Report No. 3

Application Description and

Evaluation for NLS

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NLS (On-Line System) is a text-editing, dialog-support, and communications system which provides users with a state-of-the-art tool for document production, communication, and information management and retrieval. This paper reviews the history of NLS at one site, and indicates the range of potential uses for the tools inherent to NLS. These uses were primarily for correspondence, document production, and information management. An informal evaluation is the second major part of this report. It concentrates on users' impressions of the system's utility, ease of access, and factors which might →

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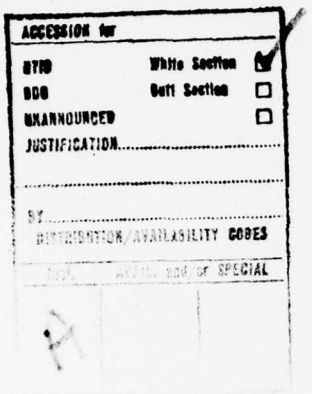
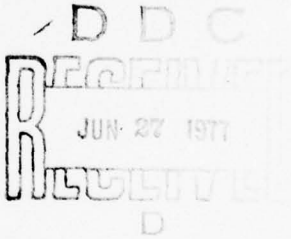
impede acceptance. Sample products and a discussion of office automation conclude the report.





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APPLICATION DESCRIPTION: ETS
(Educational Testing Service, Princeton)

Introduction

NLS (On-Line System) is a text-editing, dialog-support, and communications system developed and managed by the Augmentation Research Center at Stanford Research Institute. It provides users with a state-of-the-art tool for document production, communication, and information management and retrieval.

This paper reviews the history of NLS use at ETS. The intent is to provide some indication of the range of uses to which the tools represented by NLS can be put, even in a setting where their use is purely experimental.

Use of NLS at ETS grew initially out of access to the system provided as a part of a research contract with ARPA (Advanced Research Projects Agency), an arm of the Department of Defense. Brian McNally, a research assistant on the ARPA Project, was the first active ETS user; all of his NLS work revolved around the ARPA Project.

In addition to ARPA use, David Potter in October, 1974 began to use the system as a support tool for project and proposal-related document production and control. His use of the system grew until by January he was using the system for virtually all of his clerical support, and had gained sufficient expertise in its use to assume the role of system Architect at ETS. As the Architect, he began to build a group of other ETS users and to develop system applications that would allow ETS to fully exploit the system's capabilities.

Applications of NLS at ETS were in three major areas: document production and correspondence; data base construction and management, including bibliographies; and instrument construction.

The following descriptions include application strategies, generalizable descriptions of the specific uses of NLS, and a content specific description of the work.

Correspondence

Correspondence is written in the usual manner using NLS editing functions. The output is intended for non-NLS users, and therefore must be formatted for hardcopy printing. The formatting was done manually until recently when a special program was written called ETSMEMO. This program is similar in nature and function to LETTER, but it formats a file into the standard ETS memo style.

Document Production

Document production involves everything from writing an initial outline through the production of camera-ready copy. It includes composition (creating and formatting), editing, and revising, as well as the production and review of intermediate working copies. NLS is well-suited to all phases of this process; the application descriptions below summarize several examples.

Information Management

Several users have employed NLS as an information management and retrieval tool. This capability is particularly useful in building bibliographic data bases which may be explored interactively as well as being readily updated; again, the application description below contains several examples.

Two locally developed subsystems, INFOTEST and INDEXMAKER, were used to enhance NLS' basic information management capabilities while at the same time making these tools more easily available to the technologically naive user. INDEXMAKER, for example, can be used to create author, subject, or title indexes for a data base file (sample entries follow):

000791 - Achenbach-Lewis Symptom Checklist by Thomas M. Achenbach, Melvin Lewis; c1974; Ages 4-16.

This list of symptoms covers the kinds of behavior that typically are of enough concern to make a child a candidate for treatment. The checklist is intended to be filled out for children aged 4 to 16 by parents, interviewers, therapists, and people who know the child well.

001512 - Harvard - MLA Tests of Chinese Language Proficiency by John B. Carroll, Wai-Ching Ho, K.P. Chou, John de Francis, Y.K. Kao, H.C. Mills, R.C. Pian, J. Wrenn; c1959-65; Grades 13-16 and Adults.

This measure of proficiency in Chinese consists of two tests: Pictorial Auditory Comprehension Test, and Intermediate Reading Comprehension Test in Modern Chinese.

001716 - Work Performance Rating Form by Edwin I. Megargee; c1970; Adults.

This form is designed to assess the adjustment and behavior of inmates in their work in a correctional setting. It contains nine, five-point scales

pertaining to quality and quantity of work, job motivation, and interpersonal behavior.

This subsystem allows a user to create an index by using one simple command and specifyng the file for which the index is to be produced. The system does the rest. A sample of a portion of a system-generated author index follows:

Brown, Bob Burton
005947
005948
005949

Brown, Jeanette A.
007316

Busse, Thomas V.
007081

Cardon, B. W.
004811

Carroll, John B.
001512

This subsystem provides an excellent illustration of the tremendous gains in productivity which can be realized through the use of NLS. Generation and production of the author index without NLS takes several days; use of NLS as a text editor cut this back to two days. INDEXMAKER does the same job in approximately two minutes.

