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Network User Information Support

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Network User Information Support

National Bureau of Standards MAY 1 4 1974

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FOREWORD

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- Primary Issues in User Needs

 D. W. Fife
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- 2. Some Technical Considerations for Improved Service to Computer Users T. N. Pyke, Jr. COMPCON, 1973 Seventh Annual IEEE Computer Society International Conference
- Computer Networking Technology A State-ofthe-Art Review
 T. N. Pyke, Jr. and R. P. Blanc
 COMPUTER Magazine
 Computer Society of the IEEE, August 1973
- Review of Network Management Problems and Issues A. J. Neumann NBS Technical Note 795, October 1973
- Annotated Bibliography of the Literature on Resource Sharing Computer Networks
 R. P. Blanc, I. W. Cotton, T. N. Pyke, Jr., and S. W. Watkins
 NBS Special Publication 384, September 1973
- Network Management Survey

 W. Cotton
 NBS Technical Note 805, Fall 1973

- User Procedures Standardization for Network Access
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 NBS Technical Note 799, October 1973
- Review of Computer Networking Technology R. P. Blanc NBS Technical Note 804, Fall 1973
- Microeconomics and the Market for Computer Services

 W. Cotton
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- Cost Analyses for Computer Communications R. P. Blanc NBS Report, Fall 1973
- 11. Network User Information Support A. J. Neumann NBS Technical Note 802, Fall 1973
- 12. Quality Service Assurance Experiments R. Stillman NBS Technical Note 800, Fall 1973
- A Guide to Networking Terminology A. J. Neumann NBS Technical Note 803, Fall 1973
- 14. Research Considerations in Computer Networking D. W. Fife NBS Technical Note 801, Fall 1973

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NETWORK USER INFORMATION SUPPORT

A. J. Neumann

With increasing interest in the development of computer networks and the proliferation of remote entry capability from user terminals, user support takes on new dimensions. Some user characteristics are outlined as they affect user support. User support requirements are identified for training, terminal operation, and general information to aid in network operations. Support capabilities include online aids, information available on request, and tutorial information available at the terminal. User support also includes pertinent documentation and human consultation. Areas of future research are identified as: interactive language design, tutorial design, integration of hard copy and on-line capabilities, and further development of user feedback capability.

Key words: Computers; consultation; documentation; information support; networks; on-line support; user needs; user support.

1. INTRODUCTION

With increasing interest in the development of computer networks, more and more users have an opportunity to operate computers from a remote terminal. The location of the terminal may be such that the user becomes separated from the "computer center environment," and from needed user aids. These may be reference manuals, directories, and specialized technical documentation, or human contact with the computer operator, programmers, system analysts and subject specialists.

The remote terminal operator still needs this support, and this report summarizes these requirements from the viewpoint of the user at a remote terminal.

System capabilities which can be brought to bear to satisfy these requirements are automated support available in an interactive mode or on request at a terminal, supporting documentation, and human consultation and assistance. They can support the user during a variety of activities. There may be training assistance to teach system operation and operation of special applications packages, either provided automatically or on explicit request. Also, questions may arise which need to be answered immediately and automated network support is designed to do just that. Finally, the network is a useful communications medium to provide news about network events, network status, and summary of historical information of interest to the user.

This study details terminal user requirements, presently available or desired system capabilities, and some of the interactions between alternate possible methods of implementation, and trade-off possibilities. It will also identify further research needs that could lead towards greater network utility from the user's standpoint.

2. USER CHARACTERISTICS

There are many kinds of users in the network environment. Kugel [1]* defines two major classes: The "serious users," and "non-serious" users. The latter class is rather impressed by the technology, the lights and switches on the terminal, and is satisfied that there is a response at all to an information request. The serious user, on the other hand, is more critical and is quite concerned with the utility of the answers supplied by the system.

Another broad class of users are direct consumers of user services, such as scientists, engineers, and technical managers, who make direct use of the information or service supplied by the network. In contrast to these "primary users," are "secondary users," who act as intermediaries and provide information received over the network to others. They may be librarians or information scientists, or persons which McCarn [2] calls "gatekeepers," i.e., people whom other people ask for advice. Their common characteristic is that they are interested in information, and that they are a highly motivated clientele, interested in the dissemination of information. System support requirements differ for serious and non-serious users. They also vary for computer specialist users, or non-computer oriented professionals.

