and the roles and responsibilities of various governmental agents in this area.

This volume, and the symposium on which it was based, recognize that the technologies of computers and electronic communications are still developing, and that the problems which follow their use are not solved. Rather, the presentations here constitute a snapshot of the current state and discernible projected trends of the technology, and the present efforts to cope with the attendant problems. Those of us involved with the symposium and this volume feel that this picture will be a useful part of the total panorama of developments in the field.

Thanks are due to those who made the original presentations in Houston in January, and then updated or edited their material for inclusion in this volume. We express particular appreciation to Starr Roxanne Hiltz, who arranged for the greatly-expanded discussion of experiences with computerized conferencing. Special thanks go to Marcia MacNaughton who played all the roles of symposium co-arranger, speaker, author, and volume co-editor. We thank Elaine Begeman who transcribed most of the symposium recording. And we give an extra-special thanks to Mary Ellen Crane, whose patience and skill in the production of the individual chapters made this volume possible.

Bibliography

Cawkell, A. E. Developments in interactive on-line systems and teletext information services in the home. On-Line Review. 1(1): 31-38; 1977.

Cawkell, A. E. The paperless revolution. Wireless World. 84(1511/1512): 38-42, 69-74; 1978.

Fedida. S. Viewdata - a Post Office interactive information medium for the general public. Electronics & Power. 23(6): 467-473; 1977.

Fedida, S. The Viewdata computer. Wireless World. 84(1508): 44-48; 1978.

Garfield, E. Viewdata and Scitel bring interactive information systems into the home. Current Contents. 1977(40): 5-10; 1977.

Hedger, H. Telesoftware - home computing via Teletext. Wireless World. 84(1515): 61-64; 1978.

Weizenbaum, J. Once more a computer revolution. Bull. Atomic Sci. 34(7): 12-19; 1978.

Viewdata - a review and bibliography. On-Line Review. 2(3): 217-224; 1978.

The Prestel user's guide and directory - a complete guide to information providers and services (Price £1.50). Eastern Counties Newspapers, Rouen Road, Norwich, England.

Conclusion

The EIES system appears to be a viable means of facilitating communication within a scientific community. However, it does require convenient access to a computer terminal and high motivation on the part of its users to communicate with one another. In order for users to invest the time to learn to use the system and to participate actively, the activity which they are carrying out on the system must be seen by them as important and rewarding.

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References

1. National Science Foundation, Division of Science Information. Program Announcement. Operational trials of electronic information exchange for small research communities. NSF76-45; 1976.

2. Hiltz, Starr Roxanne; Turoff, Murray. The network nation: human communication via computer. Reading, Mass.: Addison Wesley Advanced Book Program; 1978.

3. Kuhn, Thomas S. The structure of scientific revolutions. (Second edition, enlarged). Chicago: The University of Chicago Press; 1970.

4. Martino, Joseph. A computer conference on futures research. Proposal submitted to National Science Foundation; 1977.

5. Umpleby, Stuart. General systems theory: an example of the integration of scientific disciplines. Proposal submitted to National Science Foundation; 1977.

6. Merton, Robert. The sociology of science: theoretical and empirical investigations. Edited and with an introduction by Norman W. Storer. Chicago and London: University of Chicago Press; 1973.

7. Homans, George. Social behavior as exchange. American Journal of Sociology. 62; 1958.

8. Turoff, Murray; Hiltz, Starr Roxanne. Development and field testing of an electronic information exchange system: Final report on the EIES Development Project. New Jersey Institute of Technology, Computerized Conferencing and Communications Center. Research Report Number Nine; 1977.

9. Merton, Robert. The ambivalence of scientists. Sociological Ambivalence and Other Essays. New York: The Free Press; 1976.

References

Ashby, W. Ross. An introduction to cybernetics. London: Chapman and Hall; 1956.

Hiltz, Starr Roxanne; Turoff, Murray. The network nation: human communication via computer. Reading, Mass.: Addison-Wesley Publishing Company; 1978.

Kochen, Manfred, ed. Information for action. New York: Academic Press; 1975.