INFOTEST was designed to fill the need of ETS management for fast, efficient access to accurate, up-to-date information on the status of tests going through the various stages of the production process. INFOTEST, like INDEXMAKER, gives even the relatively untrained user access to many of the most powerful features of NLS. The system prompts the user to enter all necessary information about a test (e.g., title, form, project-job, program, director, all scheduled action dates, etc.) in order to create for each test an entry like the following:

(SOCSTUD-YCT2)
TEST: SOCSTUD-YCT2 DATE: 4/22/76

Program: CLEP P/J: 180/20

Subject : Social Studies And History Form: Yct2

Director: Rhodes

Coordinator: Pfeiffenberger

Assembler: Brown

SCHEDULE:
ACTIONS PENDING:

4	Sent to Committee.	12/31/75
5	Returned to Production.	1/21/76
6	Sent to Printer.	1/30/76
7	Delivered by Printer.	3/22/76
8	Administration Date.	4/15/76
9	Closed.	5/1/76

TASKS COMPLETED:

1	Received by Test Editing.	11/21/75 11/27/75
2	Sent to TA Secretary.	12/3/75 12/5/75
3	Received by Production.	12/4/75 12/21/75

A set of simple commnds allows the user of INFOTEST to retrieve all needed information quickly and easily. For example, one can list all tests for which some action is due by a given date; all tests associated with a given individual.... In fact, any field in the above example can be used as the basis for retrieval. In addition, entries can be modified, tasks marked as "finished," and reports of four types (Initial, Progress, Change, and Late) can be generated.

Report on Health Planning (Walton, Fortna, et al; HEW, Region 2 support)

A large report concerned with the technical assistance needs of the Public Health Service was written and produced through NLS. The report discusses the Public Law requirements for a Center for technical Assistance to the Health Service. The report was written with input and review from several geographically distributed contributors. Thus, NLS was ideally suited to the numerous revisions that were collected initially via phone converations with Barbara Esser, who supervised the report preparation.

Len Swanson developed and implemented a number of interesting applications:

1. Committee selection (internal P/J)

   The system was used to record and maintain information on people who are being considered for membership on a committee. The names were originally entered from notes and memos suggesting nominees. After sorting the names, addresses and information about each nominee were entered. Periodically additional information was added. The aggregate list was then printed so that several people could "rate" the nominees and select their top choices. The consensus of these choices were then culled from the original file and put into a second file, which was used to record expanded biographical data and prepare a summary report listing the desired names in order of selection.

2. Mailing List (ARPA support)

   Len Swanson is about to use the system to enter a 700 name mailing list and sort it (geographically) in order to remove duplicates. The result will be used to prepare mailing labels for distribution of project reports, and to produce listings of subsets of names.

3. Report (internal P/J)

   Len has used the system to prepare several working documents and one (brief) formal report. The report was prepared in several stages, with intermediate external review. The first step was to enter the topics (sections and subsections) and basic content. He next wrote sections (at random) as they occurred to him. After two editings and one restructuring of the file it was prepared for output and distribution.

4. Joint Papers (ARPA support)

Loraine Sinnott and Len Swanson are working on three documents which they expect to prepare jointly. Initial drafts of each have been entered by Len, and Lorraine will modify them and/or suggest changes through the system. These papers include an interview guide for TRAIDEX interviewers, a list of information to be obtained prior to interviews, and a paper on the catalog of non-DOD information resources.

5. TRAIDEX scratch pad (information management; ARPA support)

Len has created a file to maintain miscellaneous information related to one of his projects. The file contains a list of key people (with addresses and phone numbers) related to the project, a bibliography of relevant reports and documents, a set of notes on various phases of the project, and a list of project milestones and date-related events.

Sex Differences and Discrimination in Education Data Base (Harris, Ekstrom, Lockheed; internal P/J)

Currently 736 bibliographic citations extracted from other more general data bases have been entered in a single file for searching using the standard NLS search functions, particularly content filters. Searching is done by author, titlewords, journal, date, and the other elements of a standard bibliographic entry (Psychological Abstracts Format).

[Citation sample:] Abel, H. And Sahenkaya, R. Emergence of sex and race friendship preferences. CHILD DEVELOPMENT, 1962, Vol. 33, 939-943.

Abstracts are available and it is planned to enter them in a separate file linked to the appropriate citation in the bibliography. This would form the basis of a free text search and retrieval function on the abstracts.

Volunteer Activities of Women Data Base (Harris, Lockheed, Ekstrom; FIPSE support)

This bibliographic data base is part of a study to evaluate and analyze the volunteer activities of women to establish a means of assigning academic credit to those activities.

Test Collection Index (Fortna; Support from ERIC and internal P/J)

ETS maintains a large collection of all published (and many unpublished) tests. As new tests are received and added to the collection, basic information about each test is recorded in a standardized format. The following is a sample:

001716 - Work Performance Rating Form by Edwin I. Megargee; c1970; Adults.