Support requirements depend not only on the type of user, but also on his experience and his exposure to a particular system. Katter and McCarn [3] have defined

*Number in brackets refers to reference at end of report.

patterns of user reaction, which they call the "confidence phase," the "insight phase," and the "incorporation phase."

During the first phase, the confidence phase, "the user shifts from an uncertain, hesitant, somewhat anxious approach to the terminal to a more relaxed attitude of ease and optimism regarding his personal ability" to operate the system. During the insight phase, the user shifts from rote memorization of system use to learning about the underlying principles and potentials of the system. He begins to explore the capabilities with a view towards his own specific problems. Finally, during the incorporation phase, the system becomes an integral part of his information usage practices.

Marcus, et. al., [4] have observed certain factors of user behavior. They believe that these factors can cause difficulty in instructing the user. They are paraphrased here: (1) Users often fail to notice even the most explicit instructions. (2) There is no one single method applicable to all users. (3) If there are too many instructional options, they are all ignored; the user prefers to be given instructions only when he needs them. (4) Users do not like to spend time in preparation for system use; they would rather use the system. (5) Users are constrained by experience with previous manual systems and by training. There is a barrier against learning anything new. (6) Some users fear the machine, either because they think they may appear foolish, or because they fear they may damage the system (machine fear). Some users do not want to ask for advice (people fear). (7) Users are overawed by the complexity of the system, and "assume they need not or cannot understand the system." Such attitudes impede learning.

With this perceived background of user behavior, the authors offer some advice: (1) Users learn best by doing, especially when the system responses reinforce user actions. (2) Users work best on real problems, i.e., when they have a real need for information. (3) General ideas are better presented by examples than by general rules. (4) Human personal instruction is best. On-line instruction is more effective than off-line instruction, even when materials are identical. (5) It is important for the user to know that he cannot break the system. (6) A variety of instructional materials is necessary so that the user can choose the one most suitable to him. (7) Several learning strategies are identified: some persons want to understand the system, while others only want instructions on what to do; some want to know everything about the system before they start, while others want to learn as they go; and some understand computers, while others don't.

3. USER ACTIVITIES REQUIRING SUPPORT

For the purposes of this study, user activities requiring information support are grouped into three areas: (1) training, (2) actual terminal operation, and (3) general information needs. These requirements are met by a range of system capabilities covering on-line automated processes, documentation, and human support. Figure 1 shows a matrix relating requirements and system capabilities. Rows of the matrix show user requirements for training, terminal and system operation, and general information support. The columns summarize system capabilities, which can be supplied, such as automated interactive, or "on request" support, documentation, or human support. Each box of the matrix contains products which are provided by the system to satisfy the requirements. It provides a framework for the following discussion.

3.1 Training

Training of users involves primarily learning how to use the network facilities. This involves programming in languages available on the network, information retrieval, or other available services. Implicit in learning how to use the system is a basic understanding of some functioning of hardware, such as computers, input-output equipment and communications equipment. Also required is some knowledge of the operating systems in use on different host computers, communications handling programs, and those applications programs and high level languages to be used by the user.

Training support requires great flexibility, both in scope and depth of material presented to the student. The material must be subdivided in such a manner that students have the choice of selecting training aids to suit their particular needs. There is close interaction in training material for general system use, and use of specialized applications, such as on-line programming, information retrieval, or teleconferencing. New system users should have an opportunity to learn system operations through a combination of courses at a training location and by means of sessions at an interactive terminal.

3.2 Operation

Operational networking activities cover the gamut of available applications programs. They not only include a variety of computational techniques and on-line programming, but various information retrieval systems, text processing

HUMAN SUPPORT	. Instructors Several levels and fields of interest . Reference capability	 Consultants Hot Line/Face to face Several levuls Disciplines Varyiny scope Ploblem Diagnosis General Assistance 	 Consultants Critical Reviews Evaluativo capability
SUPPORT DOCUMENTATION	. Overview brochure . Introductory manual . Training manuals . Reference manuals . Pocket Guides	 Operator/User manuals Application catalogs Maintenance Aids Directories 	. User Newsletter . Management Newsletter . Development Reports own/other systems
AUTOMATED SUPPORT Interactive On Request	. System Overview . Interactive Backup Drill Material . Programed Programs Instruction Manual Updates	 Frompting HELPI Diagnostics EXPLAINI Error reporting Format Options Becumentation Revisions Status Information Session Statistics 	. Change Notices . System News . Capability Index . User Feedback
SYSTEM CAPABILITIES REQUIREMENTS CAPABILITIES	TRAINING Introduction Drill and Fractice Teaching Experimentation	OPERATION . Computation . Information Rotrieval . Text Proparation . Teleconferencing . Syntom Anguranco ,	SRUEFAL INFORMATION . News . Statistical Summaries . Other Information . Poference . Raferral