Umpleby, Stuart A.; Umpleby, Karen Thomas. Applying systems theory to the conduct of systems research. Paper prepared for the International Conference on Cybernetics and Systems, Amsterdam; 1978 August.

References

1. Mullins, Nicholas C. Theories and theory groups in contemporary american sociology. New York: Harper and Row; 1973.

2. Killworth, Peter; Bernard, H. Russell. Informant accuracy in social network data. Human Organization. 35: 269-286; 1976.

3. Campbell, Donald T. Factors relevant to the validity of experiments in social settings. Psychological Bulletin. 54: 297-312; 1957.

School of Medicine, Los Angeles, Calif.; Leonard B. Seeff, MD, Veterans Administration Hospital, Washington; Wolf Szmuness, MD, New York Blood Center, New York, NY.

References

1. Schoolman, Harold M.; Bernstein, Lionel M. Computer use in diagnosis, prognosis, and therapy. Science. 300: 926-931; 1978 May 26.

2. Bernstein, Lionel M.; Siegel, Elliot R.: Ford, William H. The hepatitis knowledge base prototype. Proceedings of the IEEE second annual symposium on computer application in medical care. Washington, DC; 1978 November.

3. Siegel, Elliot R.: Information transfer for health practitioners: an innovative approach. Proceedings of the 41st annual meeting of the American Society for Information Science, New York, NY; 1978 November.

Notes and References

1. For another view of accountability in large record systems, see Kling, Rob. Five models for the social accountability of computing: a brief review (mimeo). Irvine, CA: Department of Information and Computer Science, University of California; 1978 January.

2. Privacy Protection Study Commission. Appendix IV: The privacy act of 1974: an assessment. Washington, DC: U.S. Government Printing Office; 1977.

3. Ibid: 53.

4. Federal data processing reorganization study: operational management team report (draft). Executive Office of the President; 1978 June 15.

5. Privacy Protection Study Commission. Appendix IV: 33.

6. Mowshowitz, Abbe. The conquest of will. Reading, Mass.: Addison-Wesley; 1976.

7. Privacy Commission. Appendix IV: 16.

8. For additional discussion of management responsibilities and ethics in the operation of large record systems, see Sterling, T.; Laudon, K. Humanizing information systems. Datamation; 1976 December.

9. Sterling, T. System errors and their impact on end users (forthcoming). Communications of the ACM. 1979.
Laudon, K.; Sterling, T. Frequency, origin and consequences of error in large systems (forthcoming).
Laudon, K. Complexity in large federal databanks. Society/Transaction; 1979 May.

10. A national survey of the public's attitudes towards computers. Montvale, N.J.: American Federation of Information Processing Societies; 1971.

11. A preliminary assessment of the NCIC computerized criminal history system. Office of Technology Assessment, U.S. Congress; 1978 March.

12. LEAA, a principal funder of State Criminal History Systems, has never conducted a data quality study of these systems. Partial examinations will be found in the following references:
Criminal record systems. General Accounting Office; 1973 January. (most examined records in California found

inaccurate or incomplete).
New York Times; 1974 October 27.
Proposed criminal history program. Federal Bureau of Investigation; 1976. (45% of records found incomplete in survey of 800,000 criminal histories).
The American criminal history record. Sacramento, California: Project Search, Inc.; 1976. (criminal justice personnel perceive 31% of records incomplete, 10% erroneous.

13. Costs and benefits of the comprehensive data system program. Washington, D.C.: Institute for Law and Social Research; 1975.

14. Internal Revenue Service. Summary of major TAS features - present and proposed security and privacy measures. Preliminary analysis of the IRS tax administration system. Washington, D.C.: Office of Technology Assessment; 1977 March.

15. The difficulties of comprehending very large programs is discussed in Weizenbaum, Joseph. Computer power and human reason. San Francisco: Freman; 1976.
The extent to which lower-level programmers can make subtle changes in programs unknown to the original planners is discussed briefly in Kling, Rob. Electronic fund transfer systems and quality of life. Montvale, N.J.: AFIPS Conference Proceedings, National Computer Conference, Vol. 47; 1978.