This form is designed to assess the adjustment and behavior of inmates in their work in a correctional setting. It contains nine, five-point scales pertaining to quality and quantity of work, job motivation, and interpersonal behavior.

Dick Fortna (ROF) has begun putting this information online. Currently 118 tests have been entered; the Output Processor has been used to prepare publishable copy from the file. In addition, specially-developed L10 programs, together with looping process commands branches, are used to prepare from this file a title index, an author index, and a subject index. Finally, subject codes at the end of each test entry allow automated retrieval of all tests in specific subject categories. (See the discussion if INDEXMAKER, above <016:gw>)

In addition, Fortna has used Output COM to publish papers for the ERIC (Educational Resources Information Clearinghouse) Center on Tests and Measurement. NLS has significantly reduced turnaround time in preparing and editing these documents, and promises cost reductions in composition and printing.

Teacher Behavior Research (Potter; internal P/J)

Online Teacher Behavior Data Base

David Potter is working in the area of educational assessment, developing evaluative tools and instruments for the assessment of teacher behavior in the public schools. The methodologies are sociometric and involve various techniques common to social psychology, e.g., shadowing, case studies, interviews, and questionnaires -- the latter using the online index.

The online index is a structured list of statements that describe the behavior of teachers in the classroom. It is based on the "Florida Catalog of Teacher Competencies".

The index is accessed through a locator modeled after

the Locator in Userguides at Office-1. It is not limited to teacher behavior, and includes additional top level headings such as Pupil Level, Object of Change, etc., and Teacher Behavior. Each of the 8 categories has lower level headings such as Developing Personal Skills, Performing Administrative Duties, etc. The next level contains more specific behavior categories such as Accepting Responsibility, Conferring with Parents, Motivating /Reinforcing Students, and so on.

Instrument Development

The online teacher behavior data base described above is being used by Potter to develop questionnaires, rating scales, and other instruments to be used in his Job Analysis of Teaching project. Use of the system in this manner has allowed working copies of these instruments to be produced quickly and efficiently, which enables him to make much better use of outside review than is the case when each instrument -- and all revisions thereof -- must be typed separately.

Example of question item with scale (instructions are added to the beginning of each questionnaire of course):

[Heading =] PLANNING INSTRUCTION

8. Selecting and specifying goals, aims, and objectives

```
Time Teachers |         |         |         |         | Hours/
SHOULD Spend  |....|....|....|....|....|....|....|....| Month

Time Teachers |         |         |         |         | Hours/
DO Spend      |....|....|....|....|....|....|....|....| Month

Time          |         |         |         |         | Hours/
YOU Spend     |....|....|....|....|....|....|....|....| Month
              0         10        20        30        40
```

Directives are used in the questionnaires and are inserted manually due to the highly structured nature of the questionnaire. One difficulty is encountered in the use of the directive .Plexnum; which will number every statement in a plex sequentially, e.g., 1. 2.... This is perfect for questionnaires except for the fact that all the questions are not in one plex. The headings ("Planning Instruction" in the above case) are logically at a higher level, yet the questions they subsume must be numbered from the beginning of the questionnaire. This limitation has been circumvented by putting the headings of individual questionnaire sections at a level below the questionnaire items.

Other Questionnaires are constructed from the locator using different scales. For example, the respondents are asked to rate the importance of each category:

8. Selecting and specifying goals, aims, and objectives

Not at all Important.....|.....|.....|.....|.....|.....Extremely Important
1 2 3 4 5

The Work Diary, also created from the locator category list, is best described by including the instructions for the respondent:

"This work diary is intended to help us understand how you spend your time as a teacher -- that is, how is your time distributed across the 44 teaching tasks listed below? We would like you to fill this form out three times a day: (1) around noon, to tell us how you spent the morning; (2) at the end of the school day, to describe the afternoon; and (3) around the end of the evening, so we can find out what job-related tasks you've been working on since the end of the school day. [check the appropriate category:]

[Example:] PERFORMING ADMINISTRATIVE DUTIES

23._____Supervising aides, tutors, etc.

24._____Arranging physical environment

(There are 44 statements total in the questionnaire under approximately 12 headings.)

The Critical Incident Record Form (Type I) uses an open ended questionnaire design that when generated from NLS allows the reiteration of the instrument design to proceed without re-keying the highly formatted pages (produced by manually inserted directives). Example of instructions and questionnaire item:

"Think back over a period of time (six months or so) long enough for you to have observed the activities of all your teachers. Focus your attention on any one thing that one of your teachers may have done which made you think of him/her as an outstandingly good or very effective teacher. In other words, think of a critical incident which has added materially to the overall success of your school or department. Please do not record any names of persons involved in the following incident.

What were the general circumstances leading up to this incident?"

Document Composition and Production

Potter has for some months been doing virtually all of his writing on the system. This has included proposals, reports, letters, and memoranda.