Support Requirements and System Capabilities

Figure 1

capabilities, and possibly in the not-too-distant future some type of teleconferencing capability. The user of a terminal would like to be assured of proper systems operation at all times. He also will want to be in contact with colleagues in his field of specialization, who may also be network users, and with whom he may collaborate on common problems.

Support for these activities will have some common elements, and some specialized capabilities. A user would like to proceed speedily through his task, but receive support as soon as needed. He also needs system status information and session statistics, i.e., resources used, usage times, and usage costs.

There is need for user manuals, again in flexible formats, to support users with different levels of experience; possibly different manuals for different user levels need to be prepared. Catalogs are needed regarding availability of application programs, costs, sizes, machine and programming language details for a variety of disciplines. Directories of "who is doing what where," with names, addresses, telephone numbers, and a brief description of efforts underway would help human communications in the scientific area.

The terminal user who is, at least geographically, isolated from the computing center community needs human intellectual support at several levels. He may be puzzled by a trivial formatting problem, may require some programming assistance, or may even have a technical problem which, although not network-service related, could be solved by another network participant.

3.3 General Information

In contrast to specific information pertaining to training and system operation, there is a need for general information which must be available to a user. For instance, he wants to be apprised of the status of the system, i.e., the operability of all hardware and software components. This may include such detail as specific knowledge of a hardware configuration at a specified site, a software specification release number, or some specifics on operating procedures.

He further would like to be made aware of coming hardware and software changes. He also would like to know impending alterations of schedules, billing schemes, and other procedural detail affecting his use of the system. At times, he may want to receive summaries of usage statistics, such as total cost per project, total cost per month, total cost for the current year, and so on. He may want to inquire about specific system capabilities at a network site, such as availability of a - say - FORTRAN compiler, a data base, or a computational package. In the interest of efficient system use, he may want to compare compile or run times for a specific program at available sites.

With rapidly changing technology, systems are changing rapidly, and networks are in a state of flux. Additions are made, and some nodes may be disconnected. A systems capability index would be invaluable in providing the required capability data. Systems evaluations and reports on systems performance would also be of interest in this connection.

Advice may be desired on his own system, or on other systems at other network nodes. Finally, just as in training, there is need for general consulting assistance. Though not of real-time urgency, a network user may want to discuss network-related or discipline-related problems with a colleague. He may want an answer to a question such as: "Who is working on my specific problem, or a related problem where?" The human mind still is the best tool to solve problems of that nature.

4. SUPPORT CAPABILITIES

The user support requirements outlined in the previous chapter may be satisfied by a variety of capabilities. Starting with the most complex, an interactive system may have a built-in dialog which is specifically designed for user support. Other automated support may be available from the terminal upon request. Both methods depend on time constraints. If data are required as part of the operating process, they must be furnished by the user--immediately. If a system reaction is required immediately, this too leads to an automated implementation. On the other hand, if time is not of the essence, or if information is not subject to rapid change, conventional hard copy documentation may satisfy the need. Finally, certain information is best handled by the human mind, and a consultant, i.e., human-tohuman dialog will best serve the need. In the following, we will outline some of the possible implementations of user support.

4.1 Automated Support

Whenever there are urgent time requirements and rapidly changing data involved, automation of the information process is a necessity. Automated support may be designed in two modes: (1) It may be available as on-line instruction or guidance, i.e., it is built into the interactive process itself, or (2) it may be available at the request of the user. He may use the latter facility as augmentation of the on-line process, or he may use it exclusively for selfinstruction or use at his own speed.

These aids are useful at several operational levels: during the first system entry, during communication with a host computer and its operating system, and during later use of specific, specialized working systems such as information retrieval, interactive programming and operation, text processing, or teleconferencing.