Linton C. Freeman, Sue C. Freeman

8. A Semi-Visible College: Structural Effects on a Social Networks Group

Abstract

This is a report of an examination of the impact of EIES on the structure of interpersonal relations among a set of participants. Sociometric data were collected at the start of participation and compared with those collected after seven months of activity. Results suggest that EIES participation affects not only the patterns of intellectual exchange among participants but their more personal relationships as well.

Introduction

This is a report of the first seven months of electronic information exchange by a collection of specialists in the study of social networks. As a collectivity of specialists, we are pretty much like the Futures or the General Systems groups (as described elsewhere in this volume). We come from a broad range of disciplines, we are spread out through seventeen states and two Canadian Provinces and we are involved in an emerging field of science. Like those other groups, we are at a stage in our development as a field where regular and significant communication is essential if we are to develop consenses and the norms and standards that are needed for growth.

Our overall responses to the EIES experience have also closely paralleled those of the Futures and General Systems groups. We succeeded in recruiting a small core of very active participants, but overall activity rates were rather low and a number of seemingly eager applicants never appeared on

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the system. We were able to develop a few worthwhile intellectual efforts, but most of our conferences failed to sustain a continuing intellectual thrust; they withered and died. We found that EIES participation greatly simplified the solution to a number of practical organizational problems, but we were continually frustrated by its tendency to demand attention and intrude on our other day-to-day activities. In short, we were--pretty much--a typical EIES trial community; we had both positive and negative experiences.

From the beginning, we also shared with several of the other trial groups a concern with using EIES to develop a sense of community among the participants. In our case, however, this concern was central. As social networks scientists, we were conscious of the importance of communication in facilitating the development of linkages between persons. Only by establishing such interpersonal links could we hope to arrive at the common understandings, norms and consenses needed in a developing field.

Even before the EIES trials started, one of our number, Mullins (1), had suggested that the emergence of a specialty in science requires more than the sort of communication that is provided by journals, the mails or even the telephone. Mullins proposed that a developing field needs the kind of communication that can engender friendship and trust--the kind that is usually associated only with long term face-to-face colleagueship. Thus, as networkers, one of our main concerns all along has been a question about how well EIES could be used to develop intimate interpersonal ties between participants.

Beginning as we did, with a sort of loosely knit collection of scholars with overlapping interests but few interpersonal ties, we wondered whether we could use EIES to develop into a real community characterized by ties of friendship and trust. Participants on EIES are at least potentially accessible to each other. They have a sort of interpersonal visibility that they might otherwise lack. The problem is whether this semi-visibility can help us to evolve from a mostly anonymous collectivity to a genuine tightly knit academy.

These were the sorts of questions that were prominent among those asked by the social networkers as we entered the EIES world. These questions are addressed, in a preliminary way, in this report. We will examine the impact of the EIES experience on the sociometry of the social networks community.

Sociometric Analysis

Data for the current analysis were generated by two questionnaires, the first of which was administered interactively on EIES at the very start of the experimental trial period. The second set were mailed out to participants seven months later. Altogether, 29 participants completed the questionnaire both times. These 29 people generated the data for the present report.

The questionnaires contained four items that are relevant to the determination of interpersonal contacts among participants. 1. Each participant was asked to designate all other participants that he or she had "heard of or read." 2. Participants were asked to indicate those others whom they had "met, exchanged letters or phone calls or computer-conferenced with." 3. Next, they were asked to indicate those others whom they considered to be "friends." 4. Finally, they were asked to indicate those others whom they considered to be "close personal friends."

These are the data that are examined in the current report. They allow us to address two questions: 1. To what extent and how were these participants linked together at the start of the experimental trials? 2. What changes in interpersonal linkages took place in the first seven months of the trial period?

The density of a relation is the ratio of the number of reported ties to the total number possible. Table 1 shows the densities for the four relations studied here. Initially, only 62 percent of the participants were linked by having heard of one another. And, at the same time, less than 50 percent of these pairs report having met.