General Comments:

The ETS architect's general intent is, at least in part, the augmentation of clerical functions. It may be that additional capabilities have been added that would take an unreasonably large task force of clerical personnel, and therefore would not have been accomplished outside of an augmented knowledge workshop. The typing of questionnaires with scales is laborious at best, while the repetitive functions can be easily accomplished in NLS. The job would become odious if there were numerous revisions necessitating complete retyping of the questionnaires each time. This editing augmentation is extended beyond the traditional word processing systems when the data bases, locator, and automatic generation of special subsets are considered.

In sum, ETS's application includes questionnaire production and bibliographic storage, search and retrieval, in addition to the usual functions of communication, and document composition and production.

OVERALL IMPRESSIONS

USEFULNESS OF THE SYSTEM

Use of NLS at ETS (as outlined in the Application Description) covers a considerable range of applications. The reaction of users to has been generally very favorable (for limitations on this, see the section on "Factors Limiting Use <04>").

The basic reason for the generally positive reaction to NLS has been based on the considerable reduction in personnel time required for document production. In several cases, users were able to generate reports or other papers quickly enough to meet deadlines which would otherwise have been impossible to meet. In other cases, notably the "Tests in Microfiche" document, no deadline existed, but personnel time reductions both reduced costs and permitted the production of a more timely, up-to-date document.

It should be emphasized that our use of NLS has not approached full utilization of the system's potential. The communications capability has been basically ignored; use of COM has been limited; and the building and manipulation of on-line data bases has only begun at a rudimentary level. Despite this, use of NLS at ETS has grown from near zero to approximately 100 hours per week (during the period from October through December of last year) in one year. The number of users and their sophistication in the use of NLS has grown in a similar fashion. This growth has been based on (and reinforces) our growing conviction that NLS is an extremely powerful, flexible tool for day-to-day use in text editing and document production.

EASE OF USE

A factor which has greatly facilitated user acceptance of NLS has been the ease with which both clerical and professional staff members have been able to gain basic competence in system use. Secretaries and professionals alike have with minimal training and experience been able to gain enough expertise to allow them to enter text, edit it, print it out, and communicate with other users -- that is, to perform independently all basic text processing and document production tasks. An extreme example of this was provided in mid-December by a secretary who, with no prior experience or training with any sort of automated text processing system, was handed the task of carrying a ten-page document all the way from initial typein through photocomposition. Sufficient proof of her success is provided by the fact that the document had been typed, edited, revised,

proofed, and revised by the end of the first week; page proofs were back from the COM supplier by early January. This degree of success was particularly impressive in view of the fact that half of the document was written in French, a language with which the secretary in question was unfamiliar.

FACTORS LIMITING USE

The only major factor inhibiting use of NLS has been the awareness on the part of the staff that our use of the system was fundamentally exploratory. Resistance to change of any sort is a basic facet of human nature; when the change is implicitly temporary (by virtue of the fact that it is not definitely permanent), this resistance often increases. In a very real sense ETS users confronted a paradox: no firm organizational commitment to NLS could be made until experience with the system had allowed adequate evaluation of its worth -- but without any long-range commitment, most individuals and organizational areas were unwilling to make the plunge into the kind of system use required for adequate evaluation.

One additional limitation on system use bears mentioning: Use of the system was limited by the number of phone lines and terminals available. This was essentially a nuisance factor, as we had enough of both to go around for all except real peak use situations; nevertheless, the annoyance of getting a busy signal on dial-up certainly had a small but significant negative impact.

OTHER COMMENTS

Our evaluation of NLS as a basic working tool was strongly positive. Despite this, ETS is no longer a client of SRI. This has nothing to do with our impression of the system; rather, it is based on the fact that thus far SRI has been unwilling to sell the service on other than a one-year bulk basis. The fact that the basic $52,000 subscription provides a tremendous amount of power and service at a unit cost that is potentially far lower than anything available elsewhere does not change the fact that $52,000 is a lot to spend on services which have not yet been received, and which might therefore conceivably never be used. In a very real sense, this problem, which is purely a financial management question, represents the greatest single reason for ETS' withdrawal from the NLS user community.

Attachments:

D. A. Potter 16 JUL 76

INTRODUCTION

Automation has had a profound influence on our lives. Computers maintain records, control production, write letters, prepare bank statements, help children to learn, assist physicians in diagnosis... Few areas of modern life remain untouched by automation.

There is one noteworthy exception. In the midst of a conversion process unparalleled since the industrial revolution, the modern office sits, placid and serene, an island of pencils and paper in a solid-state sea of change. While a physician in Philadelphia receives in minutes vital diagnostic assistance from a computer in Texas, a Boston executive sits in his office, dictating a memo to his secretary, who will then type it, submit it for revisions, retype it, then put it in the inter-office mail to be carried from the third to the fifth floor -- a process which in all may consume twenty minutes of executive and thirty minutes of secretarial time, and four sheets of paper. All this will produce a message which will be delivered two days after its inception.