4.1.1 Interactive Support. Interactive support is based on the capability of the system to alert the user to various system conditions, as part of normal operations or under conditions of faulty system operation. These "system messages" may be simple prompting signals, brief system messages, or complex statements in clear English.

Prompting commands may be graphic symbols such as "*" or "?" having precise meanings such as "go ahead!" or "repeat entry!". A large variety of prompting signals exist in the networking environment [5], and the casual user requires good system documentation, and often step-by-step prompting in meaningful, clear English. Experienced users, on the other hand, prefer a minimum of prompting, but appreciate on-demand system assistance.

Other system messages during an interactive session may indicate the present status of the system, or anticipated system changes of interest to the user. Anticipated changes in system availability often are indicated by messages such as: "System will be down from Friday 23:00 through Monday 09:00." It is common to indicate the present version of system software, and in some cases system configurations, port number, or other hardware and software details, to aid the user in tracing malfunctioning of operations.

Syntactic analysis of user entries provides error messages in a variety of forms, ranging from the very specific to rather cryptic symbology. A few typical examples are: WRONG USER NUMBER, ILLEGAL PASSWORD, FILE NON EXISTENT, SYSTEM NOT AVAILABLE, WHAT?, T CAN'T, EH?, or just plain "?".

User guidance for error correction may also be provided. For instance, if a line communications error is detected, the system requests retransmission by the user, by printing: "Sorry, say again."

4.1.2 <u>Support on Request</u>. Most systems provide additional assistance, beyond the immediate interactive process. During a terminal session, for instance, a user may want to request a summary of all available system commands including meanings and related procedural detail.

Entry of a "?" by ARPANET¹ users, while in a command mode, will in some systems provide a listing of all top level commands, if no previous command entry has been made. At lower levels, subordinate commands will similarly be listed. The command "Where am I," causes a printout of the local job summary, system in use, user terminal and remote host connection. In most systems, INFORMATION, or HELP commands by the user will provide additional instructional material on the terminal display. Detail of content, or sequence of display often is variable to meet varying user needs.

In some systems, entry of the command CATALOG may produce a listing of all existing user files under a specific account number, and also may indicate the availability of these files. Some may be "public," and available to all authorized users; some may be "private," and only available to specific users. Other information available on request deals with currently active network nodes, nodes presently not in operation, listings of program available in the public program files, and directories.

Good hard-copy documentation backup is required for automated on-line capability and the query capability. Hard-copy and automated capabilities need to be well integrated with each other to be most effective. Online tutorials may want to refer to passages in the manual text, while manual chapters may refer to specific portions of the on-line exercises and drills.

¹ARPANET, a nation-wide distributed research network sponsored by the Advanced Research Projects Agency, a U. S. Government Agency.

Most systems provide a variety of format options, abbreviated system commands, short login sequences and abbreviated tutorials. These features are welcomed by the experienced user.

4.1.3 <u>Self-paced Assistance</u>. Another form of tutorial assistance permits the user to explore the system at his own speed. This method follows the methodologies developed in "Computer Aided Instruction" (CAI). Software and computer requirements for tutorial capability may however be quite sizeable. The following data were quoted for the INTREX² system [6].

The interactive part or dialog handling program requires about 15,000 bytes of computer storage. There are 75 types of messages, each in a long and short form, which are made up of about 300 message fragments. The message fragment file requires about 19,000 bytes. The reference guide requires about 80,000 bytes of storage, or more than half of the interactive capability.

The design of tutorial assistance programs faces the same difficulties that exist in development of computeraided instruction. Requirements differ for each individual, and the tutorial designer cannot anticipate all variations of scope, depth, and ordering of questions which may arise some time in the future. Printing of straight text may possibly be done more economically by conventional offset processes, rather than by terminal printing. On the other hand, immediate availability of authentic instructional hard-copy does have its advantages.

Much work has been done on computer-aided instruction and further applications in network support will undoubtedly take place. The computer is a versatile tool for presenting information to a student, recording answers, reviewing progress and modifying the course. It is not a substitute for a teacher, but in conjunction with a teacher it may perform useful functions. One large manufacturer has used the technique to provide field engineers with a uniform background on fundamentals before bringing them together for more advanced

²INTREX, an automated library system developed at the Massachusetts Institute of Technology.

training in the classroom [7]. Meadow claims a reduction of training costs in this connection [8]. There are many problems yet to be solved, the biggest being course writing.