Table 1. Density for four relations over two times

Relation	TIME	
	First	Second
heard of	.62	.77
met	.49	.68
friends	.14	.22
close friends	.05	.06

These results say something about the effects of brief contact, since 21 of these 29 people had just attended a day-long conference in Pennsylvania immediately before taking the questionnaire. It supports the notion that, as Killworth and Bernard (2) have suggested, actual social contacts and reports of these contacts are often quite different phenomena.

The data for the second questionnaire show a considerable amount of consistent change. There were noticeable increases in the proportion of people reporting relationships of all four kinds. It would seem that the computer conference, or perhaps some other events that took place during that seven month period, brought these people closer together.

So far, we can see that the density of ties increased during the period of study, but we can learn more by looking at the pattern of these ties. In order to do that, we must examine some other characteristics of the network. First, we shall consider how close people are to one another.

Reachability in a social network is defined as the condition in which two people are able to contact one another either directly or through intermediaries in terms of some specified relation. Thus, if we were interested in friendship: I can reach my friend, I can reach my friend's friend, my friend's friend's friend and so on. Moreover we can talk of the distance along such a path in terms of the number of links that are necessary for one person to reach another. My friend is at distance 1 from me and his or her friend is at distance 2.

The numbers of reachable pairs and the distances between them in our EIES group are shown in Table 2. The number of reachable pairs is growing wherever possible (there are 812 reachable pairs possible for these data). Moreover, the participants are getting closer together--distances are shrinking--on all relations but one. For close personal friends the second questionnaire shows that, although there are more than twice as many reachable pairs, the average distance between them is increased. Overall, then, this group seems to be drawing together.

For close personal friends, data from the first questionnaire seemed to show the presence of tight little cliques; by the time of the administration of the second questionnaire there were many more personal friends reported and they were beginning to be loosely linked together into larger structures. This suggests that at the end of the second questionnaire there was much more of a "community" among these social networks people.

Table 2. Average distances between reachable pairs and number of reachable pairs for four relations at two times.

Relation	TIME			
	First		Second	
	Distance	No.of Prs.	Distance	No.of Prs.
heard of	1.38	812	1.17	812
met	1.52	812	1.30	812
friends	2.76	728	2.18	812
close friends	2.01	96	3.13	221

We can learn something about inequalities in social choice by looking at the frequencies with which individuals were chosen for each of the relationships. Some kind of stratification is indicated by the tendency for some individuals to be chosen too often and some too seldom. An index of this tendency is given by the variance in the numbers of times individuals were selected as targets for a given relation. In general, the greater the variance, the greater the tendency for individuals to be unequal in being chosen. A large variance suggests that some people are chosen much too much and some too little. Such a tendency toward over- and under-choosing indicates that people are arranged into some kind of hierarchy. In contrast, if the variance is small, we have evidence that the relation being studied is egalitarian. Data on variances of being chosen are shown in Table 3 along with their expected values under the assumption that choices were random.

Data for the first time period show that variance in being chosen decreased markedly with increasing intimacy of relationships. This makes sense. It suggests that the tendency of people to "hear of" one another is highly stratified--participants differed in their prominence prior to their entry into EIES. On the other hand, the choice of "close personal friends" is quite egalitarian--apparently they were chosen without reference to "status."

By the time of the administration of the second questionnaire, however, things had changed considerably. The variances for the less intimate relationships had been reduced, presumably because since most people had gotten to know one

Table 3. Variances, expected variances and ratios of variance to expectation of distributions of number of times chosen for four relations at two times.

Relation	TIME					
	First			Second		
	V	E(V)	V/E(V)	V	E(V)	V/E(V)
heard of	42.9	7.5	5.7	19.0	5.6	3.4
met	23.5	8.1	2.9	20.8	7.2	2.9
friends	9.4	3.8	2.5	20.6	5.2	3.9
close friends	1.3	1.3	.9	2.0	1.7	1.2

another, there was less effect of prior prominence. The increased variance for the more intimate relations, however, suggest that the tendency toward establishing hierarchy has shifted from acquaintanceship to friendship. As these people got to know one another more intimately, it would seem, they began to stratify one another in more intimate terms. There was a shift from stratification in terms of academic status to stratification in terms of personal popularity.