The office is perhaps the most heavily labor-intensive segment of the world of work today. According to Alan Purchase, senior industrial economist at Stanford Research Institute, the annual investment in capital equipment per office worker is only $2000, compared to $25,000 per year spent on capital equipment for each manufacturing employee. The explanation is simple: work which in a manufacturing context would be done by machines is typically performed in an office by people. Moreover, many activities are performed not once but several times, often involving totally redundant work.

A tremendous proportion of office work involves working with information and ideas. The executive described above is a case in point. The basic processes involved in this example will be analyzed below in greater detail; at this point, it is important simply to realize that the executive's work involves the generation, recording, and transmission of ideas (in this case, from an office on the third floor to another on the fifth). This type of work has often been called "word processing."

Of course, attaching a special term to a process does not suddenly render the process unique or esoteric. All office operations are involved in word processing; in fact, it is one of their basic reasons for existence, and the resulting flow of paper has grown until it threatens to choke the organization it was intended to serve. Gaining control of this process, reducing the mountains of paper, eliminating the redundancy inherent in

traditional approaches to word processing -- these are among the benefits of office automation.

A valuable analysis of "The Economics of Word Processing" was contributed by Benjamin Tartaglia. Writing in the Journal of Systems Management (November, 1973), he uses as an example the preparation of semi-technical manuals:

> "When you measure conventional typing speeds... you find that good operators are turning out around 10 words a minute. Some operators turn out 15 or 20 words per minute but they'll either quit or have a nervous breakdown at that rate. On... magnetic tape equipment you can get up to 20 to 23 words a minute. Using computer assisted word processing, you can get about 2000 words per minute. The reason computer assisted text processing is so much faster is that the manipulation of the data is in computer storage and not on tape... with computer assisted systems the operator is already entering the next job, while the operator at the magnetic tape equipment is watching the first tape play out..." (italics added)

This example illustrates the considerable benefits to be gathered from office automation, not only in word processing, but also in communication, information management, and document production. The office of the future is here today -- if we want it.

TEXT PROCESSING AT THE CLERICAL LEVEL

The considerable costs savings and productivity increases described by Tartaglia are based on applications at the secretarial/clerical level. His analysis of automated word processing breaks word processing systems into three basic elements: the originator, the transmission element, and the keystroking element. These examples all involve cases in which the three elements are discrete; they are clear examples of the benefits which can be realized simply by automating current procedures.

This sort of automation leaves the executive comfortably ensconced in a swivel chair, dictating or writing a draft of a document. These words are then transmitted (on paper, on dictation equipment, over facsimile equipment, etc.) to a secretary or typist who enters the text into the word processing system, after which it is played back and returned to the originating executive for review and modification. All changes are then made by yet another keyboard operation.

As Tartaglia demonstrates, office automation even at this level can produce tremendous gains in productivity, with commensurate

cost reductions, simply by reducing or eliminating redundant keyboard operations. Logically, however, only one step separates managers from full exploitation of current technology. Executives who, instead of writing or dictating, enter their thoughts and ideas from a deskside terminal, not only eliminate the redundancy inherent in the separation of the three elements; they also gain far greater control over the flow and form of their words.

Despite the widespread use of automated systems in other functional areas of the organization, the office -- particularly at the management level -- operates much as it did years ago. The primary medium for the flow of words and ideas whithin the organization is still the printed page; and although the ideas on the page may have been dictated into a central dictation system and transcribed by a member of the typing pool, the basic process has changed little. Origination, transmission, and keystroking (not to mention the redundant cycling through these steps during editing and revision) remain separate.

It is not the lack of adequate tools for office automation which guards the status quo. An excellent example of the scope and power of applications of technology to office operations is provided by NLS (oN-Line System), which is maintained and marketed by Stanford Research Institute.

For thirteen years the Augmentation Research Center (ARC) at SRI has been developing computer-based tools to enhance the abilities of individuals and groups working with knowledge. This research, under the direction of Dr. Douglas C. Engelbart, has been sponsored by the Defense Advanced Research Projects Agency, the U.S. Air Force, and other government agencies.

The set of integrated tools developed at ARC is termed the "Augmented Knowledge Workshop (AKW)." The focus has not been on problem-structuring methods or on analytical capabilities, but on an overall environment in which people can work with information and ideas. This effort has been guided by an orientation toward the nontechnical user, such as the business executive. These tools have been applied with considerable success to the work of a diverse set of organizations throughout the United States and Canada. The growth and further evolution of this information environment looks highly promising.

The change implied here is far greater than simply the automation of the way we work. Techniques like those developed by Engelbart and his colleagues hold the potential for actually changing significantly the procedures and structures of organizational life. According to George Pake (as quoted in the June 30 issue

of Business Week), "There is absolutely no question that there will be a revolution in the office over the next 20 years. What we are doing will change the office like the jet plane revolutionized travel and the way that TV has altered family life." And he continues, saying that within 20 years his office will be completely different: "I'll be able to call up documents from my files on the screen, or by pressing a button... I can get my mail or any messages. I don't know how much hard copy I'll want in this world."

AUTOMATION AT THE EXECUTIVE LEVEL

An organization's success depends on the effectiveness of its executives in guiding the organization through its complex environment. The scarcity and cost of executive talent imputes a high value to its efficiency. Organizations are becoming increasingly interested in providing a supportive working environment for their executives.