4.1.4 User Feedback. An important facet of on-line operation is the capability of instant user feedback to the system. This is useful for error reporting [14], where a user may communicate a system malfunction and related information to a central facility, which would collect error statistics. A host node could then be charged with solution of problems of system malfunction. Another type of feedback which has great merit is the ability of the terminal user to indicate satisfaction regarding various system features, and to suggest improvements.

4.1.5 <u>Support to On-Line Programming</u>. One of the major advantages of timesharing systems is the capability of on-line debugging. Some automated assistance is available in most systems. Syntactic analysis of user commands is a main feature of such assistance. An invalid command is recognized, the user is informed, and the command is not executed. Frequent typical errors are format errors or misspellings. It also is possible to make reference to a data item for which a value has not been established. An instruction: SET X = Y + 5, may elicit a computer response: Y = ?, indicating that no value has been assigned to this variable. The extent to which such command analysis has been implemented varies. The limits to which such analysis is technically possible are still unknown, and are studied in the general field of structural linguistics. The extent to which an error is indicated to the user also varies among systems. A command: PRINT X, may cause a system response "?" or WHAT. Another system may respond: FORMAT ERROR. A third system may say: INCORRECT COMMAND. The question of how much error diagnosis should be designed into the system is still a controversial one. From the programmer's viewpoint, complete error diagnosis and instructions how to correct the error would be desirable. But the designer of a syntactic analysis program can only provide for recognition of an error; he usually cannot predetermine the cause of the error.

One of the leading timesharing systems provides about 70 system messages to the user, of which about 20 are labeled "self-explanatory" in the instruction manual. A few typical self-explanatory system messages are: WRONG PASSWORD, INPUT ERROR, RETYPE, NO SUCH FILE, etc. Other messages--although in plain English--are subject to program and system restrictions, and are open to interpretation by the programmer. Tutorial assistance on program debugging will be useful and necessary services to be provided in future systems.

4.1.6 Information Retrieval Support. Several typical on-line service commands from the MEDLINE³ information system illustrate support to information retrieval The EXPLAIN command allows the user to obtain on-line explanations of any command or program message. NEIGHBOR provides index terms that are alphabetic neighbors of the search term, TREE causes a thesaurus display of terms related hierarchically to the specified term, and NEWS provides the user with announcements. Some instructions are issued automatically such as: IF IN TROUBLE AT ANY TIME TYPE "HELP" or DO YOU WISH A FURTHER SUMMARY OF OPERATING FEATURES? TYPE YES OR NO AND CARRIAGE RETURN. A positive answer then provides an initial summary of operating features. After about 15 lines of print, the system asks: CONTINUE PRINTING? (YES/NO). This permits the user to terminate the instructive session at regular intervals.

Similarly, in the BASIS⁴ system, alphabetically adjacent search terms are listed, if a term not in the alphabetic index is entered. On-line orientation is provided by a routine question during the early phase of the log-in procedure: DO YOU DESIRE OPERATING INSTRUCTIONS YES OR NO? A YES answer then provides user assistance.

4.2 Documentation Support

While the previous section has described existing automated support capabilities in some detail, this chapter deals with conventional hard-copy documentation support.

Individual computer manufacturers provide generous numbers of user's and operator's manuals, and other reference material. These publications vary both as to scope and detail provided, as is proper to meet the needs of different user communities. In the networking environment, however, one user

³MEDLINE, an on-line medical information system, sponsored by the National Library of Medicine.

⁴BASIS, an information retrieval system providing access to several data bases, developed at the Battelle Institute, Columbus, Ohio.

may want to work with terminals of different make, computers from different manufacturers, and a variety of communications equipment either furnished by the common communications carrier or by commercial vendors. He now faces documentation with different formats, reference structures, manual titles and sources and this creates problems. He may be flooded with volumes of paper, he may have problems organizing the material for instant use, and he may find it difficult to update his collection.