Data in Table 4 on mutual choices can begin to tell us something about how this stratification might work. First of all those data show that the choices are much more predominantly mutual with increased intimacy of relationship. Less intimate relations, then, tend not to be reciprocated, and differences in being chosen probably reflect a stratified hierarchy of individuals.

The predominance of mutual choices for friends and close personal friends, however, tells a different story. For these more intimate relations, any tendency toward stratification probably embodies a tendency to form a hierarchy of clusters of closely tied individuals. Thus, for friends, we seem here to be developing a stratified set of clusters. For close personal friends, since they exhibit even more mutuality of choice, choices probably reflect the development of an increasingly stratified set of tightly knit and unconnected cliques.

Table 4. Number of mutual choices, expected number and ratio of the observed number to its expectation for four relations over two times.

Relation	TIME					
	First			Second		
	M	E(M)	M/E(M)	M	E(M)	M/E(M)
heard of	204	155.9	1.3	276	243.3	1.1
met	167	98.9	1.7	236	189.1	1.3
friends	33	8.4	3.9	53	19.3	2.7
close friends	12	.9	13.3	18	1.5	12.0

Discussion of Results

Overall, these data reveal some systematic changes in relationships among these people. They are both more aware of one another and more willing to claim ties of friendship. Pairs of people are closer together and fewer individuals are isolated. There are increased numbers of mutual choices and the patterns of stratification are switching from individual hierarchies to hierarchies of clusters. The data suggest a general pattern of increased density and structural organization of relationships.

These observed changes in patterns of personal ties are particularly interesting in this context because, unlike those observed in other longitudinal sociometric studies, the participants here had very little face-to-face contact during the study period. Most of their contacts were computer-based.

It is difficult to tell how many of these changes are due to the EIES experience, and how many have resulted from other events that took place during the same time period. Anecdotal data can throw some light on this matter. Reports from participants reveal that on at least four occasions during the course of this project friendships were formed between pairs of persons who had never met face-to-face. In one case a pair of people agree that they have developed a close personal friendship while using the EIES system.

In general, however, individual subjective reports seem to suggest that EIES is more useful as an adjunct to personal contact than as a substitute. For a pair of people who have actually met, electronic communication seems to be able to provide an adequate medium for the sort of frequent interaction that is needed in building up a friendship. Moreover, people who are on the road to becoming friends electronically are probably more likely to agree to attend the same face-to-face conferences and more aware of one another if they do. Many of our participants report a sense of "kinship" with other EIES people when they meet at a conference.

Participants suggest that when they do meet and develop some effectual ties they can maintain contact by using EIES. At this point, then, the subjective data seem to suggest that although EIES can be used in the creation and support of more intimate relationships, it is probably best conceived--in this context--as an adjunct to more traditional sorts of interpersonal contacts.

Summary and Conclusions

The overall results in this study show marked changes in patterns of linkages between the two waves of data collection. Participants got closer together and the initial patterns of stratification seemed to shift in form. Not only did participants "meet" via the computer, but there were noticeable increases in the extent of more intimate personal links between them.

Taken as a whole, the results were very much like those one might observe in a group of people brought together in a common physical location for an extended period of time. It is tempting, therefore, to conclude that computer-based communication can substitute for face-to-face interaction. Of course, such a conclusion cannot be drawn. Although this is a comparative study, it is not experimental. The confounding effects of history, maturation, testing and instrument decay described by Campbell (3) all compete with the computer experience as explanations of observed differences.

We do, however, have enough anecdotal information to suggest that the computer conference itself had an impact on the structure of this group. It is not unreasonable, then, to end with the conclusion that computer conferencing does seem to provide the sort of experience that can affect patterns of interpersonal linkages. Not only can participants exchange information, but they seem to be able to exchange friendship as well.

References

1. Mullins, Nicholas C. Theories and theory groups in contemporary american sociology. New York: Harper and Row; 1973.

2. Killworth, Peter; Bernard, H. Russell. Informant accuracy in social network data. Human Organization. 35: 269-286; 1976.

3. Campbell, Donald T. Factors relevant to the validity of experiments in social settings. Psychological Bulletin. 54: 297-312; 1957.