A large part of the executive's day involves working with information and ideas. Executives must be aware of the organization and its environment, through a wide range of contents and many levels of information specificity and permanence. They must solve unstructured as well as structured problems. They must work with others on ideas. Essentially, they are employed to think and to communicate. Advanced information-handling tools can play an important role in improving the effectiveness of the executive's use of valuable time.

Many organizations provide management with tools which are designed to help coordinate the flow of information. A management information system may help executives to get necessary information, no more, no less, pretty much when it is needed. Financial or accounting systems may keep the books, while still other systems are used to analyze business or market trends and forecast probable futures. To date, however, these systems have remained separate, and typically require specialized, trained personnel to run them. No one system either provides executives with the various information-handling tools they need, or even a coherent context through which they can reach these tools. Moreover, current systems tend not to be user-oriented -- that is, they are relatively difficult to learn and to use, sufficiently so as to discourage all but the most determined from aquiring sufficient skill in their use to garner any significant benefits.

The executive might use tools like those developed at SRI in many ways. Collecting information about the organization,

communicating with peers, superiors, and subordinates, collaborative work without regard to the locations of the collaborators -- and yes, even text processing and document production -- all are tasks well within the scope of currently available tools.

WHAT KIND OF AUTOMATION?

Magnetic tape (or disk) equipment

The vast majority of the word processing systems currently on the market fall into this category, which includes such equipment as IBM's memory typewriter, the near-classic Magnetic Tape Selectric Typewriter (MTST), and VYDEC's screen-oriented editor. These units are completely self-contained; to date, in fact, few if any provide even the option of communicating with computer-assisted systems.

Tartaglia (Journal of Systems Management, August 1974) estimates that such equipment can usually cut overall costs betwen 25 and 30 percent. For some applications, this may be more than adequate; not all text processing tasks require or can even use the power and flexibility afforded by more sophisticated systems. Before committing an organization to the purchase of any system, however, careful study should be devoted to the flow of text processing and document production through the organization. Generally speaking, magnetic tape equipment is relatively limited in its ability to grow and flex with the constantly changing needs of the company; moreover, its capabilities limit even its current uses.

Characteristically, these "stand-alone" devices are not designed for massive editing jobs. With the MTST, for example, basic editing is limited to the substitution of character strings (text) of equal length. Larger-scale editing changes require that the document be copied onto a second tape, manually stopping and starting the respective tapes when areas to be edited are reached, a process which closely resembles the way in which audio or videotapes are edited. Their major advantage is their cost; in terms of short-term costs, they represent the least expensive first step toward office automation.

Computer-assisted systems

Until recently, the thought of using a computer as the heart of a word-processing system would have been discarded as hopelessly impractical. The rapid growth in the availablity of increasingly powerful and increasingly economical interactive computers, however, has brought radical changes to the field. William Vetter, Director of Advanced Planning and Research for the Franklin Life Insurance Company (Best's Review, October, 1973) describes the result:

> At Franklin Life, a computer (word processing) system has been used for over five years. It followed an extensive use of automatic typewriters and it immediately lowered the unit cost to less than half. With practically no training, each operator began producing three times the volume produced on an automatic typewriter.

To compare:

Automatic Typewriter	Computer
Equipment --$285/month	Keypunch --$110/month CRT --$75/month Computer --$60/hour
Output, words per minute --150	15,000
Cost per thousand words --$.73	$.066
Operator input, letters per day --150	450
Input cost per letter -- $.153	$.051

As though unsure of the ability of these figures to convince the skeptic, Vetter goes on to list other advantages of the computer over the magnetic tape units:

1. Preworded letters and paragraphs can be stored on direct access economically.
2. There is no need to group letters by type.
3. The computer will "put on" the master letter in a few microseconds.
4. The work load can be smoothed out -- letters can be requested when the information is available and let the computer print and date the letter when it's time to send it.

Van Dam and Rice, in a survey of on-line text editing systems

published five years ago in Computing Surveys, summarized the advantages of the computer-assisted systems available at the time (it should be noted that the speed and power of these systems increased tremendously, with equally large cost reductions, in the five years which followed):

1. easy access;
2. immediacy of response;
3. ease of making hard copy without intermediate stages of typesetting, proofreading, resetting, reproofing, etc.;
4. reduced "turnaround" time for any type of file research and writing task;
5. common access to the same data base (this is useful for a pool of researchers or documenters working in the same area, or for common access to updated (project) management information;
6. "constructive plagiarism": the easy modification of previously written materials for present purposes (as in the writing of papers, contracts, proposals, or brochures);
7. great simplification of document dissemination and storage -- no hard-copy bulk, but any degree of archival protection desired;
8. far greater flexibility for browsing and linking text fragments than with manual methods of working with hard copy; and
9. relatively modest cost for all this increase in activity and efficiency, when compared with all aspects of present systems: writing delay, retyping, proofreading, typesetting, revision of galley and page proof, printing, binding, distribution, storage (and subsequent inaccessibility due to distance, lack of shelf space, poor indexing, borrowed or lost copies, etc.). The user cost includes the machine time used (typically a 5% or smaller rate of CPU utilization/user time) and the rental or purchase cost of the terminals employed.