A useful tool which is available from most systems is a little "pocket size" system summary or system guide. It provides an overview of access methods, systems commands, operating hours, costs, telephone numbers, and other useful information. These guides are most helpful to the user and are relatively cheap to produce, update, and distribute. From a networking standpoint, it would be useful to develop, some time in the future, integrated pocket guides listing service features available on all network service facilities. They might follow the precedent of the integrated airline guide which lists in a concise fashion all airline schedules for the top 33 traffic producing cities, is updated monthly, and is available on a subscription basis from a non-airline publisher.

Introduction of automation is beginning to change the documentation pattern. In training, conventional programmer or operator training material no longer meets the needs of the sophisticated user.

Also, some of the training can now be done at the remote terminal, either by programmed instruction (CAI), or by the opportunity for self-teaching and experimentation. The distinction between classroom training and on-the-job training is shifting from the classroom to the user terminal environment. This requires a new approach to meet the changing needs of the remote terminal user. Texts need to be integrated with on-line support, as previously outlined, and references both from the automated system to hard-copy manuals, and from the manuals to the systems procedures should be provided. They should be designed to facilitate learning of system operation as well as aiding a skilled terminal user in the use of new system features, either new to him or recently introduced. There is a fruitful area for further investigative work in this hard-copy, online interface area. Tradeoff studies and experimentation are required to determine the overall cost effectiveness and utility of total user information support. New formats may have to be developed, possibly in loose leaf form, to permit a user to collect all necessary documentation in a practical and useful manner. Material should be integrated,

indexed with the user's viewpoint in mind, must be easily updateable, and must indicate currency of each item in the collection. Updating through the terminal, provision of announcements of new material available, including a simple order form, are some of the possibilities which should be explored.

Other material required are system directories, listing users both alphabetically and classified by field of interest and location. Also of use would be catalogs of available software packages, classified by name, machine capability required, and location.

Similarly, the preparation of brochures given a systems overview might be of benefit to potential new users.

Newsletters, geared to the needs of different communities and distributed on a periodic basis would be a welcome tool for the total networking community. A user newsletter would announce new capabilities, resources, schedules, pricing schemes and applications available on the network. A management newsletter would address policy issues, matters of legal concern, financing schemes, system performance characteristics and other matters of interest to the management community.

These publications would form a link between the human support capability discussed in the next chapter and the continuously improving automated system capabilities.

4.3 Human Support

The advent of automation has opened new vistas in the field of processing of text and of intellectual tasks. The history of the past 20 years regarding language translation and language analysis is well documented and need not be discussed further here. One thought is appropriate, however: no machine has yet even approached some of the innate human capabilities. The diversification of human memory, the ability to integrate myriads of facts, suppositions, premises and the dynamics of human information processing are in no way matched by efforts in mechanization, automation and machine processing.

At this point of time, even the most automated information system still requires human aid, human intervention and human support, especially at the interface of automated systems with people.

The first exposure of a user to a networking capability is some instructional phase. He may take a programming course in a conventional classroom, or through the medium of programmed learning, or he may learn to program by himself with the aid of training manuals, textbooks, and the terminal.

A good teacher in the classroom goes far in making the new subject palatable to the student. Textbooks have to be written by knowledgeable people, and programmed instruction material to be used with computers similarly has to be prepared by subject-matter experts. It is well recognized that the main bottleneck in the useful application of automated instruction is a lack of knowledge on how to prepare good material and a dearth of good "course writers."

Human support is equally important and needed during the operational phase. In a dynamic on-line situation, human experience and knowledge are best transferred to a user by direct human support. Face-to-face advice at the terminal will go a long way in diagnosing problems, suggesting remedies, or outlining approaches towards a possible solution. The possibility exists to have two terminal operators at different locations work together on a common problem. Although the immediate personal contact is lacking, a consultant still can give quick and direct assistance in this case. Another means of providing remote human assistance is by means of a "hot line," where the terminal operator may have instant voice access to a consultant via a direct telephone connection.

For both teachers and consultants, several levels of competence should be available, covering the available technology, including hardware, operating systems, communications, and other general purpose software. Similarly, assistance will be appreciated in the special interest areas of the users. A terminal operator often becomes "format bound," or "algorithm bound," at a level of system operation where he loses the overview. A consultant can bring his experience to bear on the problem and can assist with problem identification, problem diagnosis, and guides to solutions. This saves the time and energy of the user, and helps to maintain interest, especially during the "confidence" phase of system operation.

As far as general information support is concerned, human consultation may provide answers to questions which initially cannot be precisely formulated. Human support may also provide answers which it may not be advisable to document. A consultant may provide a critical view of present user's efforts, or he may provide a critical overview of the field, leading to a reorientation of the user's approach. He may provide evaluative capability and also may provide referral to other workers in the field, to answer the typical question: "Who is doing what in my speciality?" Although organized general efforts exist to provide information on names, projects, location, etc., the network consultant will have the viewpoint of the network user, and will be able to provide specialized guidance as well as broad referral capability.

5. NEXT STEPS AND FUTURE RESEARCH

User support in automated interactive systems in the networking environment will become increasingly important. This report has summarized some of the requirements and has shown diverse methods for providing user support, ranging from assistance during the interactive session through documentation and human support.

Several problem areas emerge. Proper design of support capabilities needs to be addressed in an integrated manner, providing support when and where needed on a highly individualistic basis, but at the same time considering the overall system economies of preservation of processing and storage capacity, both in the automated system and in hard-copy production and distribution. Major interest should focus on: interactive language design, tutorial design, integration of hard-copy documentation and on-line printing, and further exploitation of user feedback.

System designers have given considerable thought to the language design problem. Katter and McCarn [9] make the point that there seems to exist a certain "response press" which the network terminal exerts on the user during the early phases of use. "This sense of pressure from the terminal can probably be heightened or diminished by the nature of the readiness cue from the system that it can accept input. Words such as READY, NEXT, and GO might cause more neophyte distress than USER or DONE." They are also concerned with providing the system with "graduated [human] memory support" for various stages of human learning.

Ershov [10] opposes the use of natural language. He states:

Organizing the man-machine dialogue, one must (also temporarily) avoid unnecessary personification (humanization) of the machine. In particular, excessive fragments of natural languages as a linguistic means for dialogue appears to be ineffective because it overloads memory and channels and produces delusions in the user. He later elaborates, saying that application of natural languages in contact with the machine has been harmful, both for the professional and non-professional user:

For the non-professional man it is harmful because the application of natural language increases the tendency towards machine personification and towards extrapolation of the experience within inadmissable limits. For the professional man, because a symbolic language is as yet more laconic, more neutral, and can more easily be subjected to specialized mnemonization and selection of dialects.

One common difficulty users are experiencing with system messages is their inability to determine the source of the message or the system level. In a timesharing system using one computer, a user may alternately communicate in the command mode, the working system mode, or with a subsystem. Various system layers often recognize different sets of commands, and after an intensive work session at the terminal, a user often cannot keep track of the program level and the appropriate command structure. This could be remedied by level indicators in system messages and by some standardization of system messages and command. If standardization efforts are initiated, proper design of a command language will, however, require some fundamental studies, such as the appropriateness of using plain language words and applying purely symbolic representations in command languages.

Tutorial design is closely related to the problem of computer aided instruction. Interactive system designers should profit from both positive and negative results obtained in this field. Nickerson [11] in a survey article challenging human factors research paraphrases Holmes [12]: "The need of the future is not so much for computer-oriented people as for people-oriented computers." Many authors in the field of man-terminal interaction are still "computeroriented people." There is need for inter-disciplinary efforts, including computer science, linguistics, psychology, and other human-oriented disciplines.

Documentation integration has been addressed very little, yet this may become an even greater problem as time goes on than it is now. Magnino [13] stated that: "There was no significant literature on combination manuals in 1970, and this author believes that there is a significant gap in our development here that must be filled if terminal systems are to be properly exploited." With the advent of networking, this problem undoubtedly will be compounded, and research in this area will enhance system usage and utility. User feedback provides a powerful tool, not only for the systems developer, but for the system operator, and future system planner as well. A real opportunity exists now to measure not only system performance, but user reaction to system capability. Further research on user feedback requirements and system capabilities will contribute to improved networking operations.

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16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

With increasing interest in the development of computer networks and the proliferation of remote entry capability from user terminals, user support takes on new dimensions. Some user characteristics are outlined as they affect user support. User support requirements are identified for training, terminal operation, and general information to aid in network operations. Support capabilities include on-line aids, information available on request, and tutorial information available at the terminal. User support also includes pertinent documentation and human consultation. Areas of future research are identified as: interactive language design, tutorial design, integration of hard-copy and on-line capabilities, and further development of user feedback capability.

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