Of course, selection of a computer-assisted system is no easier than choosing a hardware-oriented system. ATS, Wylbur, Hpertext, Script, TECO, and a host of others wait in an array of resources more likely to bewilder than to inform the potential user of their relative merits.

COST-EFFECTIVENESS

Clearly, computer-assisted systems have tremendous advantages over "stand-alone" systems. They offer greater power, speed, and flexibility; in addition, they hold the promise of improving productivity not only at the clerical level (by automating the traditional word-processing cycle) but also at the professional or executive level. Imaginative applications of such systems can provide not only vastly improved text processing and document production; they can also give executives the tools they need to move at ease through all the varieties of information handling, retrieval, and dissemination tasks that in the final analysis constitute their work. Management information systems, financial planning and budgeting, word processing, communications, and record keeping can be merged, with a desk-side terminal providing the professional with easy access to whatever tools are needed for the job at hand.

Equally obvious are the short-range economies of the "stand-alone" system. Not only do such systems require a smaller initial investment; they also exert less impact on organizational structure, personnel, and procedures. The full potential impact of computer-assisted tools was described years ago by Douglas Engelbart, Director of SRI's Augmentation Research Center, whose system, NLS, is much more than just a text editor; Engelbart's goal is to provide a new way of thinking and working by fully exploiting the power of current technology:

> We are concentrating fully upon reaching the point where we can do all of our work on line -- placing in computer store all of our specifications, plans, designs, programs, documentation, reports, memos, bibliography and reference notes, etc., and doing all of our scratch work, planning, designing, debugging, etc., and a good deal of our intercommunication, via the console.

Dr. James Emery of EDUCOM describes two components of system cost-effectiveness:

1. Do the right thing: that is, get the job done. The more power and flexibility a system has, the more it can accomplish; today's best computer-assisted systems can handle a tremendous range of jobs of virtually any size, scope, and complexity -- jobs which simply cannot be approached with "stand-alone" tools.

2. Do the thing right: that is, get the job done with maximum efficiency. Although high-power tools like SRI's NLS can do both large and small jobs, the smaller jobs can be performed

just as well, and at lower cost, by less powerful, "stand-alone" tools.

The optimum system, if it is to meet reasonable criteria of cost-effectiveness, must be able to provide each user (from the clerical to the executive level) with precisely the power needed for the job at hand -- no more, no less. "Stand-alone" systems, lacking the power for large jobs, cannot meet this criterion; computer-assisted systems, because of their cost, also generally represent a compromise in this respect.

Two approaches, both currently feasible, provide a resolution to the conflicting requirements of power and economy -- hierarchical systems and hierarchical networks. Both approaches rest on a common principle: they are multi-level systems which allow the user to reach out from a single piece of equipment (usually a deskside terminal) to use precisely the power needed to efficiently perform the job at hand. Such systems allow any user to perform tasks ranging from basic text entry (the initial keyboard operation required by all systems) up through tasks as demanding as complex search and retrieval operations, heavy document editing and revision, and photocomposition, and to do so in a cost-effective manner.

Hierarchical Systems

Hierarchical systems are essentially hybrids. They represent a melding of computer-assisted and "stand-alone" systems; that is, they use relatively low-power systems (e.g., magnetic tape units) for initial text entry and simple editing, and rely on the computer to supply both efficient long-term storage and retrieval and the power needed for large-scale editing and formatting operations.

Efficient hierarchical systems can be built primarily through careful selection of the equipment that will comprise its component parts. The basic rule for equipment selection is simple: choose only equipment that provides a communication capability. Such equipment (e.g., IBM's Communicating Mag Card units, Vydec's screen-oriented system) provide local text capture and reasonable editing capability; in addition, they allow the user to connect (via dial-up phone connections) to the computer when additional resources are needed.

Ideally, such a system should be as modular in design as possible. That is, the frontend equipment -- the equipment which provides the basic interface with the user -- should be as simple and self-contained as possible. This is necessary if the user is to perform economically those jobs (e.g., interoffice

memos) which require little if any automation. Although higher-powered units like the Vydec system will of course perform such tasks quickly and pleasantly, costs will be higher than they need to be.

Equally important is the need for the user to be able to use this same frontend equipment to reach out for additional power when it is needed. This process should be as simple and straightforward as possible; in fact, the ideal system would automatically provide precisely the power needed by the user at any given moment. Such flexibility is beyond the capabilities of a modular or hierarchical system (but within those of a hierarchical network -- see the discussion below); nevertheless, the process of getting extra power should be a simple one. Here again the answer lies in the selection of relatively self-contained frontend equipment.

Although the equipment comprising a hierarchical system would vary from one organization to another, it would generally be oriented around typewriter terminals connected to tape cassette units. Such terminals are relatively inexpensive, can provide excellent print quality at up to thirty characters per second, and, when linked to tape units, can be used for local text capture and simple editing. Anderson-Jacobson, for example, markets terminals expressly designed for text processing applications; these terminals not only support the functions just described, but can also be used as sophisticated office typewriters when no automation whatsoever is needed (for example, for inter-office memos).

Other useful equipment includes portable terminals to be used from remote locations, display (CRT) terminals for more powerful editing and efficient browsing through on-line files and data bases, and high-speed printers for high-volume, large scale document production. All of this equipment is readily available; indeed, many organizations already have made substantial investment in terminals and related equipment. When used in conjunction with powerful computer systems like SRI's NLS, such tools combine to form a true hierarchical system.

Hierarchical Networks

Hierarchical networks (c.f. Datamation, February 1975) are conceptually similar to the hierarchical systems described above. Instead of local magnetic tape (or disk) units providing a low-level editing and storage capability, however, the hierarchical network uses minicomputers to perform the same functions.

Basic user interface with the system is provided by the same types of terminals described above, but without self-contained magnetic storage and editing facilities. Minicomputers providing these capabilities are connected to central facilities which provide whatever additional supporting power is needed on a time-shared basis. The major difference to the user is that, while text entry and editing in a hierarchical system generally differs considerably according to whether the process is in a "stand-alone" or computer-assisted mode, with the choice made in every case by the user, the individual using a hierarchical network may be entirely unaware of the system level at which he/she is working. Initial typein, editing, retrieval, composition, and communications, may all be handled by a hierarchical network using one basic set of commands in a manner that is virtually transparent to the user.

In other words, the hierarchical system is a set of related tools, having a common purpose and supported by a common systemic framework, but requiring different procedures according to the level of power and flexibility needed. The hierarchical network, on the other hand, appears to the user as a single coordinated system, providing him/her with all basic information handling functions.

Although several hierarchical networks are currently operational, none supports the capabilities needed for office automation. Current technology, however, is fully capable of supporting such an application; in fact, developmental efforts now under way at SRI's Augmentation Research Center are directed toward this goal.

From: Tests in Microfiche: Annotated Index, Educational Testing Service, February 1976.

Numerical Index

000794 - Denny-Ives Creativity Test by David A. Denny, Sammie Ives; c1964; Grade 6. **206,

This test, a research device designed to assess creativity in the dramatic arts, is in two parts. Scores for fluency and redefinition are derived from Part I, while Part II yields scores for originality and sensitivity. Audiotapes and slides are required to administer the test.

001333 - Facts About Science Test by Glen Stice; c1958; Grades 7-8. **146,

Designed to measure students' knowledge of the general nature of science, the special characteristics of scientists, and the way science fits into our society.

001513 - Sizing Up Your School Subjects by Henry S. Dyer, Anne H. Ferris; c1958; Grades 7-16. **300, 305,

Designed to measure the reactions of students to instruction by television.

001518 - Independent Activities Questionnaire by Stephen Klein; c1965; Grades 9-13. **168, 206,

Designed to assess an individual's achievements in various fields, such as art and science, which may not be reflected in school grades. The items describe activities or accomplishments of a socially significant type that can be taken as evidence of a student's creative potential.

001519 - Experimental Comparative Prediction Battery by John W. French; c1963-64; Grades 9-16. **200, 213, 217, 219, 220, 222, 302,

The battery includes measures of six aptitudes: Induction, Integration, Visualization, Meaningful Memory, Number Facility, and Spatial Orientation. An Interest Index is also available.

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SELECTING EDUCATIONAL RESEARCHERS AND EVALUATORS

Jason Millman

ABSTRACT

Aimed at those individuals who are in a position to hire or promote educational researchers or evaluators, this paper provides some practical suggestions for assessing these personnel. Meta-evaluators (evaluators who evaluate evaluations) and referees of research proposals will also find this article relevant. Selection of a research or evaluation (R and E) firm is not treated separately from the task of hiring an individual; the quality of work done by a firm depends largely on the people who do the job. Much consideration should be given to specifying job descriptions and requirements. The value of R and E competencies depends upon the specific tasks expected to be performed. A synthesis of the efforts of a task force of the American Educational Research Association to identify educational R and E competencies grouped under 25 general tasks is included in the document. In an effort to identify a universe of evaluation competencies, Stufflebeam and Bunda produced approximately 250 items grouped under eight major categories. The categories and examples of corresponding self assessment items are also included. These groups of competencies reference tasks, abilities, and knowledges of the almost total exclusion of sensitivities. Interpersonal sensitivities and personality characteristics may be even more important than technical knowledges and skills in insuring the success of R and E. Several strategies for assessing whether an individual possesses the competencies needed for a specific job are considered. These include discussions of certification, formal training, testing, R and E output, bibliographic and academic characteristics, and membership in special professional associations and directories having more stringent entry requirements than presently exist.

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Introduction

This paper provides some practical suggestions for selecting educational researchers and evaluators. It is directed primarily to those individuals who are in a position to hire (or possibly to promote) educational researchers or evaluators. Meta-evaluators